



**SHRI SHIVAJI EDUCATION SOCIETY, AMRAVATI'S**  
**SHRI SHIVAJI COLLEGE OF ARTS, COMMERCE AND SCIENCE, AKOLA (MS)**  
**Affiliated with Sant Gadge Baba Amravati University, Amravati (MS)**  
**UGC Status- College with Potential for Excellence (Phase II Completed)**  
**DST- FIST (Level "00") Support;**  
**Lead College Status by S. G. B. Amravati University, Amravati (MS)**  
**Website: [www.shivajiakola.ac.in](http://www.shivajiakola.ac.in)**

**1.3.2**

**Average percentage of courses that include experiential learning through project work/ Fieldwork/ internship during last five years**

**Academic Year: 2016-2021**

Shri Shivaji Education Society, Amravati's

# SHRI SHIVAJI COLLEGE OF ARTS, COMMERCE AND SCIENCE, AKOLA



NAAC Re-Accredited with A grade with CGPA 3.24  
UGC Status of 'College with Potential for Excellence', DST-FIST level-0 Support

Lead College status by S.G.B.A.U. Amravati

Near Shivaji Park, Akola - 444 001 (Maharashtra)

Phone & Fax : 0724-2410438/2411039

Website : shivajiakola.ac.in E-mail : principal@shivajiakola.ac.in



**Late Dr. Panjabrao Deshmukh**

Founder President

**Hon. Harshvardhan Deshmukh**

President

**Dr. Ambadas L. Kulat**

Principal

No. SSC/AKL/

Date 15/12/2021

## Declaration

This is to declare that the information, reports, true copies and numerical data etc. furnished in this file as supporting documents is verified by IQAC and found correct.

Hence this certificate.

Dr. A. S. Raut

**Dr. A. S. Raut**  
IQAC Co-ordinator  
Shri Shivaji College of Arts,  
Commerce & Science, AKOLA

Dr. A. L. Kulat

**PRINCIPAL**  
Shri Shivaji College, of Arts  
Commerce & Science, AKOLA  
A GRADE C.GPA. 3.24., BY NAAC



**SANT GADGE BABA  
AMRAVATI UNIVERSITY**  
AMRAVATI - 444602  
(M.S.)

☎ : 2662206, 2662207, 2662208, 2662249, 2662358.  
website : www.sgbau.ac.in

FAX NO. 0721-2660949, 2662135

SGBAU/8/C-330/2021

Date:- 16/12/2021

**TO WHOM IT MAY CONCERN**

This is to certify that Shri Shivaji Arts, Commerce & Science, College, Akola.(205) (MS) is affiliated to the **Sant Gadge Baba Amravati University, Amravati** since 1963 and the following Courses / Subjects are taught in the said college as per approval.

Sr. No.	Name of the Course(s) and Duration	Affiliation	Validity Period
1.	<b>Under Graduate Arts : B.A.</b> (Economics, English, Geography, Hindi, History, Home Economics, Marathi, Music, Political Science, Psychology, Sociology, Philosophy, Yogshastra, Marathi Litt., English Litt., Hindi Litt.)	Permanent	Permanent
2	<b>Under Graduate in Commerce And Management : B.Com</b>	Permanent	Permanent
3	<b>Under Graduate in Home Science :</b> B. Sc.(Home Science)	Permanent	Permanent
4	<b>Under Graduate in Science And Technology :</b> B.Sc. (English, Marathi, Hindi, Urdu, Biotechnology, Biochemistry, Botany, Chemistry, Computer Science, Electronics, Geology, Mathematics, Microbiology, Physics, Statistics, Zoology.)	Permanent	Permanent
	B.Sc. ( Forensic Science)	Temporary	For Session 2020-21
5	<b>Post Graduate Arts : M.A.</b> English, Marathi ,Music, Political Science,Sociology,Economics, Philosophy.,Psychology.	Permanent	Permanent
6.	<b>Post Graduate in Home Science : M. Sc.</b> Food & Nutrition, Human Development, Textile and Clothing.	Permanent	Permanent
7	<b>Post Graduate in Commerce And Management :</b> M.Com	Permanent	Permanent
8	<b>Post Graduate in Science And Technology :</b> M.Sc. (Biochemistry,Botany, Chemistry, Computer Sci.,Geo informatich, Microbiology, Physics, Zoology, Mathematics.)	Permanent	Permanent

*Sipahi*  
Dy. Registrar (Coll.)  
Sant Gadge Baba  
Amravati University,  
Amravati

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NOTIFICATION

**Criterion – I- Curricular Aspects [QIM – 1.3.2]**

No. : 67/2019

Date : 11 July, 2019

**Subject: Implementation of Syllabi of Various Course / Subjects as per Semester and Credit Grade System in the Faculty of Humanities from the Session 2019-2020 and onwards.**

It is notified for general information of all concerned that the authorities of the University has accepted the Syllabus of the following various courses / subjects as per Semester and Credit Grade System as mentioned in Column No.2 which are to be implemented from the session 2019-2020 and onwards with appendices which are attached herewith as shown in column No. 3 of the following table.

**TABLE**

<b>Sr.No.</b>	<b>Course / Subjects</b>	<b>Appendices of the New Syllabi</b>
	<b>B.A. Semester-V &amp; VI</b>	
1.	History	The Syllabi prescribed for the subject History which is appended herewith as <b>Appendix – ‘A’</b>
2.	Geography	The Syllabi prescribed for the subject Geography which is appended herewith as <b>Appendix – ‘B’</b>
3.	Economics	The Syllabi prescribed for the subject Economics which is appended herewith as <b>Appendix – ‘C’</b>
4.	Philosophy	The Syllabi prescribed for the subject Philosophy which is appended herewith as <b>Appendix – ‘D’</b>
5.	Home Economics	The Syllabi prescribed for the subject Home Economics which is appended herewith as <b>Appendix – ‘E’</b>
6.	Sociology	The Syllabi prescribed for the subject Sociology which is appended herewith as <b>Appendix – ‘F’</b>
7.	Psychology	The Syllabi prescribed for the subject Psychology which is appended herewith as <b>Appendix – ‘G’</b>
8.	Political Science	The Syllabi prescribed for the subject Political Science which is appended herewith as <b>Appendix – ‘H’</b>
9.	Statistics	The Syllabi prescribed for the subject Statistics which is appended herewith as <b>Appendix – ‘I’</b>

**Syllabi of B.A. Final  
Semester-V & VI**

**(Implemented from 2019-2020 Session)**

**Instructions for Both Semester V & VI of B.A. Final**

- (1) Students will have to Solve TWO (2) Long Questions from any Two of Five Units. Each of these Long Question carries SIXTEEN (16) Marks. Internal Choice is available from same unit.
- (2) Students will have to Solve EIGHT (8) Short Questions in all choosing four questions from each of Two units out of Total Five Units. Each of these Short Question Carries FOUR (4) Marks. Internal Choice is available from same unit.
- (3) Students will have to Solve SIXTEEN (16) Multiple Type Questions from all the Five Units. Each of these Short Question Carries ONE (1) Mark. No Internal Choice is available .

**Distribution of Internal 20 Marks**

- (1) TEN (10) Marks to be awarded by the Teacher concerned on ASSIGNMENT submitted by the Student. ASSIGNMENT is based on the syllabus.
- (2) TEN (10) Marks to be awarded by the Teacher concerned on student's performance in VIVA-VOCE which is based on the syllabus.

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**Syllabi of B.A. Final  
Semester-V  
History of Modern World  
(From 1780 to 1920 AD)**

Time : 3 Hours)

Marks : 80

Int.Ass. :20

**Objectives –**

The students should have an integrated view of the process of change in the Society, Economy and Civilization in the contest of Political Developments.

**Notes :** 1) One Question or a set of Questions from each unit will have to be answered.

2) Five Periods per week shall be provided for instructions.

3) Facilities of excursion tours to students are made available once a year, preferably in Diwali Vacation. The Financial Burden shall be borne by the students only.

---

**Unit-I**

1. **French Revolution** -Crisis of the ancient regime, Intellectual currents, Participation of Social Classes.
2. Emergence of Napoleonic Bonaparte - Expansion, Consolidation and downfall.
3. Congress of Vienna (1815 AD).



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**SANT GADGE BABA AMRAVATI UNIVERSITY GAZETTE - 2019 - PART TWO - 9**

**Unit-II**

1. Making of the Nations - States of Italy and Germany.
2. Foreign Policy of Germany under Bismark.
3. Germany under Kaiser William II.

**Unit-III**

1. Triple Entente (1907 AD).
2. Russo – Japanese War (1904 – 05 AD)
3. First World War – Causes and Effects.  
A) The Fourteen Points of President Wilson.

**Unit-IV**

1. The Entry of the U.S.A. into First World War.
2. Concept of Communism, Capitalism, Socialism.

**Unit-V**

1. Paris Peace Conference
2. Versailles Treaty – (i) Treaty of Versailles, (ii) Trianon Treaty & (iii) Sevres Treaty.
3. The League of Nations – Aims, Objectives, Structure, Achievement and Failure.

**Books Recommended :-**

- |  |                        |
|--|------------------------|
| 1. Europe since Napoleon   | - Thomson David        |
| 2. Bismark   | - Robertson G.         |
| 3. From Bismark to the world war                                   | - Brandenburg E.       |
| 4. The Struggle for Mastery of Europe 1848-1948                    | - Taylor A.J.P.        |
| 5. European History since 1870                                     | - Benns                |
| 6. Contemporary Europe   | - Hughes H.S.          |
| 7. The first world war   | - Taylor A.J.P.        |
| 8. Europe M. 19 <sup>th</sup> & 20 <sup>th</sup> Century(Hmdi also | - Lipsons. E.          |
| 9. Europe since 1870   | - Zable S.H.           |
| 10. The Rise of Modern Europe                                      | - Langer, William (ed) |
| 11. History of the league of Nations                               | - Walters F.P.         |
| 12. Europe between th World War                                    | - Carr. E.H.           |
| 13. Europe since 1919  | - Langsam              |
| 14. International Relations (Between the two wars 1920-1939        | - Carr. E.H.           |
| 15. Fascism M. gtaloy  | - Trannanbaum. E.      |
| 16. History of the United States                                   | - Current, W.          |
| 17. Origins of the cold war  | - Fleruing D.G.        |
| 18. Soviet Foreign Policy after Stalin                             | - Dallm D.J.           |
| 19. International Politics   | - Schuman              |
| 20. International Politics   | - Paimer&Parkins.      |
| 21. Europe in Nineteenth Century                                   | - E. Lipson            |

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**Syllabi of B.A. Final  
Semester-VI  
History of Modern World  
(From 1921 to 1965 AD)**

Time : 3 Hours)

Marks : 80

Int.Ass. : 20

**Objectives –**

The students should have an integrated view of the process of change in the Society, Economy and Civilization in the context of Political Developments.

**Notes :** 1) One Question or a set of Questions from each unit will have to be answered.

2) Five Periods per week shall be provided for instructions.

3) Facilities of excursion tours to students are made available once a year, preferably in Diwali Vacation. The Financial Burden shall be borne by the students only.

**Unit-I**

1. Rise of Fascism in Italy –  
Musolini and his Internal & Foreign Policies.
2. Rise of Nazism in Germany –  
Hitler and his Internal & Foreign Policies
3. Rise of Stalin in Russia – Internal Policies of Stalin.
4. The Great Economic Depression (1929 A.D.) and its impact.

**Unit-II**

1. Causes and Result of the Second World War.
2. Entry of the U.S.A. into the Second World War.
3. Diplomatic Conferences during the War Period (1935-1945 A.D.)

**Unit-III**

1. United Nations Organization :- Aims, Structure, Achievement and Failure.
2. The Emergence of the U.S.A. as World Power, Causes and Effects.
3. The Emergence of the U.S.S.R. as World Power, Causes and Effects.

**Unit-IV**

1. Post War World - The Cold War – Causes and effect, Origins and Meaning
2. Truman Doctrine, The Marshal Plan, Point Four Programme.
3. Military Alliances – The NATO and Warsaw Pact, the SEATO, The CENTO.

**Unit-IV**

1. The Suez Crisis - The Eisenhower Doctrine,
2. European Unity and Disunity, European Common Market – The Common Wealth of Nations – The Berlin Crisis of 1958, Quba Crisis.

**Books Recommended :-**

- |   |                        |
|---|------------------------|
| 1. Europe since Napoleon  | - Thomson David        |
| 2. Bismark  | - Robertson G.         |
| 3. From Bismark to the world war                                    | - Brandenhurg E.       |
| 4. The Struggle for Mastery of Europe<br>1848-1948                  | - Taylor A.J.P.        |
| 5. European History since 1870                                      | - Benns                |
| 6. Contemporary Europe  | - Hughes H.S.          |
| 7. The first world war  | - Taylor A.J.P.        |
| 8. Europe M. 19 <sup>th</sup> & 20 <sup>th</sup> Century (Hmdi also | - Lipsons. E.          |
| 9. Europe since 1870  | - Zable S.H.           |
| 10. The Rise of Modern Europe                                       | - Langer, William (ed) |
| 11. History of the league of Nations                                | - Walters F.P.         |
| 12. Europe between th World War                                     | - Carr. E.H.           |
| 13. Europe since 1919   | - Langsam              |
| 14. International Relations (Between the<br>two wars 1920-1939      | - Carr. E.H.           |

**SANT GADGE BABA AMRAVATI UNIVERSITY GAZETTE - 2019 - PART TWO - 11**

- |  |                   |
|--|-------------------|
| 15. Fascism M. gtaoy                   | - Trannanbaum. E. |
| 16. History of the United States       | - Current, W.     |
| 17. Origins of the cold war            | - Fleruing D.G.   |
| 18. Soviet Foreign Policy after Stalin | - Dallm D.J.      |
| 19. International Politics             | - Schuman         |
| 20. International Politics             | - Paimer&Parkins. |
| 21. Europe in Nineteenth Century       | - E. Lipson       |
| 22.                                    |                   |

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**B.A. Part-III (Semester-V)**

**Subject : Geography**

**Paper :Geography of India**

**Appendix-B**

The Examination in Geography will comprise of three head, One Theory paper, Internal Assessment and one Practical. The Theory paper shall be of Three Hours duration and shall carry 50 Marks, the Internal Assessment shall carry 20 Marks and the Practical Examination shall be of Three Hours duration and shall carry 30 Marks The following syllabus is prescribed on the basis of Five Lectures per week and one practical of Two Periods for each batch 16 students.

**Theory**

50 Marks

(10 Marks Per Unit)

- |                  |  |
|------------------|--|
| <b>Unit-I)</b>   | India in the context of world, India a Land of Diversities & Unity within diversities, Physical Division of India.                 |
| <b>Unit-II)</b>  | Drainage System of India. Indian Climate: The Monsoon, Western Disturbance, Norwesters.  |
| <b>Unit-III)</b> | Soil Types of India, their distribution & Characteristic.<br>Major Crops in India: Wheat, Rice, Cotton & Sugarcane.                |
| <b>Unit-IV)</b>  | Spatial distribution of Population and density, Population Explosion, Urbanization & Sex ratio in India.                           |
| <b>Unit-V)</b>   | Distribution & Conservation of Minerals: Iron, Copper, Bauxite & Power Resource Coal and Mineral Oil, Industrial regions of India. |

**Practical**

30 Marks

- |                |   |          |
|----------------|---|----------|
| <b>Unit-I</b>  | Study of Map-projection. Drawing of following projection by   |          |
|                | Graphical Method with their properties and uses   | 10 Marks |
|                | i) Zenithal equi-distant projection: Polar Case<br>ii) Zenithal equal-area projection: Polar Case<br>iii) Simple cylindrical projection<br>iv) Cylindrical equal -area projection |          |
| <b>Unit-II</b> | Study of Indian Topographical maps of the following regions.  |          |
|                | a) Mountain b) Plateau and c) Plain.  | 10 Marks |
|                | Practical Record  | 05 Marks |
|                | Viva  | 05 Marks |

**Internal Marks Distribution (20 Marks)**

- |                              |          |
|------------------------------|----------|
| 1) Home Assignment           | 10 Marks |
| 2) Group Discussion /Seminar | 10 Marks |

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SANT GADGE BABA AMRAVATI UNIVERSITY GAZETTE - 2019 - PART TWO - 12  
DEPARTMENT OF GEOGRAPHY

CERTIFICATE

Name of the College : \_\_\_\_\_

This is to Certify that, this Practical Records is the Bonafide Practical Work of Shri / Ku.  
\_\_\_\_\_ during the Academic Year  
\_\_\_\_\_.

Class :

Dated :

1. \_\_\_\_\_
2. \_\_\_\_\_
3. \_\_\_\_\_

Signature of the Teacher  
who taught the  
Examinee

Head of the Department

**Note :** In absence of Certified Practical Record Book, Examinee will not be allowed to appear for the practical Examination.

**Books Recommended :-**

- 1) Deshapande C.D. : India A Regional Interpretation, northern Book Centre, New Delhi 1992.
- 2) Sing R. L. : India A Regional Geography National Geographical Society India Varanasi 1995
- 3) Wadia D.N. : Geology of India MacMillan & Co. Calcutta
- 4) Khullar D.R.– India
- 5) Khullar D.R.– India – A Comprehensive Geography, Kalyani publishers 2011
- 6) Sing Gopal : Geography of India
- 7) Majid Husain : Geography of India, McGraw Hill Education 2017
- 8) Sing R. L. : Elements of Practical Geography ManavBooks 2015
- 9) चतुर्भुज मामोरीया : भारत का भूगोल, साहित्य भवन पब्लिकेशन मेरठ.
- 10) चहाण तेजसिंग : भारत का भूगोल, विन काशन जोधपुर
- 11) गिलबट एवं मिसह एफ. : भारत का भूगोल, तुलसी काशन, पुणे.
- 12) अिहरराव, अलीशहा धापते व धरात : भारताचा भूगोल, निराली काशन, पुणे.
- 13) सारंग सुभाषचं : भारताचा भूगोल, विन काशन नागपूर.
- 14) खतीब के.ए. : भारताचा कृषी भूगोल, मेहता पब्लिकेशन हाऊस पुणे.
- 15) घारपुरे विनल : भारताचा भूगोल, पिंपळापुरे काशन, नागपूर २०१८
- 16) घारपुरे विनल : भारत भौगोलिक विनल ेक्षण, पिंपळापुरे काशन, नागपूर २०१८
- 17) ससेना उमेश किकशोर. : मानिक विनल एव योगात्मक भूगोल.
- 18) चतुर्भुज मामोरीया : मानिक विनल एवं कायोगिक भूगोल, साहित्य भवन पब्लिकेशन मेरठ. २०१५
- 19) ज. पी. शमाक : कायोगिक भूगोल, रतोगी पब्लिकेशन, शिवाजी रोड मेरठ -२००२.
- 20) अजुन कुंभार : कायोगिक काशन डबिवली पूव १९९८.  
भूगोल, सुमक

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**SANT GADGE BABA AMRAVATI UNIVERSITY GAZETTE - 2019 - PART TWO - 13**

**B.A. Part-III (Semester-VI)**

**Subject : Geography**

**Paper : Geography of Maharashtra**

The Examination in Geography will comprise of three head, One Theory paper, Internal Assessment and one Practical. The theory paper shall be of Three Hours duration and shall carry 50 Marks, the Internal Assessment shall carry 20 marks and the practical examination shall be of Three Hours duration and shall carry 30 marks The following syllabus is prescribed on the basis of five lectures per week and one practical of two periods for each batch 16 students.

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**Theory**

50 Marks  
(10 Marks Per Unit)

**Unit-I)** Maharashtra in the context of India,

Physical division of Maharashtra, Drainage System of Maharashtra

**Unit-II)** Climate: Distribution of rainfall, Soil Types, Vegetation

**Unit-III)** Major Crops in Maharashtra: Wheat, Rice, Jawar, Cotton & Sugarcane.

**Unit-IV)** Maharashtra: Minerals : Manganese, Bauxite and iron ore, Power Resource : Coal, Hydro-electricity, Major Industries : Cotton Industry & Sugar Industry.

**Unit-V)** Population: Distribution of Population and density, Population Migration. Geographical Tourist Places.

**Practical**

**30 Marks**

**Unit- I** Prismatic Compass Survey

10 Marks

**Unit-II** Study Tour or Socio-Economic Field Survey

10 Marks

Practical Record

05 Marks

Viva

05 Marks

**Internal Marks Distribution (20 Marks)**

1) Home Assignment

10 Marks

2) Group Discussion /Seminar

10 Marks

**DEPARTMENT OF GEOGRAPHY**

**CERTIFICATE**

Name of the College :

This is to Certify that, this Practical Records is the Bonafide Practical Work of Shri /  
Ku. \_\_\_\_\_ during the  
Academic Year \_\_\_\_\_.

Class :

Dated :

1. \_\_\_\_\_
2. \_\_\_\_\_
3. \_\_\_\_\_

Signature of the Teacher  
who taught the Examinee

**SANT GADGE BABA AMRAVATI UNIVERSITY GAZETTE - 2019 - PART TWO - 15**

Head of the Department

**Note :** In absence of Certified Practical Record Book, Examinee will not be allowed to appear for the Practical Examination.

**Books Recommended :-**

- 1) Arunachalam B. : Geography of Maharashtra
- 2) Deshpande C.D. : Geography of Maharashtra, Northern Book Centre, New Delhi.
- 3) Sawadi&Keche : Maharashtra
- 4) Deshpande : Economy of Maharashtra
- 5) Dixshit K. R. : Maharashtra in Maps

**Paper Pattern for All Six Semester**

**Appendix-C**

**(Semester-I to Semester-VI) (Economics)**

Theory : 80 Marks

Int.Ass. : 20 Marks

**Instructions :**

- i. All Questions are Compulsory
- ii. All question carry Equal Marks (Each Question SIXTEEN Marks)

1. Student will have to Solve TWO Long Question from Any Two of the Five Units. Each of these broad Question carry SIXTEEN Marks. (Internal Choice is Available)

$$2 \times 16 = 32$$

2. Student will have to Solve EIGHT Short Question in all choosing four Question from Each of the Two units out of the Total Five. Each Short Question Carries Four Marks (Internal Choice is Available)

$$8 \times 4 = 32$$

3. Student will have to Solve EIGHT Multiple Choice Type Question from Any One of the five units. Each of these Questions Carries Two Marks.

$$8 \times 2 = 16$$

$$\text{Total} = 80$$

**Internal Examination : 20 Marks**

1. Viva- Voce - 10 Marks

2. Assignments - 10 Marks

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**B.A. Final  
Semester-V  
Indian Economy**

**(To be Implemented from 2019-2020 Session)**

Credit : 04

Marks : 80

Int.Ass. : 20

**Unit-I Indian Economy and Planning :**

- 1.1 Basic Feature of Indian Economy
- 1.2 Economic Planning : Objectives, Types, Objective of 11<sup>th</sup> & 12<sup>th</sup> Five Year Plan.
- 1.3 New Economic Reforms :- Liberalization, Privatization, Globalization

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**SANT GADGE BABA AMRAVATI UNIVERSITY GAZETTE - 2019 - PART TWO - 16**

**Unit-II Agriculture :**

- 2.1. Importance of Agriculture in Indian Economy :
- 2.2 Productivity :- Causes of Low Productivity and Remedies to increase productivity
- 2.3 Agricultural Marketing : Difficulties and Remedies of Agricultural Marketing
- 2.4 Subdivision and Fragmentation : Concept, Causes & Remedies.

**Unit-III Industrial :**

- 3.1 Industrial Policy – 1991
- 3.2 Small Scale Industry : Importance, Problem, Remedies
- 3.3 Industrial Disputes : Causes, Remedies
- 3.4 Trade Union : Characteristics and Functions

**Unit – IV External Sector an Important Areas of Concern :**

- 4.1 India's Foreign Trade :- Direction & Composition
- 4.2 Poverty :- Causes, Remedies
- 4.3 Unemployment : Causes, Types, Remedies
- 4.4 Self Help Group

**Unit-V Environment and Pollution :**

- 5.1 Environment : Meaning and Types
- 5.2 Natural Resources : Land, water, Forest, Causes and Remedies of Air, Water and Land Pollution
- 5.3 Global Warming.

**Books Recommended :**

- 1) Rudra Datta & K.P.M. Sundaram Indian Economy, S. Chand & company New Delhi
- 2) Five Year Plan, Govt. of India
- 3) Jalan Bimal :- Indian Economic Policy, preparing for the 21<sup>st</sup> Century, Viking, New Delhi

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**B.A. Final  
Semester-VI  
Demography**

Credit : 04

Marks : 80

Int.Ass. : 20

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**Unit - I Introduction**

- 1.1 Meaning and Scope of Demography
- 1.2 Theories of Population- Malthus, Optimum Population Theory, Theory of Demographic Transition
- 1.3 Population Explosion

**Unit - II Fertility and Mortality**

- 2.1 Importance of Study of Fertility
- 2.2 Factors affecting Fertility- Socio-Economic Factors, Economic Status, Health, Education, Nutrition, Caste, Religion, Race, Region, Rural-Urban and Status of Husband & Wife.
- 2.3 Mortality- Death Rate, Birth and Infant Mortality Rate, Factors for Decline in Mortality in Recent Years.

**Unit - III Migration of Population**

- 3.1 Concept and Types- Temporary, Internal and International Migration
- 3.2 Effects of Migration on Population
- 3.3 Factors affecting Migration.

**Unit - IV Urbanization of Population**

- 4.1 Meaning and Causes of Urbanization
- 4.2 Pattern of Urbanization in India
- 4.3 Effects & Remedies to Urbanization

**Unit - V Population and Development**

- 5.1 Population and Human Development Issues
- 5.2 Evaluation of Population Policy in India- The shift in Policy from Population Control to Family Welfare to Women Empowerment
- 5.3 Family Planning Strategic and their Outcomes, the New Population Policy, (2000)



**Recommended Books :**

- 1) Agrawal S.N. (1972) - 'Indian Population Problems', Tata McGraw Hill Com., Bombay.
- 2) Boque D.J. (1971) - Principles of Demography, John Willey New York.
- 3) Srinivasan K. and A. Shariff (1998) - India, Towards Population and Demographic Goals, Oxford University Press, New Delhi.
- 4) Srinivasan K. (1998) - Basic Demographic Techniques and Applications, Sage, Publication, New Delhi.

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**Appendix-D**

**Syllabi of B.A.Final  
Semester-V**

**Paper : (A) Indian Philosophy (Part-I)  
(Implemented from 2019-2020 Session)**

Time : 3 Hrs.

Total Marks : 100

Theory : 80

Int.Ass. : 20

**INSTRUCTIONS :** Each Paper will Carry 100 Marks, 80 Marks for Theory Paper having 3 Hrs. duration and 20 Marks for Internal Assessment. Minimum 32 Marks in Theory and 08 Marks in Internal Assessment for Passing. There shall be separate passing in Theory Paper and Internal Assessment. There shall be Long Answer Type Questions on Any Two Units, Short Answer Type Questions on Any Two Units and Multiple Choice Question on any One Unit out of Five Units. Internal Assessment Marks shall be allotted on the basis of Home Assignment, Classroom Work, Seminar, Paper Writing & Presentation, Participation in Activities, Viva-Voce and an observation of the subject teacher.

- Unit-I** Nature of Indian Philosophy, Plurality, as well as Common Concerns.
- Unit-II** 1) Vedic Philosophy – Theory of Karma, Concept of Varna and Concept of Ashram, Concept ofYadnya (Sacrifice).  
2) UpanishadicPhilosophy : Concept of Brahma, Concept of Jivatma, Concept of Liberation.
- Unit-III** CharvakaDarshan – Materialism, Theory of Knowledge, Naturalism, Refutation of God& Self, Hedonism.
- Unit-IV** Jain Darshan – Classification of Knowledge, Syadvada, Nayvada, Jiva&Ajiva, Bondage & Liberation.
- Unit-V** BoudhdaDarshan - Four Nouble Truths, Theory of Causation, Momentariness, Theory of no self, Nihilism of Madhyamika, Vidnyavada of Yogachar, Bahyanumeyavada of Sautrantika, Bahyapratyakshavad of Vaisheshika.

**Books Recommended :**

- 1) Introduction of Philosophy - Datta& Chatterjee
- 2) Outline of Indian Philosophy - M. Hiriyanna

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**Semester-V**

**Paper : (B) Logic (Part-I)**

Time : 3 Hrs.

Total Marks : 100

Theory : 80

Int.Ass. : 20

- Unit-I** Introduction : Definition of Logic, Subject Matter of Logic, Definition of Argument, Kinds of Argument.
- Unit-II** Truth and Validity, Relation between Truth and Validity, Formal Truth and Material Truth, Sentence, Kinds of Sentences.
- Unit-III** Proposition : Simple and Compound Propositions, Truth Functional and Non-Truth Functional Propositions, Truth Values.
- Unit-IV** Terms : Kinds of Terms, Words and Name, Proposition and Judgement.
- Unit-V** Traditional Classification of Propositions, Modern Classifications of Judgement, Laws of Thoughts.

**Books Recommended :**

- 1) Symbolic Logic - I.M. Copi
- 2) Introduction to Logic - I.M. Copi

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**Semester-VI**

**Paper : (C) Indian Philosophy (Part-II)**

Time : 3 Hrs.

Total Marks : 100

Theory : 80

Int.Ass. : 20

- Unit-I** NyayaDarshan – Theory of Pramanas.
- Unit-II** VaisheshikaDarshan (a) Saptapadartha (b) Atomism.
- Unit-III** SamkhyaDarshan and Yoga Darshan : A Stane Yoga.  
(a) Satkaryavada (b) Nature of Prakriti and Purusa (c) Theory of Evolution
- Unit-IV** MimansaDarshan :Nature of Knowledge, Sources of Knowledge, Theories of Error (J<sup>अर्थोत्पत्ति</sup> त्तेन)
- Unit-V** SankaraVedant : (a) Concept of Brahman and Atman (b) Theory of Causation (Vivartvada) (c) Concept of Maya (d) Nature of Moksa.

**Books Recommended :**

- 1) Introduction of Philosophy - Datta& Chatterjee
- 2) Outline of Indian Philosophy - M. Hiriyanna

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**Semester-VI**

**Paper :(D) Logic (Part-II)**

Time : 3 Hrs.

Total Marks : 100

Theory : 80

Int.Ass. : 20

- Unit-I** Logical Connectives – not', 'and', 'or', if-then', if and only if then. 'Use of Symbols, Symbolization.
- Unit-II** Statement Forms – Tautologous, Contradictory, Contingent.  
Decision Procedure – Truth Table Method, Shorter Truth Table Technique.
- Unit-III** Formal Proof of Validity, Nineteen Rules : Rules of Inference and Rules of Replacement, The Rules of Conditional Proof, the Rule of Indirect Proof..

**Unit-IV** Inference : Kinds of Inference, Definition & Description, Rules of Definition, Kinds of Definition, Logical Fallacies.

**Unit-V** Induction – Definition of Induction, Principle of Induction, Nature of Induction, Problem of Induction, Postulates of Induction, Whether it can be proved or not ? Mill's Method of Experimental Enquiry.

**Books Recommended :**

- |                          |                   |
|--------------------------|-------------------|
| 1) Symbolic Logic        | - I.M. Copi       |
| 2) Introduction to Logic | - I.M. Copi       |
| 3) Formal Logic          | - Richard Joffery |
| 4) Method of Logic       | - W.V.O. Quine    |
| 5)                       |                   |

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**Appendix-E**

**Pattern of Question Paper  
Examination: B.A. Sem-I to Sem-VI  
Home Economics**

Time- 3 Hours

Full Marks -50

- Instructions:** i) All questions are compulsory  
ii) All questions carry equal marks.

Question No. 1: Long answer question with internal choice from any unit of 10 Marks.

Question No. 2: Long answer question with internal choice from any unit of 10 Marks.

Question No. 3: Four Short Answer questions with internal choice from any unit of 2½

Marks each (2½ x 4= 10 Marks)

Question No. 4: Four Short Answer questions with internal choice from any unit of 2½  
Marks each (2½ x 4= 10 Marks)

Question No. 5: Ten objective questions without internal choice. (1 x 10 = 10 Marks).

**Rules and Regulations**

- 1- There will be **five periods per week** for theory paper.
- 2- **For one practical** there will be **two periods per week per batch**.
- 3- The batch for practical will comprise of *Sixteen students*.
- 4- Next (second) batch will be started when the number of students exceed 19. (i.e. when the number of students exceed 20% of the approved batch of 16 Students.)
- 5- The minimum passing marks of theory paper will be 20 (i.e.40%).
- 6- The minimum passing marks for practical will be 12 (i.e.40%)
- 7- The minimum passing marks for internal assessment will be 8 (i.e.40%)
- 8- Separate passing in theory, practical and internal assessment is necessary.
- 9- Marks will not be allotted to students if she is found absent for Practical and sessional.

**Private Candidate :**

- 1- With regard to the practical work the private candidate should be instructed to complete the practical prescribed in the college where she desires to appear for annual practical. The record book should be duly signed by the concerned head of the department.
- 2- Private candidate should write to the Principal concerned at the beginning of the session for permission to appear for the practical examination from the college.

**Syllabi for B.A.Final**

**HOME ECONOMICS  
Semester-V HUMAN DEVELOPMENT**

**(Implemented from the 2019-2020 Session)**

Periods of Instruction Per Week-5

Total Marks :100

Theory: 5 Periods Theory : 50

Practical: 2 Periods Per Batch

Practical:30

Int.Ass. :20

- Objectives :**
- 1.To Introduce the Concept of Human Development
  2. To know the Factors affecting on Human Development
  3. To study the definitions and Meaning Concerning the Concepts

**UNIT-I**

- 1.1 Meaning, Definitions and Importance of Human Development
- 1.2 Stages of Development & Developmental Tasks.
- 1.3 Principles & Factors affecting on Growth & Development
- 1.4 Stages of Prenatal Development.

**Unit-II**

- 2.1 Male and Female Reproduction System.
- 2.2 Sex determination & Twins & Premature Baby-Care & Causes
- 2.3 Advantages of Breast Feeding & Artificial Feeding.
- 2.4 Child Diseases -Diarrhea, Jaundice, Diphtheria, Whooping Cough & Immunization

**Unit-III**

- 3.1 Motor Development : Meaning, Skills.
- 3.2 Causes of Delayed Motor Development.
- 3.3 Physical development : Changes and Factors affecting Physical Development.
- 3.4 Play- Importance, Types & Social Adjustment.

**Unit-IV**

- 4.1 Intellectual Development : Classification of Intelligence. Intelligence Quotient (IQ)
- 4.2 Factor Affecting on Intellectual Development
- 4.3 Speech Development : Stages of Speech Development & Factors affecting on Speech Development
- 4.4 Speech Defects

**Unit-V**

- 5.1 Social Development ; Companion & Playmates.
- 5.2 Emotional Development – Characteristics, Types.
- 5.3 Moral Development ; Method & Factors for Moral Development
- 5.4 Discipline–Types & Merits & Demerits.

**INTERNAL (Total 20 Marks)**

1. Seminar on Related Topics	..	05
2. Case Study / Project (Group)	..	10
3. Educational tour/ visit (Report With Soft Copy)	..	05

**CLASS WORK**

- 1) Celebration of Breast Feeding Week .. 04
- 2) Preparation of Supplementary Food for Babyhood-Cerelac/Nachnisatwa/ Sajina – Ghehuna / as per Nutrients. (Any One) (Group) .. 05
- 3) Poster Competition -Immunization Charts/ Female Foeticide / Personality / Intellectual. .. 05

**PRACTICALS(30 Marks)**

**A) Cooking – Diet Planning and Preparations of Following Recipes**

\*For Pregnant Women – Mix Veg Paratha, Veg Upma , Dalia & Veg Paneer

\*For Lactating Women – Gum Laddoo, VegDhirdi & Veg Cutlet & Halwa.

\*Baby During Weaning Period – Khir, Tomato Soup, Sooji, Soft Khichidi

**B) Preparation of Children's Play Materials Best Out of Waste**

**Distribution of Marks (30 Marks)**

Preparation of Dish (Any One)	- 08 Marks
With Presentation	
1) Diet Plan (Any One)	- 05 Marks
2) Class Work/ RB	- 14 Marks
3) Viva	- 03 Marks

**References :**

- 1. Herlock Elizabeth - Child Development
- 2. Swaminathan M.B. and Bharghave, R.K. - Our Food.
- 3. Herlock Elizabeths - Child Growth and Development
- 4. Fontana Davind - Personality and Education
- 5. Gardner, D. Bruce - Development of early childhood

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SANT GADGE BABA AMRAVATI UNIVERSITY GAZETTE - 2019 - PART TWO - 22  
**HOME ECONOMICS**  
Semester-VI  
**HUMAN DEVELOPMENT**

(Implemented from the 2019-2020 Session)

Periods of Instruction Per Week-5  
Theory: 5 Periods  
Practical: 2 Periods Per Batch

Total Marks : 100  
Theory : 50  
Practical : 30  
Int.Ass. :20

**Objectives: This Course Will Enable The Students**

1. To aware the Role of Heredity & Environment in Development
2. To State the Role of Parent & Teacher in Child Development.
3. To Introduce the Problems of Child .
4. To Inspire the Students for Skill Based Activity.

**Unit-I**

- 1.1 Heredity- Meaning & Laws
- 1.2 Role of Heredity- in Development of Child
- 1.3 Role of Environment- in Development of Child
- 1.4 Role of Family in Development of Child ( Nuclear & Joint)

**Unit-II**

- 2.1 Personality: Types& Factors Affecting on Personality Development.
- 2.2 Defense Mechanism
- 2.3 Self Concept- Types (Positive & Negative) .
- 2.4 Role of Self concept in Personality Development.

**Unit-III**

- 3.1 Leadership- Types & Qualities.
- 3.2 Childhood Behavioral Problems: Lying, Stealing, Nail Biting, Thumb Sucking. (Causes and Remedies)
- 3.3 Need& Importance of Sex Education
- 3.4 Handicapped Child- Types & Education & Learning Difficulties.

**Unit-IV**

- 4.1 Adolescence- Developmental Task
- 4.2 Physical & Emotional Changes in Adolescence .
- 4.3 Adolescence Habits & its effect on their life ( Jvenile Delinquency. Drugs. & Alcoholic)
- 4.4 Role of Parents & Teacher in Developing Positive Attitudes Towards Life.

**Unit-V**

- 5.1 Parenting- Importance & Types
- 5.2 Parent – Child Relationship & Importance,
- 5.3 Methods of Child Rearing Practices.
- 5.4 Parental Challenge – (Junk Food, Television Watching, Social Media)

**INTERNAL (Total 20 Marks)**

- 1) Seminar on related Topics - 10 Marks
- 2) Manage any Event Using Management Process - (Birthday / Tea Party/Any Program)(Report Writing with ICT- Soft Copy) - 10 Marks

**CLASS WORK**

1. Guest Lecture on women Awareness.
2. Workshop on personality development.

**PRACTICALS (30 Marks)**

- A) Cooking – Diet Planning and Preparation of following Recipies
- Pre-school Children – Sandwiches, Groundnut Chikki, MixLadoo, VegPuri.
  - School Going – Cake, Appe and Chutney, Chirvante, Mix Dal Wada
  - Adolescence – Dhokla, Pannertikki, Pav-Bhaji, & Halwa
- B) Drafting and Sticking Any One of the following
- a) Kurti b) Nighty c) Gown d) Salwar

OR

C) Preparation of Children Play-Material (Games) for Self- Employment

**Distribution of 30 Marks of Practical Examination**

A) Preparation of Dish (Any One) With Presentation	- 08
B) Drafting / Play Material	- 06
C) Class Work / R.B	- 13
D) Viva	- 03

**References :**

1. Herlock Elizabeth - Child Development
2. Swaminathan M.B. and Bharghave, R.K. - Our Food.
3. Herlock Elizabeths - Chilgrowth and Development

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**Appendix-F**

**Syllabi of B.A. Final (Sociology)  
Semester-V**

**Social Anthropology  
(Implemented from 2019-20)**

Total Marks : 100

Theory :80

Int.Ass. : 20

**Unit-I**

**Introduction to Social Anthropology:**

- a) Meaning & Definition of Social Anthropology
- b) Why we Study Primitive Society
- c) Characteristics of Primitive Society
- d) Relation of Social Anthropology with other Social Science i) Sociology, ii) Economics, iii) History, iv) Psychology & v) Political Science.
- e) Importance of Sociology Anthropology in India

**Unit-II**

**Methods of Social Anthropology :**

- a) Field Method : Importance of Field Method Role of Researcher in Field Method
- b) Historical Method, Comparative Method & Functional Method
- c) Importance of Tribal in Social Anthropology
- d) Historical background of Tribal Study

**Unit-III**

**Tribal Society in India :**

- a) Geographical Distribution of Indian tribes
- b) Racial Classifications of Indian tribes
- c) Linguistic Classification of India Tribe

**Unit-IV Tribal Religion:**

- a) Meaning & Definition of Tribal Religion
- b) Theories of the Origin of the Religion
- c) Beliefs & Rituals
- d) Definition of Magic, Type of Magic
- e) Shaman & Priests

**Unit-V Tribal Economics :**

- a) Classification of Tribal Economy
- b) Meaning & Characteristics of Tribal Economy
- c) Economic Life in Indian Tribal

\*\*\*\*\*

**Reference Books :**

- 1) Mujumdar and Madan - Social Anthropology Development.
- 2) Beals and Hoijar - Introductions to Social Anthropology

\*\*\*\*\*

**Semester-VI  
Social Anthropology**

**(Sociology)**

Total Marks : 100

Theory :80

Int.Ass. : 20

**Unit-I Tribal Social Life :**

- a) Marriage (i) Meaning & Characteristics of Marriage (ii) Origin of Marriage Type of Marriage (iii) Ways of Acquiring Mates in Tribal Society

**Unit-II**

- a) Family (i) Definition, Elements & Characteristics of Family.  
ii) Theories of Origin of Family Type of Family
- b) Clan :(i) Meaning & Type of Clan (ii) Characteristics of Clan and Functions of Clan

**Unit-III**

- a) Totemism:(i) Meaning & Characteristics of Totemism(ii) Theories of Origin of Totem (iii) Importance of Totem

- b) Dormitory System :

- i) Daily life of Dormitory
- ii) Function of Dormitory
- iii) Origin of Dormitory
- iv) Present Position of Dormitory

**Unit-IV Tribal Problems :**

- a) Poverty & Indebtedness
- b) Land Alienation & Agrarian Issues
- c) Illiteracy & Exploitation

**Unit-V Tribal Development :**

- a) Tribal Development Approaches : Isolation, Assimilation, Integration
- b) Tribal Development policies: Land, Education & Health.
- c) Obstacles to the Tribal Development.



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**SANT GADGE BABA AMRAVATI UNIVERSITY GAZETTE - 2019 - PART TWO - 25**

**Reference Books :**

- 1) Mujumdar and Madan - Social Anthropology Development.
- 2) Beals and Hoijar - Introductions to Social Anthropology
- 3) " \*\*\*\*\*

**Appendix-G**

**General Instructions**

The examination in Psychology will comprise of one Theory Paper and one Practical. The Maximum Marks for theory will be 50, for Practical 30 and Internal Assessment will comprise of 10 marks for Theory and Practical each.

Independent Passing in Theory and Practical is Mandatory. Minimum Passing Marks for Theory will be 20. Minimum Passing Marks for Practical will be 12 and for Internal Assessment, Minimum Marks will be 8. There will be Five Theory Periods and Three Practical Periods in a week, per batch of 16 students. Students will not be allowed to appear in the Practical examination without completed Practical Record book duly signed by the teacher and Head of the Department.

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**CERTIFICATE**  
**DEPARTMENT OF PSYCHOLOGY**

Name of the College.....-

This is to Certify that this Practical Record is Original Work done by Mr./Ms./Smt. ....-

..... Class.....Semester----- during the Academic Year.....

.....'

He/She has submitted/not submitted the Home Assignment/Unit Test/Group Discussion Report/Seminar as prescribed by Sant Gadge Baba Amravati University, Amravati.

Signature of the Teacher

Signature of the Head of the Department

Signature of the External Examiner

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**Pattern of Question Paper**  
**Examination U.G. Level**  
**Psychology**  
**Semester I, II, III, IV, V and VI**

**Time :** Two Hours

**Total Marks :** 50

**Instructions :** A) All Questions are Compulsory

B) All Questions carry Equal Marks

**Notes:**

- 1) Number of questions to be set in Each paper will be FIVE
- 2) One Multiple Choice Question with ten sub Questions will be set from all units.
- 3) Two long answer questions and two short answer questions to be set on four units.
- 4) For every question, long answer type or short answer type, there will be an alternate choice. However, there shall be no internal choice in the question.
- 5) In each short answer type question there will be three to five sub questions with no internal choice.
- 6) There will not be a question like 'Write short notes on'.

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**Pattern of Examination**

**Theory** : One Theory Paper in each Semester will of 50 Marks and Three Hours Duration.

**Practicals** : 1) One Practical Examination in each Semester of 30 Marks and three Hours Duration  
Practical examination in each semester will be conducted by Internal and External Examiners appointed by the University.

2) Distribution of Marks for Practical Examination

1) Record Book	----	05
2) Conduct of experiment	----	07
3) Report of experiment	----	08
4) Viva voce	----	10

**Total Marks** ----- **30**

**Internal Assessment of 20 Marks**

1) Head of the Department will monitor Internal Assessment of the students on the basis of evaluation report from the concerned teacher/teachers, under the supervision of the Principal of the College and will be done at the end of each semester.

2) Distribution of 20 Marks for Internal Assessment is as under :

A) i)	Home assignment <u>OR</u> Unit Test	...	10 Marks
ii)	Group Discussion <u>OR</u> Seminar on relevant Topic ..		10 Marks
	<u>OR</u>		
B)	Study Visit and its Report	..	20 Marks

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**Syllabi for B.A. Final Semester-V**

**Applied Psychology**

**(To be Implemented From 2019-2020 Session)**

Marks : Theory - 50

Practical - 30

Int.Ass - 20

**Objective :**

- To introduce the basic concepts of the growing approach of **Applied Psychology** and understand its application in various domains.
- To make students understand importance of applications of Psychology in daily life.
- To acquaint the students with various psychological tools.

**Unit-I Clinical Applications :**

- 1.1 Definitions, Nature and Scope of Applied Psychology
- 1.2 Clinical Applications : Therapies
  - 1.2.1 Meaning, Definitions and Goals of Therapies
  - 1.2.2 Psychoanalysis
  - 1.2.3 Behaviour Therapy
  - 1.2.4 Client Centered Therapy
  - 1.2.5 Rational Emotive Behaviour Therapy.

**Unit-II Applications in Industries and Organizations :**

- 2.1 Definitions, Nature and Fields of Industrial and Organizational Psychology
- 2.2 Performance Pressure, Recruitment and Training
- 2.3 Advertising and Consumer Psychology : Psychological Impact of Advertisements.
- 2.4 Methods used by Consumer Psychologist – Survey and Observation

**Unit-III Forensic Psychology :**

- 3.1 Definitions, Nature and Fields – Correlational and Investigative
- 3.2 Criminal Psychology : Cyber Crimes and Violence – (Meaning and Types)
- 3.3 Investigative Procedure and Role of Psychologist
- 3.4 Law : Contribution of Psychology of Law
- 3.5 Current Challenges : Reliability of Investigative Procedures – Polygraph, Eyewitness, Testimony, Identity Kit and Narco Analysis.

**Unit-IV Statistics :** Correlations : Rank Difference Correlation and Product Moment Correlation.

**Practicals (Any Five) (30 Marks)**

1. Self Confidence Scale
2. Job Satisfaction Scale
3. Aspiration Scale
4. Self Control Scale
5. Dimensional Personality Scale
6. Free Association Test
7. Aggression Scale
8. Emotional Competence Scale
9. Self Perception Scale.

**20 Marks of Internal Assessment (As shown in above Instructions)**

**Recommended Books :**

1. Advanced Applied Psychology - Ramnath Sharma, Atlantic Publisher, Vol. 2004.
2. Industrial Psychology - M.L. Blum, J.C. Naylor, CBC Publisher, 1984.
3. Psychology Applied to Modern Life - Weiten and LLoyd, Thompson, 2007.
- 4.

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**Semester-VI**

**Scientific Research and Psychological Testing**

Marks : Theory - 50  
Practical .- 30  
Int.Ass – 20

**Unit-I Scientific Research :**

- 1.1 Developing Ideas for Research : Cultural Context, Personal Experience, Literature Context.
- 1.2 Characteristics of the Scientific Method
- 1.3 Goals of Research
- 1.4 Types of Scientific Research : Pure Vs Applied, Descriptive Vs Analytical, Quantitative Vs Qualitative, Conceptual Vs Empirical.
- 1.5 Research Approaches : Experimental, Inferential and Simulation

**Unit-II Variables :**

- 2.1 Meaning and Types
- 2.2 Research Problems : Sources and Types, Criteria of a Good Problem
- 2.3 Hypothesis : Meaning and Types
- 2.4 Sampling : Meaning and Types
- 2.5 Methods of Data Collection : Experimental, Interview, Survey and Case Study

**Unit-III Introduction to Psychological Testing :**

- 3.1 Definitions, Types, Characteristics and uses of Psychological Testing
- 3.2 Reliability : Definition and Types
- 3.3 Validity : Definition and Types
- 3.4 Norms : Definition and Types.

**Unit-IV Statistics :** Critical Ratio 't' (Small Sample) and Chi Square

**Practicals (Conduct Five) (30 Marks)**

1. Expectation from Life Partner Scale
2. Happiness Scale
3. Marriage Attitude Scale
4. Locus of Control
5. Type A, B Behavioural Pattern Scale
6. Deva's Social Adjustment Inventory
7. Interest Inventory
8. Normal Probability Curve

**20 Marks of Internal Assessment (As shown in above Instructions)**

**Recommended Books :**

1. Psychological Testing and Assessment - Ronalds Jay Cohen, Mark E. Swerdlik 6<sup>th</sup> Edition, McGraw Hill, New Delhi – 2005..
2. Psychological Testing - Anne Anastasi, Susana Urbina, Pearson Education, 2005.
3. Psychological Testing - Frank S. Freeman 3<sup>rd</sup> Edition, Oxford and IBH Publishing, New Delhi – 1965.
4. Psychological Testing - Kaplan and Saccuzzo, Wadsworth Thompson, 2001.
5. Research Methods - McBurney, Thompson, Indian Edition, 2000
6. Essentials of Research Methods in Psychology - Shaugknessy, Tata McGraw Hill, 2009.

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**Syllabi for B.A. Final**  
**Semester-VI**  
**Concepts of Western and Indian Thinkers**

Marks : Theory – 80  
In.Ass - 20

**Unit-I Concept of State :**

- a) Aristotle - Classification of State.
- b) M.K. Gandhi – Concept of Ramrajya.

**Unit-II Concept of Democracy :**

- a) Walter Bagehot – Concept of Democracy
- b) Abraham Lincoln – Concept of Democracy
- c) Dr. B.R. Ambedkar – Parliamentary Democracy.

**Unit-III Concept of Nationalism :**

- a) Niccolo Machiavelli – Concept of Nationalism
- b) Swami Vivekananda – Concept of Nationalism
- c) V.D. Sawarkar – Concept of Nationalism

**Unit-IV Socialism :**

- a) Karl Marx - Concept of Socialism
- b) Pt. Jawaharlal Nehru – Concept of Socialism
- c) Ram Manohar Lohiya – Concept of Socialism

**Unit-V Behaviouralism and Sovereignty :**

- a) David Eston - Concept of Behaviouralism
- b) Gabriel Almond - Concepts of Post Behaviouralism
- c) John Austin - Concept of Sovereignty.

**Internal Assessment of Marks (20 Marks)**

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**SANT GADGE BABA AMRAVATI UNIVERSITY GAZETTE - 2019 - PART TWO - 30**

- |   |     |          |
|---|-----|----------|
| 1) Bibliography Related to Syllabus                 | ... | 10 Marks |
| 2) Home Assignment (Any One)<br>Related to Syllabus | ... | 10 Marks |

**Books Recommended :**

- |                           |   |
|---------------------------|---|
| 1) Francis W. Coker       | - Recent Political Thought, The World Press Pvt. Ltd.                       |
| 2) George H. Sabine       | - A History of Political theory, George G. Harrap & Company Ltd.<br>London. |
| 3) C.L. Wayper            | - Political Thought, S.T. Paul, Honce Warwick Lane London, Ec,4.            |
| 4) V.D.Mahajan & R.R.Seth | - Recent Political Thought, Premier Publishing Co. Delhi.                   |
| 5) Radhey Sham Chourasia  | - History of Western Political Thought – Volume I & II                      |
| 6) Suda, J.P.             | - History of Political Thought.   |

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**SANT GADGE BABA AMRAVATI UNIVERSITY GAZETTE**



Official Publication of Sant Gadge Baba Amravati University

PART – TWO

Thursday, the 15<sup>th</sup> June, 2017

**NOTIFICATION**

No. 40/2017

Date : 15 June, 2017

**Subject :** Implementation of Syllabi of Various Courses / Subjects as per Semester and Credit Grade System in the Faculty of Humanites from the session 2017-2018 and Onwards.

It is notified for general information of all concerned that, the authorities of the University has accepted of Semester & Credit Grade System syllabi of various Courses/ Subjects of B.A. Part-I Semester-I & Semester – II mentioned in column No.2 and which is to be implemented stagewise from the session 2017-2018 and onwards, with appendices as shown in column No.3 of the following table.

**TABLE**

Sr.No.	Course / Subjects	Appendices of the New Syllabi
1	2	3.

**B.A.Part-I Semester – I & II**

1. English  
The Syllabi prescribed for the subject Compulsory English, English Literature, Functional English & Supplementary English which is appended herewith as **Appendix-A**
2. Marathi  
The Syllabi prescribed for the subject Compulsory Marathi , Marathi Literature, which is appended herewith as **Appendix-B**
3. Hindi  
The Syllabi prescribed for the subject Compulsory Hindi, Hindi Literature, & Prayojanmulak Hindi which is appended herewith as **Appendix-C**
4. Music  
The Syllabi prescribed for the subject Indian Music which is appended herewith as **Appendix-H**

Sd/-

Registrar

Sant Gadge Baba Amravati University

**SANT GADGE BABA AMRAVATI  
UNIVERSITY SPECIAL NOTE FOR  
INFORMATION OF THE STUDENTS**

(1) Notwithstanding anything to the contrary, it is notified for general information and guidance of all concerned that a person, who has passed the qualifying examination and is eligible for admission only to the corresponding next higher examination as an ex-student or an external candidate, shall be examined in accordance with the syllabus of such next higher examination in force at the time of such examination in such subjects, papers or combination of papers in which students from University Departments or Colleges are to be examined by the University.

(2) Be it known to all the students desirous to take examination/s for which this prospectus has been prescribed should, if found necessary for any other information regarding examinations etc. refer the University Ordinance Booklet the various conditions/provisions pertaining to examinations as prescribed in the following Ordinances-

Ordinance No. 1 : Enrolment of  
Students. Ordinance No.2 : Admission of  
Students Ordinance No. 4 : National Cadet Corps  
Ordinance No. 6 : Examination in General  
(relevant extracts)

Ordinance No. 18/2001 : An Ordinance to provide  
grace  
marks for passing in a Head of  
passing and Improvement of  
Division (Higher Class) and  
getting Distinction in the

subject and condonation of  
defficiency of marks in a subject  
in all the faculties prescribed  
by the Statute NO.18,  
Ordinance 2001.

Ordinance No.9 : Conduct of Examinations  
(Relevant extracts)

Ordinance No.10 : Providing for Exemptions and  
Compartments



- Ordinance No. 19 : Admission Candidates to Degrees
- Ordinance No.109 : Recording of a change of name  
of a University Student in the records of the University
- Ordinance No.138 : For improvement of Division
- Ordinance No.19/2001 : An Ordinance for  
Central  
Assessment Programme,  
Scheme of  
Evaluation and Moderation of  
answerbooks and preparation  
of results of the  
examinations, conducted  
by the University, Ordinance  
2001.

Registrar  
Sant Gadge Baba Amravati  
University

**SANTGADGE BABA AMRAVATI UNIVERSITY,  
AMRAVATI DIRECTION**

No. : 16/2010

Date :

11/06/2010

**Subject : Examinations leading  
to the Degree of *É É Y É É X É 9 X É É É É É 0*  
(Bachelor of Science)  
(Three Year Degree  
Course-Semester Pattern),  
Direcition, 2010.**

Whereas, University Grants Commission, New Delhi vide D.O.No.F-2/2008/(XI Plan), Dtd.31 Jan.2008 regarding new initiatives under the 11<sup>th</sup> Plan – Academic Reforms in the University has suggested for improving quality of higher education and to initiate the Academic Reform at the earliest.

AND

Whereas, the Academic Council while considering the above letter in its meeting held on 30.4.2008, vide item No.55 has resolved to refer the same to Dean's Committee, and the Dean's Committee in its meeting held on 19.07.2008 has decided to refer the matter to all Board of Studies.

AND

Whereas the recommendations of various Board of Studies in the faculty of Science regarding Upgradation and Revision of various syllabi and introduction and implementation of Semester Pattern Examination System at under graduate level was considered by the faculty of Science in its meeting held on 7.12.2009 and constituted a Committee of all Chairmen of Board of Studies and one member nominated by Chairmen of respective B.O.S. under the Chairmanship of Dean of faculty to decide the policy decision regarding semester pattern examination system.

AND

Whereas, the faculty of Science in its emergent meeting held on 11<sup>th</sup> May, 2010 vide item No.26, has considered, accepted and recommended to Academic Council, the policy decision regarding introduction of Semester pattern and the draft syllabi of B.Sc. Part-I (Semester-

I & II) along with draft ordinance and other details. The recommendations of the faculty was approved by the Academic Council in its emergent meeting held on 28.5.2010, vide item No.35 D).

AN  
D

Whereas, Ordinance No.143 in respect of Examinations leading to the Degree of  $\text{É'ÉZÉÉÉ } \text{°XÉÉÉÉÉ}$  (Bachelor of Science) is in existence in the University as per annual pattern examination system.

AN  
D

Whereas, new scheme of examination as per semester pattern is to be implemented from the Academic Session 2010-11 for Semester- I & onwards which is regulated by an Ordinance and framing of an Ordinance for the above examination is likely to take some time.

AN  
D

Whereas, the admission of students in the semester pattern at B.Sc. Part-I (Semester-I) are to be made in the Academic Session 2010-11.

Now, therefore, I, Dr. Kamal Singh, Vice Chancellor of SantGadge Baba Amravati University, in exercise of powers conferred upon me under sub-section (8) of section 14 of the Maharashtra Universities Act., 1994, do hereby direct as under:

1. This Direction may be called, "Examinations leading to the Degree of  $\text{É'ÉZÉÉÉ } \text{°XÉÉÉÉÉ}$  (Bachelor of Science) (Three Year Degree Course- Semester Pattern), Direction, 2010".
2. This direction shall come into force with effect from the date of its issuance.
3. (i) The following shall be the examination leading to the Degree of  $\text{É'ÉZÉÉÉ } \text{°XÉÉÉÉÉ}$  (Bachelor of Science) in the faculty of Science-
  - (1) The  $\text{É'ÉZÉÉÉ } \text{°XÉÉÉÉÉ}$   $\text{ÉÉÉÉ-1, } \text{°ÉÉÉ-1 } \text{É } 2$  (B.Sc. Part-I, Sem-I & II) Examination;
  - (2) The  $\text{É'ÉZÉÉÉ } \text{°XÉÉÉÉÉ}$   $\text{ÉÉÉÉ-2, } \text{°ÉÉÉ-3}$  (B.Sc. Part-II, Semester-III) Examination;

- (3) The  $\text{É'ÉZÉÉÉ } \text{°XÉÉÉÉÉ}$   $\text{ÉÉÉÉ-2, } \text{°ÉÉÉ-4}$  (B.Sc. Part-II, Semester-IV) Examination;
- (4) The  $\text{É'ÉZÉÉÉ } \text{°XÉÉÉÉÉ}$   $\text{+XÉÉÉ, } \text{°ÉÉÉ-5}$  (B.Sc. Final, Semester-V) Examination; and



Geography, Fisheries, Environmental  
Science, Microbiology, Geology,  
Food Science, Industrial  
Microbiology,  
Biotechnology and Apiculture.

**For Vocational subjects  
sanctioned by**

**U.G.C. there shall be following scheme of  
Combination of subjects :-**

**Students with Mathematics at H.S.C. Examination shall select two subjects from Group D and one from Group F.**

**Students passing with Biology, at H.S.C Examination. Shall select two subjects from Group E and One from Group F.**

**Group D :** Physics, Chemistry, Mathematics, Electronics, Statistics Computer Science, Computer Application, Information Technology and Geology.

**Group E :** Chemistry, Botany, Zoology, Micro-Biology, Geology, Geography, Environmental Science, Industrial Microbiology and Biochemistry.

**Group F :** Biological Techniques and Specimen Preparation. Industrial Chemistry, Instrumentation, Computer Application, Seed Technology, Industrial Fish and Fisheries, Computer Maintenance, Biotechnology and other Vocational subjects proposed by U.G.C. from time to time shall be included in Group F.

**The students passing HSC examination with Physics, Chemistry, Biology and Mathematics shall have the option of opting Bioinformatics subject with any one subject from Group-G and anyone subject from Group-H.**

**Group G:** Botany, Zoology, Bio-Chemistry, Microbiology, Industrial Microbiology,

and Biotechnology.

**Group H:** Chemistry, Physics, Electronics, Statistics, Geology, Mathematics and Computer Science.

**(II) The students passing H.S.C. examination (M.C.V.C. stream) with technical trades mentioned in column No.2 of the following table shall be eligible for admission to the B.Sc. Part-I course in the optional subjects mentioned in column Nos. 3 of the said table as per the scheme given in Group A to H. TABLE**

**(III) In the case of the Examination of the B.Sc. Part-II, Sem-III & IV Examination:-**

have passed not less than one academic year previously the Examination of the B.Sc. Part-I, Sem-I & II Examination of the University or an examination recognised as equivalent thereto, and

**(IV) In the case of the Examination of the B.Sc. Final, Sem-V & VI Examination:-**

have passed not less than one academic year previously the Examination of the B.Sc. Part-II, Sem-III & IV Examination of the University or an examination recognised as equivalent thereto;

7. Subject to his/her compliance with the provisions of this Direction and other Ordinances (pertaining to Examination in General) in force from time to time, the applicant for admission, at the end of the course of study of a particular semester to an examination specified in column (1) of the table below, shall be eligible to appear at it, if,
- he/she satisfied the condition in the table and the provisions thereunder.
  - he/she has prosecuted a regular course of study in a college affiliated to the University.
  - he/she has in the opinion of the Principal shown the satisfactory progress in his/her studies.

**TABLE**

Name of the Exam to appear	The student should have completed the Session / term satisfactorily	The student should have passed
1	2	3
B.Sc. Part-I (Sem-I & II)	Sem-I & II	Qualifying examination.
B.Sc.-II Semester-III	Semester-I & II	One half of the total head prescribed for Sem-I & Sem-II examination

1	2	3
B.Sc.-II Semester-IV	Semester-III	One half of the total head prescribed for Sem-I & Sem-II examination
B.Sc.-III Semester-V	Semester-III & IV	(i) passed the Sem-I & II examination and (ii) One half of the total head prescribed for Sem-III & Sem-IV examination
B.Sc.-III Semester-VI	Semester-V	(i) passed the Sem-I & II examination and (ii) One half of the total head prescribed for Sem-III & Sem-IV examination

**(Note :** For Calculating the Heads, the theory and the practical shall be considered as a separate head and on calculation fraction if any shall be ignored.)

- Without prejudice to the other provisions of Ordinance No. 6 relating to the Examination in General, the provisions of Paragraph 5, 8, 10 and 31 of the said ordinance shall apply to every collegiate candidate.
- The fee for the examination shall be as prescribed by the University from time to time.
- Every examinee for the Examination of the B.Sc. Part-II, Sem-III & Sem-IV, Examination shall be examined in each of the three Science subjects in which he has been examined at the Examination of the B.Sc. Part-I, Sem-I & II Examination.
- Every examinee for the Examination of the B.Sc. Final, Sem-V & VI, Examination shall be examined in each of the three Science subjects in which he has been examined at the Examination of the B.Sc. Part-II, Sem-III & Sem-IV Examination.

12. An examinee who is successful at the  $\text{É'ÉZÉÉXÉ } \text{°XÉÉÉÉÉÉ } \text{ÉÉÉÉ-1, } \text{°ÉÉÉ-1 } \text{É } 2$  (B.Sc. Part-I, Sem-I & II) Examination, may offer an additional subject mentioned in Para (6) (iii) not offered by him at the  $\text{É'ÉZÉÉXÉ } \text{°XÉÉÉÉÉÉ } \text{ÉÉÉÉ-1, } \text{°ÉÉÉ-1 } \text{É } 2$  (B.Sc. Part-I, Sem-I & II) Examination, on his prosecuting a regular course of study for one academic year in that subject. Such an examinee shall not be permitted to take any other examination simultaneously with the examination in the additional subjects. The fee for the additional subject shall be as prescribed by the University from time to time.
13. The Scope of the subjects of all semester opted by the students shall be as indicated in the respective syllabi from time to time. The medium of instruction and examination shall be English except for the courses in Languages.
14. The maximum marks allotted to each subject and paper and the minimum marks which an examinee must obtain in order to pass the examination shall be as per Appendices A, B, C, D, E and F appended to this Ordinance.
15. The practical examination of all semesters shall be conducted annually. That means the practical examination shall be conducted as per following schedule.

Sr.No.	Semester	Examination
1	Semester-I & II	Summer
2	Semester-III & IV	Summer
3	Semester-V & VI	Summer

16. The scheme of awarding internal marks shall be as per **Appendix-G** appended with this Direction.
17. Successful examinees at the  $\text{É'ÉZÉÉXÉ } \text{°XÉÉÉÉÉÉ } \text{+XÉÉÉ, } \text{°ÉÉÉ-6}$  (B.Sc. Final, Sem-VI) Examination who obtain not less than 60% marks in aggregate of Sem-I, II, III, IV, V & VI Examination taken together shall be placed in the First Division, those obtaining less than 60% but not less than 45% in the Second Division, and all others successful examinees in the pass Division.

### Explanation :

Division at the  $\text{É'ÉZÉÉXÉ } \text{°XÉÉÉÉÉÉ } \text{+XÉÉÉ, } \text{°ÉÉÉ-5 } \text{É } 6$  (B.Sc. Final, Sem-V & Sem-VI) Examination shall be declared on the basis of the marks obtained in the Science Subjects at the Sem-I, II, III, IV, V & VI Examination taken together.

18. There shall be no classification of successful examinees at the Sem-I to Sem-V Examinations.
19. An examinee successful in the minimum period prescribed for the examination, obtaining not less than 75% of the maximum marks prescribed in the subject shall be declared to have passed the examination with Distinction in the subject.

### Explanation :

- (1) Distinction shall be awarded only in Science Subjects including Mathematics.
  - (2) Distinction at the  $\text{É'ÉZÉÉXÉ } \text{°XÉÉÉÉÉÉ } \text{+XÉÉÉ}$  (B.Sc. Final) Examination shall be awarded on the basis of the marks obtained at the  $\text{É'ÉZÉÉXÉ } \text{°XÉÉÉÉÉÉ } \text{ÉÉÉÉ-1, } \text{°ÉÉÉ-1 } \text{É } 2$ ;  $\text{É'ÉZÉÉXÉ } \text{°XÉÉÉÉÉÉ } \text{ÉÉÉÉ-2, } \text{°ÉÉÉ-3 } \text{É } 4$ ;  $\text{É'ÉZÉÉXÉ } \text{°XÉÉÉÉÉÉ } \text{+XÉÉÉ, } \text{°ÉÉÉ-5 } \text{É } 6$  (B.Sc. Part-I, Sem-I & II; B.Sc. Part-II, Sem-III & IV, and B.Sc. Final-Sem-V & VI) Examination taken together.
  - (3) Distinction shall not be awarded to an examinee availing of the provision of the exemptions and compartments at any of the examination.
20. Provisions of Ordinance No18/2001 in respect of an Ordinance to provide grace marks for passing in a Head of passing and Improvement of Division (Higher Class) and getting Distinction in the subject and condonation of deficiency of marks in a subject in all the faculties prescribed by the Statute NO.18, Ordinance 2001 shall apply.
21. (A) The students who have passed B.Sc. Final examination of this University or any other statutory University shall be eligible to seek admission for studying practical of any other optional subjects offered for B.Sc. Degree for simultaneous study of complete three year course for that subject in one year and to appear simultaneously for all parts



of examination leading to the degree of Bachelor of Sci- ence (additional) in that subject, subject to the following condition.

An examinee shall have attended full course of laboratory instructions in a College in the subject in which laboratory work is prescribed. An examinee shall submit a certificate to that effect signed by the Principal of the College.

- (B) On securing not less than minimum marks prescribed for the subject / subjects shall be issued a certificate of having passed the examination in the additional subject/subjects as the case may be.
- (C) The application for admission to the examination under (A) above shall be submitted to the Registrar not less than three months before the date of commencement of the examination.”

22. As soon as possible after the examinations the Board of Examination shall publish a list of successful examinees at the B.Sc Part-I, Sem-I & II; B.Sc. Part-II, Sem-III & IV and B.Sc. Final Sem-

V & VI Examinations. Such list at the  $\text{ᐃᐅᐅᐅᐅᐅᐅ ᐅᐅᐅᐅᐅᐅ ᐅᐅᐅᐅᐅᐅ}$  (B.Sc.

Final) Examination shall be arranged in three Divisions. The

names of the examinees passing the examination as a whole in the minimum prescribed period and obtaining the prescribed number of places in First or Second Division shall be arranged in Order of Merit as provided in the Examinations in General Ordinance No. 6.

23. No Person shall be admitted to B.Sc Part-I, Sem-I & II; B.Sc. Part-II, Sem-III & IV and B.Sc. Final Sem-V & VI Examinations, if he has already passed the corresponding or an equivalent examination of any other Statutory University.

24. Successful Examinees at the  $\text{ᐃᐅᐅᐅᐅᐅᐅ ᐅᐅᐅᐅᐅᐅ ᐅᐅᐅᐅᐅᐅ}$ ,  $\text{ᐅᐅᐅᐅᐅᐅ ᐅᐅᐅᐅᐅᐅ}$  2 (B.Sc. Part-I, Sem-I & II) and the  $\text{ᐃᐅᐅᐅᐅᐅᐅ ᐅᐅᐅᐅᐅᐅ ᐅᐅᐅᐅᐅᐅ}$ ,  $\text{ᐅᐅᐅᐅᐅᐅ ᐅᐅᐅᐅᐅᐅ}$  4 (B.Sc. Part-II, Sem-III & IV) Examination shall be entitled to receive a Certificate signed by the Registrar and successful examinee at the end of  $\text{ᐃᐅᐅᐅᐅᐅᐅ ᐅᐅᐅᐅᐅᐅ ᐅᐅᐅᐅᐅᐅ}$   $\text{ᐅᐅᐅᐅᐅᐅ}$  6 (B.Sc. Final, Sem-VI) Examination, shall on payment of the prescribed fees, receive a Degree

Examination Scheme

$\text{ᐃᐅᐅᐅᐅᐅᐅ ᐅᐅᐅᐅᐅᐅ ᐅᐅᐅᐅᐅᐅ}$

(B.Sc. Part-I)  
(Semester-I)

Sr. No.	Subject	Theory			Practical		Total Theory, Pract. & Int.Ass.	
		Max. Mar. Theory Papers	Max. Marks Int. Ass.	Total	Min. pass Marks	Max. Marks Practical		Min. Pass Mar.
1	Compulsory English	40	10	50	18	—	—	50
2	Languages	40	10	50	18	—	—	50
3	Mathematics (Paper-I)	60	15	150	54	—	—	150
4	Mathematics (Paper -II)	60	15			—	—	
5	Science subjects excluding Mathematics	80	20	100	35	50	18	150

in the Pre-scribed form, signed by the Vice-Chancellor.

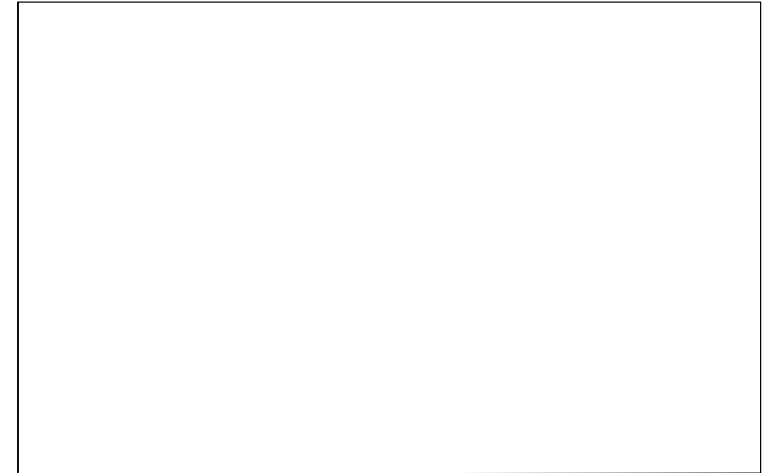
**Grand Total of Semester-I : 450+100**

Appendix-B

ବିଦ୍ୟାଳୟ ପରୀକ୍ଷା ସୂଚୀ-1

**(B.Sc. Part-I) (Semester-II)**

Subject	Examination Scheme						Total Theory, Pract. & Int.Ass.
	Theory			Practical			
	Max. Mar. Theory Papers	Max. Marks Int. Ass.	Total	Min. pass Marks	Max. Marks Practical	Min. Pass Mar.	
Compulsory English	40	10	50	18	—	—	50
Languages	40	10	50	18	—	—	50
Mathematics (Paper-III)	60	15	150	54	—	—	150
Mathematics (Paper -IV)	60	15			—	—	
Science subjects excluding Mathematics	80	20	100	35	50	18	150

**Grand Total of Semester-I : 450+100**

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**(B.Sc. Part-II)  
(Semester-III)**

Sr. No.	Subject	Examination Scheme						Total Theory, Pract. & Int.Ass.
		Theory				Practical		
		Max. Mar. Theory Papers	Max. Marks Int. Ass.	Total	Min. Pass Marks	Max. Marks Practical	Min. Pass Mar.	
1	Mathematics (Paper-V)	60	15			—	—	
4	Mathematics (Paper-VI)	60	15	150	60		—	150
5	Science subjects excluding Mathematics	80	20	100	40	50	20	150

**Grand Total of  
Semester-III : 450**

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**(B.Sc. Final)  
(Semester-V)**

Sr. No.	Subject	Examination Scheme						Total Theory, Pract. & Int.Ass.
		Theory				Practical		
		Max. Mar. Theory Papers	Max. Marks Int. Ass.	Total	Min. Pass Marks	Max. Marks Practical	Min. Pass Mar.	
1	Mathematics (Paper-IX)	60	15			—	—	
4	Mathematics (Paper-X)	60	15	150	60		—	150
5	Science subjects excluding Mathematics	80	20	100	40	50	20	150

**Grand Total of Semester-V : 450**

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**(B.Sc. Part-II)  
(Semester-IV)**

Sr. No.	Subject	Examination Scheme						Total Theory, Pract. & Int.Ass.
		Theory				Practical		
		Max. Mar. Theory Papers	Max. Marks Int. Ass.	Total	Min. Pass Marks	Max. Marks Practical	Min. Pass Mar.	
1	Mathematics (Paper-VII)	60	15			—	—	
4	Mathematics (Paper-VIII)	60	15	150	60		—	150
5	Science subjects excluding Mathematics	80	20	100	40	50	20	150

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**(B.Sc. Final)  
(Semester-VI)**

Sr. No.	Subject	Examination Scheme						Total Theory, Pract. & Int.Ass.
		Theory				Practical		
		Max. Mar. Theory Papers	Max. Marks Int. Ass.	Total	Min. Pass Marks	Max. Marks Practical	Min. Pass Mar.	
1	Mathematics (Paper-VII)	60	15			—	—	
4	Mathematics (Paper-VIII)	60	15	150	60		—	150
5	Science subjects excluding Mathematics	80	20	100	40	50	20	150

**Grand Total of Semester-IV : 450**

**Grand Total of Semester-VI : 450**

**Note:** 1 There shall be only one theory paper of each sciencesubject other than Mathematics for every semester.

2. Distribution of marks of practical within the limit of Max. Marks shall be as prescribed by the B.O.S. of the concerned subject.
3. In absence of certificate for practical record book (Appendix-H), examinee shall not be allowed to appear for the practical examination.

### Appendix-G

The internal assessment marks assigned to each theory paper as mentioned in **Appendix-A to F** shall be awarded on the basis of as-assignment, class test, attendance, project assignments, Seminar, Study tour, Industrial visit, Visit to educational institutions and research orga- nization, field work, group discussion or any other innovative practice/activity. The marking scheme for each of the practice/activity shall be as under :-

Sr. No.	Se me ster	Practice /Activity	Details of mar king sc heme	Total marks for		
				Languages	Mathe- matics	O the r Sc ience Subjects
1	2	3	4	5	6	7
1	Semester -I & II	Assignment	Two assignments per theory paper	04	05	08
2	Semester- I & II	Class Test	Two class test (on passing test)	06	10	12
<b>Total marks for Sem-I /II</b>				<b>10</b>	<b>15</b>	<b>20</b>
3	Sem-III, IV, V & VI	Project Assignment	On latest developme-nts in the subject in 100-200 words	—	03	04
4	Sem-III, IV, V & VI	Class Test	Two class test (on passing test)	—	08	10

1	2	3	4	5	6	7
5	Sem-III, IV, V & VI	Seminar, Study tour, Industrial visit, Visit to educational institutions, research organization field work, group discussion or any other innovative practice/activity.	Any one of the activity with report of the activity.	—	04	06

**Note :** 1. The concerned teacher shall have to keep the record of all the above activities till the passing out of that batch.

2. At the beginning of each semester, every teacher shall inform his/her students unambiguously the method he/she proposes to adopt a scheme of marking for the internal assessment.
3. Teacher shall announce the schedule of activity for Internal Assessment in advance in consultation with HOD/Principal.
4. Normally the teacher concerned may conduct three written tests spread periodically during the semester and award the marks on the test on passing of any two tests.
5. The internal marks shall be displayed on the notice board before three weeks of the commencement of the theory examination. Grievances if any, of the student regarding Internal Assessment marks shall be settled by the Principal at college level in consultation with the concerned teacher.
6. Final submission of internal marks to the University shall be before commencement of the theory examinations.

**CERTIFICATE**

Name of College/ Institution :

.....  
.....  
.....

Name of the Department:-

.....  
.....  
.....

This is to certify that this Book contains the bonafide record of the practical work of Shri/Kumari/Shrimati

.....  
.....

..... of B.Sc.Part-..... (Semester-.....) during the Academic year

.....

..... Dated:...../...../20.....

Signature of the Teacher who taught the examinee

1. ....

2. ....

Head of the Department

(Note : In absence of certificate for practical record book (Appendix-H), examinee shall not be allowed to appear for the practical examination.)

**Sang Gadge Baba Amravati**

**University, Amravati**

**DIRECTION**

No. : 37 / 2011

Date : 26.7.2011

Amravati

Sd/-

Date : 11/6/2010

(Dr.Kamal Singh)

Vice-Chancellor

\*\*\*\*\*

**Subject : Corrigendum to Direction No.16/2010 in re- spect of Examinations leading to the Degree of (Bachelor of Science) (Three Year Degree Course – Semester Pattern)**

Whereas, the Direction No. 16 of 2010 regarding Examinations leading to the Degree of (Bachelor of Science) (Three Year Degree Course – Semester Pattern), Direction-2010 is in existence.

AN  
D

Whereas, the existing provision regarding theory examination of Semester-I & II shall be simultaneously conducted by the University at the end of Semester-II in Summer as well as the practical examinations shall be conducted annually for each semester.

AN  
D

Whereas, the Committee constituted by the faculty of Science, under the Chairmanship of Dean of the faculty in its meeting held on 28.6.2011 and 14.7.2011 has considered the issues regarding con- duction of theory and practical examination of B.Sc. Semester-I to VI at the end of each semester, from the Academic Session 2011-12.

AN  
D

Whereas, making amendments in the Ordinance for above ex-amination is a time consuming process.

AN  
D

Whereas, it is necessary to carryout the corrections to Direc-tion No.16 of 2010 issued earlier as stated in para No.1 above, urgently.

Now, therefore, I, Dr.Mohan K.Khedkar, Vice Chancellor of Sant Gadge Baba Amravati University, in exercise of powers conferred upon me under sub-section (8) of section 14 of the Maharashtra Uni-versities Act., 1994, do hereby direct as under:

1. This Direction may be called “Corrigendum to Direction No.16/2010 in respect of Examinations leading to the Degree of (Bachelor of Science) (Three Year Degree Course – Semester Pattern)”.

2. This direction shall come into force from the date of its issuance.
3. From the Academic Session 2011-12, theory and practical examinations of each Semester shall be conducted separately at the end of each semester.

Amravati  
Date : 26/7/2011

Sd/-  
(Dr.Mohan K.Khedkar)  
Vice-Chancellor

\*\*\*\*\*

**DIRECTION**

No. : 1 / 2012  
:23.1.2012

Date

**Subject : Corrigendum to Direction  
No.16/2010 in re- spect of  
Examinations leading to the  
Degree of (Bachelor of  
Science) (Three Year  
Degree Course – Semester  
Pattern)**

Whereas, the Direction No.16 of 2010 in respect of Examinations leading to the Degree of (Bachelor of Science) (Three Year Degree Course – Semester Pattern) in the faculty of Science is in existence.

AND

Whereas, corrigendum to Direction No.16 of 2010 in respect of Examinations leading to the Degree of (Bachelor of Science) (Three Year Degree Course – Semester Pattern) was issued vide Direction No.37/2011 on dated 26.7.2011.

AND

Whereas, the Academic Council in its meeting held on 13.1.2012 vide item Nos.14 (5) (E) and 14 (5) (O) respectively has accepted to allow the students passing H.S.S.C. examination (M.C.V.C. stream) with Medical Laboratory Technician Trade for admission to B.Sc. Part-I under the group-”Chemistry, Environmental Science, Industrial Microbiology”, and the

recommendations of the Monitoring Committee under the Chairmanship of Dean, faculty of Science of its meeting dated 15.11.2011 regarding correction in marking scheme of Internal Assessment Marks at B.Sc. level.

AND



Whereas, as per decision of Academic Council, the above cor-rection are to be carried out in Column No.3 against Sr.No. 1 under the table of sub-clause (II) of Para 6 and in Appendix-G of Direction No.16of 2010 issued earlier for the Examinations leading to the Degree of (Bachelor of Science) (Three Year Degree Course – Semester Pattern) inthe faculty of Science for Summer-2012 examinations and onwards.

AND

Whereas, it is necessary to carry out the corrections in the above said Direction immediately.

Now, therefore, I, Dr.Mohan K.Khedkar, Vice Chancellor of Sant Gadge Baba Amravati University, in exercise of powers conferred upon me under sub-section (8) of section 14 of the Maharashtra Uni-versities Act., 1994, do hereby direct as under:

1. This Direction may be called “Corrigendum to Direction No.16/2010 in respect of Examinations leading to the Degree of (Bachelor of Science) (Three Year Degree Course – Semester Pattern) in the faculty of Science”.
2. This direction shall come into force from the date of its issuance.
3. In Direction No.16/2010 in respect of Examinations leading to the Degree of (Bachelor of Science) (Three Year Degree Course – Semester Pattern) in the faculty of Science-
  - A) the words “Industrial Microbiology” after the word “Bioinformatics” in column No.3 against Sr.No.1 under the table of Sub-clause (II) of para 6 of Direction No.16 of 2010 shall be added.
  - B) in Appendix-G following corrections be carried out :
    1. In column No.4, at Sr.No.1, the words “Two assignments” be replaced by the words “One assignment”.
    2. In column No.4, at Sr.No.2, the words & signs “Two Class Tests (On passing test)” be replaced by the words “One test”.
    3. In column No.4, at Sr.No.4, the words & signs “Two Class Tests (On passing test)” be replaced by the words “One test”.
    4. In column No.4, at Sr.No.5, the words “Any one of the activity” be replaced by the words “Any one of the activities”.

5. The Note No.4 be deleted and substituted by the following para.

“The test with maximum 30 marks be conducted for the students and the marks be allotted based on the performance of the students as under-”

	Languages	Mathematics		Other Sci. subjects	
	Sem-I& II	Sem-I & II	Sem-III to VI	Sem-I & II	Sem-III to VI
For the score 24 and above.	06	10	08	12	10
From 18 to 23	05	08	06	10	07
From 11 to 17	04	06	04	07	05
From 0 to 10	00	00	00	00	00

6. The following Note be added at Sr.No.7 -  
 “The student who remain absent for internal assessment through out the semester, ‘Zero’ marks be given to him/her while posting the marks instead of writing “Ab” before his/her name.”

## SANTGADGE BABA AMRAVATI UNIVERSITY, AMRAVATI

The Executive Council, dated 1/2-4 -1977, 11-7-1977 has pre-scribed the Teaching periods in the various subject in the Faculty of Science as follows.

### Examination:

### B. Sc. Part - I

Subject	Theory	Practical
1. Chemistry	6	6
2. Physics	6 + 1 Tutorial	6
3. Botany	6	6
4. Zoology	6	6
5. Geology	6	6
6. Mathematics	9 + 1 Tutorial-	-
7. Statistics	6	6
8. English		
Languages:	4 + 1 Tutorial-	-
9. Supplementary English	3	
10. Marathi	3	
11. Hindi	3	
12. Sanskrit	3	
13. Biochemistry	6	6
14. Microbiology	6	6
15. Electronics	6	6
16. Computer Science	6	6

**SANT GADGE BABA AMRAVATI UNIVERSITY GAZETTE****Official Publication of Sant Gadge Baba Amravati University**

PART TWO

Thursday, the 27<sup>th</sup> June, 2019**NOTIFICATION**

No. 56 / 2019

Date: 27/6 /2019

- Subject : I) Introduction of new syllabi for the subject Geology at B.Sc. Part-III (Sem. V & VI) level, which to be implemented from the academic session 2019-20.**
- II) Introduction of new syllabi for B.Sc. Part-III (Semester-V & VI) Computer Science / Computer Application/ Information Technology/Computer Application(Vocational)which to be implemented from the academic session 2019-20.**

**I)** It is notified for general information of all concerned that the authorities of the University has introduced new syllabi for the subject Geology at B.Sc. Part-III (Sem. V & VI) level, which to be implemented from the academic session 2019-20. Hence, the page Nos. 42 to 46, appearing in prospectus No. 2016123 be substituted respectively by the **“APPENDIX-A”**, which is appended with this notification.

**II)** It is notified for general information of all concerned that the authorities of the University has introduced new syllabi for B.Sc. Part-III (Semester-V & VI) Computer Science / Computer Application/ Information Technology/Computer Application(Vocational), which to be implemented from the academic session 2019-20. Hence, the page Nos. 88 to 97, appearing in prospectus No. 2016123 be substituted respectively by the **APPENDIX-B**, which is appended with this notification.

Sd/-  
(Dr.  
T.R.Deshmukh)  
Registrar,  
Sant Gadge Baba Amravati University

**APPENDIX-A****SYLLABI PRESCRIBED FOR B.SC. FINAL TO BE IMPLEMENTED FROM THE A.S. 2019-20SEMESTER- V****5S : GEOLOGY****ECONOMIC GEOLOGY AND MINERAL EXPLORATION**

**UNIT I :** Economic geology: Introduction, purpose and scope; Metallic and non metallic minerals, ore, ore deposits, gangue minerals, tenor and grade of the ore; Processes of ore formation, types of deposits, distribution of mineral deposits in space and time, metallogenic epochs and provinces, geological thermometers; Classifications of mineral deposits, magmatic concentration deposits, contact metasomatic deposits.

**UNIT II :** Sedimentary deposits, hydrothermal deposits (cavity filling and replacement), evaporation deposits, colloidal deposits, residual and mechanical concentration deposits, oxidation and supergene sulphide enrichment deposits, metamorphic and metamorphosed deposits.

**UNIT III :** Mineralogy, properties, uses, origin, mode of occurrence, types of deposits, geological and geographical distribution in India of the metallic mineral deposits like gold, iron, copper, lead, zinc, manganese, aluminium and chromite.

**UNIT IV :** Mineralogy, properties, uses, origin, mode of occurrence, types of deposits, geological and geographical distribution in India of non-metallic deposits like asbestos, mica, gypsum, barite, magnesite and limestone. Properties, classifications, origin, uses, geological and geographical distribution of coal deposits of India. Origin and migration of oil, oil trap and its types, geological and geographical distribution of Petroleum deposits of India.

**UNIT V :** Mineral exploration and prospecting, definition and scope, surface methods of exploration and their applications, sub surface methods of exploration like, gravity, magnetic, electrical, seismic, radiometric, geochemical and geobotanical methods and their applications in Geology.

**UNIT VI :** Guides and controls of ore localization, sampling-Its types, calculations and computation of grade and ore reserves, geochemical cycle and dispersal; Strategic, critical and essential minerals.

**Practicals**

- A. Identification of ore minerals by Physical properties ( 40 to 60 specimens)
- B. Identification of industrial Minerals by physical properties ( 20 to 30 specimens)
- C. Exercises showing major metallic and non metallic minerals on India map ( 6 to 10 maps)
- D. Exercises on calculations on grade and ore reserves ( 6 to 10 problems )
- E. Laboratory exercises in solving exploration problems ( 8 to 10 problems)

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**SANT GADGE BABA AMRAVATI UNIVERSITY GAZETTE - 2019 - PART TWO - 120**

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**Practical Examination**

Practical Examination will be of four hours duration and carries 50 Marks. The distribution of Marks will be as follows,

I.	Identification of ore minerals (5 nos.)	10 Marks
II.	Identification of industrial minerals (5 nos.)	10 Marks
III.	Exercises of metallic and non-metallic deposits of India on maps (2 maps)	4 Marks
IV.	Laboratory exercises in solving exploration problems (2 problems)	8 Marks
V.	Exercises on calculations and grades of ore reserves (2 problems)	8 Marks
VI.	Practical record	5 marks
VII.	Viva – voce	5 marks

**Total- 50 Marks**

**Books Recommended :**

1. McKinstry, H.E. (1972) Mining Geology. Prentice – Hall Inc.
2. Arogyaswamy, R.N.P. (1995) Courses in Mining Geology. Oxford and IBH publishing Co., New Delhi.
3. Bagchi, T. C., Sen Gupta, D. K. and Rao, S.V.L.N.(1979) Elements of Prospecting.
4. Jensen, M.L. and Bateman, A.M.( 1981) Economic Mineral Deposits. John Wiley and Sons, New York.
5. Deb, S. (1980) Industrial Minerals and Rocks of India. Allied Publishers, New Delhi.
6. Howel, B.F. (1959) Introduction to Geophysical prospecting. McGraw Hill.
7. Lowrie, W. (1997) Fundamentals of Geophysics. Cambridge University Press.
8. Sen, A.K. and Guha, P.K. (1993) a handbook of Economic Geology. Dynamic printers, Kolkata.
9. Banerjee, D.K. (1992) Mineral resources of India. The World Press Pvt. Ltd., Kolkata.
10. Sharma, N.L. and Ram, K.S.V. (1964) Introduction to India's Economic minerals, Dhanbad Publishers.
11. Dobrin, M.B. (1952) Introduction to Geophysical Prospecting. McGraw Hill.
12. Park, C. F. and MacDiamid, R.A Ore Deposits. Freeman and company, Saint Francisco.
13. Sinha and Sharma . Mineral Economics.
14. Krishnaswamy, S. (1979) India's Mineral Resources. Oxford IBH, Pub. Co. New Delhi.
15. Prasad Umeshwar. Economic deposits of India. CBS Publishers, New Delhi.

**SEMESTER**

**VIS :**

**GEOLOGY**

**HYDROGEOLOGY, REMOTE SENSING, ENGINEERING GEOLOGY AND GEOLOGICAL SKILLS**

- UNIT I :** Concept of hydrology, hydrogeology and ground water, Hydrologic cycle and its components, Occurrence and distribution of ground water, Water Table; Aquifer and its types – confined, unconfined and semi- confined; Properties of aquifer- porosity, permeability, specific yield, safe yields, storage coefficient, storativity and transmissivity.
- UNIT II :** Recharge and discharge, Cone of depression, Influent and affluent seepages, Springs and its types. Ground water Provinces of India. Geophysical investigations for groundwater exploration, Groundwater and water quality services, Hydrochemical parameters of ground water (Acidity, Alkalinity, Hardness, pH, Conductivity). Recharge through wells and its types. Rain water harvesting,
- UNIT III :** Aerial photographs and its types, Satellite imageries. Methods of studying aerial photographs in the form of stereo-pairs and mosaic. Pocket and mirror stereoscopes, Overlap and sidelap, Drift and crab. Photogeology and elements of photorecognition- tone, texture, shape, size, pattern; Scale of photograph and vertical exaggeration. Guidelines for lithological, structural and geomorphic interpretations. Applications of photogeology. "Introduction and scope of photogeology".
- UNIT IV :** Concept of remote sensing, types of remote sensing systems (active and passive), Elements of passive remote sensing system (data acquisition and data analysis); applications of remote sensing in studying the natural resources like minerals, ground water, soil and forests. Satellites and Satellite data - introduction and brief history, types of satellites, information obtained with reference to latest IRS & LANDSAT satellites. Sensors – types and their applications.
- UNIT V :** Engineering Geology – introduction, scope and significance; engineering properties of rocks - specific gravity, porosity, crushing strength, compressive strength, and tensile strength. Tunnels - terminology, geological conditions for tunnel sites, tunnels in folded rocks and bedded rocks. Dams – terminology, geological conditions for the selection of dam, Types of dams - Masonary dams (Gravity buttress and Arch types), earthen dams. Landslides - causes, types and prevention of landslides.
- UNIT VI :** Geological skill development - Role of geological expertise in local natural resources investigation, exploration and mining, beneficiation of minerals; Rocks and minerals thin section making, Civil engineering services, Environmental services, . Soil quality testing and conservation services, Laboratory and Research Technician. Geoheritage.

**PRACTICALS: SEMESTER VI**

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**SANT GADGE BABA AMRAVATI UNIVERSITY GAZETTE - 2019 - PART TWO - 62**

1. Plotting of ground water provinces on outline map of India.
2. Problems on determination of aquifer parameters, ground water table maps.
3. Interpretation of aerial photographs and satellite imageries.
4. Field work : Field work is an Integral part of Geology Syllabus. Every student should attend field work for a short duration and submit field diary, geological specimen collected and a report.

**PRACTICAL EXAMINATION:**

The Practical Examination will be four hour duration and carries 50 marks. The distribution of marks will be as follows-

I Plotting of Ground water provinces on outline map of India.	08
MarksII water table contour maps	Ground 06
Marks	
III Problems on determination of Aquifer Parameters.	10 Marks
IV Interpretation of Aerial Photographs and Satellite Imageries.	06 Marks
VI Field Work.	10
Marks	
VII Practical Record	05 Marks
VIII Viva Voce	05 Marks

50 Marks

**Text Books for Sem VI :**

1. Todd, D.K. (1980) Ground Water Hydrology. John Wiley and Sons Inc. New York.
2. Karanth, K.R. (1989) Hydrogeology. Tata McGraw Hill Pub.Co.Ltd., New Delhi.
3. Nagabhushaniah, H.S. (2001) Groundwater in Hydrosphere (Groundwater Hydrology) CBS Publisher, New Delhi.
4. Karanth K.R. Groundwater, Assessment, Development and Management. Tata McGraw Hill Pub. Co. Ltd., New Delhi.
5. Raghunath : Ground Water Hydrology, New Age Publication, Pune.
6. P. Arul Murugan, R.R. Krishnamurthy, .in groundwater targeting and coastal hydrogeological studies"
7. Pande, S.N. (1987) Principles and Applications of Photogeology . Wiley Eastern Limited.
8. . Sabisin, F.F. (2000) Remote Sensing Principles and Interpretations. W.H. Freeman and Company, USA
9. . Lilesand, T.M. and Kiefer, R.W.(2000) Remote Sensing and Image Interpretation. John Wiley and Sons Inc.,New York.
10. Drury, S.A. (1997) Image Interpretaton in Geology. Chapman and Hall, London.
11. Dr.AFZAL An Introduction to Remote Sensing ;SHARIEFF ;Sarup book Publishers PVT.LTD. , New Delhi.
12. Text Book of Engineering Geology - Parbin Singh, Katson Publishing, Ludhina.
13. R B Gupte, Text Book of Engineering Geology,Published by Pune Vidyarthi Griha Prakashan
14. Hand book of analysis of water sample

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**APPENDIX-B**

**Syllabus prescribed for B.Sc. Part III (Semester-V & VI) Computer Science to be implemented from the AcademicSession 2019-20 & onwards.**

**B.Sc.Part-III (Semester-V)**

The Examination in Computer Science of Fifth Semester shall comprise of one theory paper of 80 Marks of three hours duration and internal assessment of 20 Marks. The practical examination will be of 4 Hrs. duration and carry 50 Marks.

**The distribution of marks for practical examination is as under:**

1. Program writing / execution (on group A & B)	: 30 Marks
2. Practical record	: 10 Marks
3. Viva Voce	: 10 Marks

Total 50 Marks

5S: Computer Science

**. Net Technology and Java Programming**

**Unit I: Introduction to .NET Framework :** NET framework, MSIL, CLR, CLS, CTS, Namespaces, Assemblies The Common Language Implementation, Assemblies, Garbage Collection, The End to DLL Hell - Managed Execution

**Unit II: Introduction to visual programming :** Concept of event driven programming - Introduction to VB.Net environment, The .NET Framework and the Common Language Runtime. Building VB.NET Applications, The Visual Basic Integrated Development - Basic Language - Console application and windows application, Data

types, Declaring Variables, scope of variables, operators and statements.

**Unit III: Decisions and loop :** Making Decisions with If . . . Else Statements, Using Select Case, Making Selections with Switch and Choose, Loop statements - Do Loop, for, while - The With Statement - Handling Dates and Times - Converting between Data Types - Arrays - declaration and manipulation - Strings & string functions - Sub Procedures and Functions. **Unit IV : Introduction to AVA :** History and evolution ,Feature, JDK, JVM, Difference between C++ and Java, Structure of Java Program, Keywords, Variable, Data types and Literals, Operators Control of Flow, (Selection Statements, Iteration Statements),Command Line Argument, One dimensional and two dimensional array.



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**SANT GADGE BABA AMRAVATI UNIVERSITY GAZETTE - 2019 - PART TWO - 12**

**Unit V : Classes and inheritance:** Class, Object, Method, Overloading Method, Constructor, Constructor Overloading, this Keyword, **Inheritance:** Introduction to Inheritance, Super, Multilevel Hierarchy, method overriding, Abstract class, Using Final (variables , methods and classes).

**Unit VI : String, Package and Interface:** **String:** String operation, String comparison, Searching and modifying string, **Package:** Package concept, Defining Package, Finding Package, Java In-built Packages **Interface:** Interface concept, Defining, and Implementing of Interface.

**Books Recommended:**

- 1) .NET Framework, OREILY Publication.
- 2) Steven Holzner, Visual Basic .NET Black Book
- 3) Rebecca Riordan, VB.NET for Developers, Keith Franklin, SAMS
- 4) Jason Beres, Sams Teach Yourself Visual Studio .NET 2005 in 21 Days,
- 5) Jesse Liberty, Learning Visual Basic .NET
- 6) The Complete Reference JAVA2 by Herbert Schildt (Tata McGraw)
- 7) The Complete Reference JAVA by Patrik Noughton
- 8) Programming with JAVA - A Primer : By E.Balguruswamy (Tata McGraw)
- 9) Programming in JAVA : By S.S.Khandare (S.Chand)
- 10) Teach Yourself 'Java' in 2 Hrs : By Sams.
- 11) Java for You : By P. Koparkar

**Practical :** Minimum 16 Practical base on

A: Unit II and Unit III (Minimum 8 practical)

B: Unit IV, Unit V and Unit VI (Minimum 8 practical)

**B.Sc.Part-III (Semester-VI)**

The Examination in Computer Science of Sixth Semester shall comprise of one theory paper of 80 Marks of three hours duration and internal assessment of 20 Marks. The practical examination will be of 4 Hrs. duration and carry 50 Marks.

**The distribution of marks for practical examination is as under:**

- |   |            |
|---|------------|
| 1. Program writing / execution (on group A & B) | : 30 Marks |
| 2. Practical record                             | : 10 Marks |
| 3. Viva Voce                                    | : 10 Marks |

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**Total 50 Marks**

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**S: Computer Science**  
**Advanced Java and VB.net**

**Unit I : Exception Handling and Multithreading :** **Exception Handling:** Concept of Exception handling, Type of Exception, Try, Catch, and Finally. Multiple Catch blocks, Nested Try Statements, throw, throws. **Multithreading:** Multithreading concept, life cycle, creating and running thread, thread priority.

**Unit II : Applet:** Introduction to Applet, Applet life cycle, HTML applet tag with all attributes, Running the applet, Passing parameters to applets, Displaying using applet viewer, getDocumentBase() and getCodeBase() methods, Applet context, Applet vs Application, Graphics introduction, Graphic class, draw lines, circle, rectangle, ellipse.

**Unit III: Event Handling and AWT:** Introduction, Event delegation model, Java AWT event description, sources of event, Event listener interfaces, Adapter classes, Inner classes. AWT (Abstract Window Toolkit): Introduction, AWT Controls Label, Button, Checkboxes, Lists, ScrollBar, TextField, TextArea, Layout manager.

**Unit IV: Windows Applications: Forms:** Adding Controls to Forms, Handling Events, MsgBox, InputBox , Working with Multiple Forms, Setting the Startup Form, SDI & MDI Forms, Handling Mouse & Keyboard Events, **Common controls:** Text Boxes, Rich Text Boxes, Labels, Buttons, Checkboxes, Radio Buttons, Group Boxes, List Boxes, Checked List Boxes, Combo Boxes, Picture Boxes, Scroll Bars, Tool Tips, Timers, properties – methods

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**SANT GADGE BABA AMRAVATI UNIVERSITY GAZETTE - 2019 - PART TWO - 12**

**UNIT V: Object Oriented Programming: Classes and Objects:** Class definition, Creating objects, Defining Member functions, Methods and Events, Attaching a class with form, Delegates. **Exceptions Handling:** Exception classes in .net framework, Structured and Unstructured exceptions, tracing errors, breakpoints, watch, Quick watch.

**UNIT VI:** Data Access with ADO.Net, accessing data with Server Explorer, Accessing Data with data Adaptors and Data sets, Creating a new data connection, creating and populating Data set, displaying data in Data Grid, selecting a data provider, Data accessing using Data adapter Control, Binding Data to Controls.

**Books Recommended:**

1. Steven Holzner, Visual Basic .NET Black Book
2. Rebecca Riordan, VB.NET for Developers, Keith Franklin, SAMS
3. Jason Beres, Sams Teach Yourself Visual Studio .NET 2005 in 21 Days,
4. Jesse Liberty, Learning Visual Basic
5. The Complete Reference JAVA2 by Herbert Schildt (Tata McGraw)
6. The Complete Reference JAVA by Patrik Noughton
7. Programming with JAVA - A Primer : By E. Balguruswamy (Tata McGraw)
8. Programming in JAVA : By S.S. Khandare (S. Chand)
9. Teach Yourself 'Java' in 2 Hrs : By Sams.
10. Java for You : By P. Koparkar

**Practical** : Minimum 16 Practical base on

A: Unit I, Unit II and Unit. III (Minimum 8 practical)  
B: Unit IV, Unit V and Unit VI (Minimum 8 practical)

**Syllabus prescribed for B.Sc. Part III (Semester-V & VI) Computer Application /Information Technology to be implemented from the Academic Session 2019-20 & onwards.**

**B.Sc. Part-III (Semester-V)**

The Examination in the subject Computer Application/Information Technology of Fifth Semester shall comprise of one theory paper of 80 Marks of three hours duration and internal assessment of 20 Marks. The practical examination will be of 4 Hrs. duration and carry 50 Marks.

**The distribution of marks for practical examination is as under:**

1. Program based on Computer lab I	: 15 Marks
2. Program based on Computer lab II	: 15 Marks
3. Practical record	: 10 Marks
4. Viva Voce (based on lab I & lab II)	: 10 Marks

**Total 50 Marks**

**5S: Computer Application/ Information Technology**

**.Net C**

- UNIT-I :** Introduction to C # : Evaluation of C#, characteristics of C#, application of C#, difference between C++ and C#, Introduction to C# environment : The .NET strategy, the origins of the .NET technology, the .NET framework, .NET, .NET languages, benefits of the .NET approach, C# and .NET.
- UNIT-II:** Overview of C#: Programming structure of C#, editing, compiling and executing C# programs, namespace, comments, using aliases for namespace classes, using command line argument, maths function.  
Literals, variables and data types : literals, variables, data types, value types, reference type, declaration of variables, initialization of variables, default values, constant variables, scope of variables, boxing and unboxing.
- UNIT-III:** Operators and expression : arithmetic operators, relational operators, logical operators, assignment operators, increment and decrement operators, conditional operators, Bitwise operators, special operators, arithmetic expressions, evaluation of expression, precedence of arithmetic operators, type conversions, operator precedence and associativity, mathematical functions.  
Decision making and branching : if statement, if....else statement, nesting of if else statement, the else if ladder, switch statement, the ?: operator, Decision making and looping : while statement, do statement, for statement, for each statement, jumps in loops.
- UNIT-IV :** Methods in C# : declaring methods, the main method, invoking methods, nesting of methods, method parameters, pass by value, pass by reference, the output parameters, variable arguments

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**SANT GADGE BABA AMRAVATI UNIVERSITY GAZETTE - 2019 - PART TWO - 12**

list, method overloading, Arrays : 1-D array, creating an array, 2-D array, variable size arrays, the system, array class, arraylist class, String handling: creating strings, strings method, inserting strings using systems, comparing strings, finding substrings.

**UNIT-V:**

Structures and enumeration: structures, structs with methods, nested structs, difference between classes and structs, enumerations, enumerator initialization, enumerator type conversion, common program errors, Classes and Objects : Basic principles of OOP's, class, objects, constructors, static members, static constructors, private constructors, copy constructors, destructors, member initialization, the this reference, nesting of classes, constant members, read only members, properties, indexers.

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**SANT GADGE BABA AMRAVATI UNIVERSITY GAZETTE - 2019 - PART TWO - 125**

**UNIT-VI :** Interfaces : MultipleInheritance: defining an interface, extending an interface, implementing interface, interface & inheritance, explicit interface implementation, abstract class and interface, Operator overloading : overloadable operators, need for operator overloading, defining Operator overloading, overloading unary operators, overloading binary operators, overloading comparison operator. Delegates and Events : Delegate, delegate seclaration, delegate methods, delegates instantiation, delegate invocation, using delegates, multicast delegates, events, Managing Console I/O operations : console class, console input, console output, formatted output, numericformatting, standard numeric format, custom numeric format.

**Te t Boo s:-**

1.Programming in C# : E. Balguruswamy  
2.Mastering in C# : BPB Publication  
3.Programming C# : TMH Publication  
4.Programming C# : PHI Publication

**Practical:** Minimum 16 programs should be prepared on above syllabi.

**B.Sc.Part-III (Semester-VI)**

**S: Computer Application/ Information Technology**

**Computer Graphics, Multimedia & Animation**

**Unit-I :** Overview of Graphics Systems: Refresh Cathode-Ray Tubes (CRT), Raster-Scan Display, Random-Scan Display, color CRT monitor, Flat-Panel Displays,3D viewing system, stereoscopic and virtual realitysystem, raster scan system, graphics monitor and workstations, Input Devices, keyboards, mouse, trackball and spaceball, joysticks, image Scanners, Touch panels, light pen, voice system

**Unit-II :** Output Primitives: Points and lines, line drawing algorithm, DDAalgorithm, Bresenham's LineAlgorithm, parallel line algorithm, loading the frame buffer, line function ,circle generating algorithm, Attributes: line Attributes ,line type, line width, pen and brush option, line color, curve Attributes, color and grayscale level, color tables, grayscale

**Unit-III :** Areas fill Attributes, character Attributes, basic transformation, matrix representation, compositetransformation: translation, rotation and scaling

**Unit-IV :** IntroductiontoMultimedia:Whatismultimedia,multimedia and hypermedia, overview of multimedia, software tools: music, sequencing and notation, digital audio, graphics and imageediting,videoediting,Animation, multimediaauthoring, fileformat:GGIF, JPEG,PNG,TIFF,EXIF, graphics,animation files, PS and PDF, WindowWMF, Window BMP.

**Unit-V :** Multimedia Compression: IZW,DCT run length coding, JPEG MPEG, Hypertext, MHEG, Hypermedia, Document architecture, SGML, ooa Augmentedand virtual realityand multimedia: Concept, VR devices, VR chair,CCD, VCR, 3D Sound System, head mounted display.

**Unit-VI :** Animation: Introduction, History of Animation, Anatomy study, Basic Sketching, Introduction to 2Danimation, Animation with flash –Tweening,Motion tweening, Shape twining

**Te t Boo s:-**

1. Computer graphics – C Version”, Hearn D and Baker M.P , 2nd Edition, Pearson Education  
2. Multimedia Computing, Communications and Applications , Ralf Steinmetz, Klara steinmetz, Pearson education, 2004.  
3. Multimedia in Practice: TechnologyandApplication –Judith (PHI)  
4. Fundamental of Multimedia byDREW-Pearson(Practical Approach)  
5. Multimedia : Making it Work: T. Vaughan  
6. Multimedia programming :Siamon J. Gibbs and Dionysios C. Tsihrizis, Addison Wesley, 1995.  
7. Multimedia Graphics : John Villamil, Casanova and Leony Fernanadez, Eliar, PHI, 1998.

**Practical:** Minimum 16 programs should be prepared on above syllabi.

**Syllabus prescribed for B.Sc. Part III (Semester-V & VI) Computer Application (Vocational) to be implemented from the Academic Session 2019-20 & onwards.**

**B.Sc.Part-III (Semester-V)**

The Examination in vocational subject Computer Application of Fifth Semester shall comprise of one theory paper of 80 Marks of three hours duration and internal assessment of 20 Marks. The practical examination will be of 4 Hrs. duration and carry 50 Marks.

**The distribution of marks for practical examination is as under:**

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**SANT GADGE BABA AMRAVATI UNIVERSITY GAZETTE - 2019 - PART TWO - 125**

- |  |            |
|--|------------|
| 1. Program based on Computer lab I     | : 15 Marks |
| 2. Program based on Computer lab II    | : 15 Marks |
| 3. Practical record                    | : 10 Marks |
| 4. Viva Voce (based on lab I & lab II) | : 10 Marks |

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**Total    50 Mar**



## NOTIFICATION

No. 57 / 2019

Date: 27 / 6/2019

### Subject : Additional chances for the failure students of old course

It is notified for general information of all concerned that the authorities of the University has provided the three additional chances for the failure students, in the subjects Geology and Computer Science/Computer Application/ Information Technology/Computer Application(Vocational) of B.Sc. Part-III Sem-V & VI, which will be as given below :

Sr.No.	Examination	Subjects	Additional Chances Provided
1	B.Sc.-III Sem-V	Geology	Winter-2019 to Winter-2020
2	B.Sc.-III Sem-VI	Geology	Summer-2020 to Summer-2021,
3	B.Sc.-III Sem-V	Computer Science/Computer Application/Information Technology/ Computer Application (Vocational)	Winter-2019 to Winter-2020
4	B.Sc.-III Sem-VI	Computer Science/Computer Application/Information Technology/ Computer Application (Vocational)	Summer-2020 to Summer-2021,

Sd/- (Dr.T.R.Deshmukh)  
Registrar  
Sant Gadge Baba Amravati University

\*\*\*\*\*



PUBLISHEDBY

**Dineshkumar  
JoshiRegistrar,**  
Sant Gadge Baba Amravati  
University, Amravati - 444602

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(Prospectus No.2015122)**

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**SANTGADGE BABA AMRAVATI UNIVERSITY,  
AMRAVATI**

**% ORDINANCE NO. 42 OF 2005**

**Examination in Environmental Studies leading to  
Bachelor Degree, Ordinance, 2005**

Whereas it is expedient to frame an Ordinance relating to Examination in Environmental Studies leading to Bachelor Degree level, hereinafter appearing, the Management Council is hereby pleased to make the following Ordinance.

1. This Ordinance may be called "Examination in Environmental Studies leading to Bachelor Degree, Ordinance, 2005."
2. This Ordinance shall come into force from the Academic session 2005-06.
3. In this Ordinance and in other ordinances relating to the examination, unless there is anything repugnant in the subject or context :-
  - (i) "Academic session" means a session commencing on such date and ending with such date of the year following as may be appointed by the Management Council.
  - (ii) "Admission to an examination" means the issuance of an admission card to a candidate in token of his having complied with all the conditions laid down in the relevant ordinance, by a competent officer of the University.
  - (iii) "Applicant" means a person who has submitted an application to the University in the form prescribed for admission to an examination.
  - (iv) "Candidate" means a person who has been admitted to an examination by the University.
  - (v) "Regular Candidate" means an applicant who has applied for admission to a University examination through an affiliated college, Department or Institute in which he/she has prosecuting a regular course of study.
  - (vi) "Examinee" means a person who present himself/herself for an examination to which he/she has been admitted.
  - (vii) "Examination" means an examination prescribed by the University under the relevant Ordinance.
  - (viii) "External Candidate" means a candidate who is allowed to take a University examination in accordance with the provision of Original Ordinance No. 151.

% Amended by ordinance No. 7 of 2006 and 10 of 2007.

- (ix) "Non-Collegiate Candidate" means a candidate who is not a collegiate candidate.
  - (x) An "Ex-student" is a person who having once been admitted to an examination of this University, is again required to take the same examination by reason of his failure or absence thereat and shall include a student who may have joined a college, Department or Institute again in the same class.
  - (xi) "Bachelor Degree Examination" means a examination leading to Bachelor Degree of the University.
  - (xii) "Previous Year" means a year following by final year of Bachelor Degree.
4. Save as otherwise specifically provided, the conditions prescribed for admission to the examination under this Ordinance shall apply to all persons who wish to take the examination to the Degrees of the University mentioned in para 5 below.
  5. The conditions prescribed for admission to examination under this Ordinance shall apply to following degrees of the University :-
    - 1) Bachelor of Arts
    - 2) Bachelor of Performing Arts
    - 3) Bachelor of Fine Arts
    - 4) Bachelor of Mass Communication
    - 5) Bachelor of Social Work
    - 6) Bachelor of Commerce
    - 7) Bachelor of Business Administration
    - 8) Bachelor of Science
    - 9) Bachelor of Computer Science
    - 10) Bachelor of Computer Applications
    - 11) Bachelor of Pharmacy
    - 12) Bachelor of Science (Home Science)
    - 13) Bachelor of Technology (Cosmetics)
    - 14) Bachelor of Engineering
    - 15) Bachelor of Engineering (Part Time) (Civil)
    - 16) Bachelor of Textile
    - 17) Bachelor of Technology (Chemical Technology)
    - 18) Bachelor of Technology (Chemical Engg.)

- 19) Bachelor of Architecture, and  
20) Bachelor of Laws (Five Year Course)

6 i) Environmental Studies shall be a compulsory subject for a previous year examination of the following Bachelor Degrees of the University,

- 1) Bachelor of Arts
- 2) Bachelor of Performing Arts
- 3) Bachelor of Fine Arts
- 4) Bachelor of Mass Communication
- 5) Bachelor of Social Work
- 6) Bachelor of Commerce
- 7) Bachelor of Business Administration
- 8) Bachelor of Science
- 9) Bachelor of Computer Science
- 10) Bachelor of Computer Applications
  - 11) Bachelor of Pharmacy
- 12) Bachelor of Science (Home Science)
- 13) Bachelor of Technology (Cosmetics)
- 14) Bachelor of Engineering (Part Time) (Civil)

ii) Environmental Studies shall be a compulsory subject for IIIrd & IVth Semester of the following Bachelor Degrees of the University,

- 1) Bachelor of Engineering
- 2) Bachelor of Textile
- 3) Bachelor of Technology (Chemical Technology)
- 4) Bachelor of Technology (Chemical Engineering)
- 5) Bachelor of Architecture, and

iii) Environmental Studies shall be a compulsory subject for Vth & VIth Semester of the Degree of Bachelor of Laws (Five Year Course)

iv) Students admitted to Second Year/Third Year/IVth Semester Vth Semester of various degree examination courses in different faculties in the academic session 2005-06 or thereafter shall have

to appear for examination in the subject Environmental studies.

7. The main Examination leading to Environmental Studies shall be held in Summer and Supplementary examination in Winter every year, at such places and on such date as may be appointed by the Board of Examinations.

**Explanation** :- Examination shall be conducted on the basis of one common question paper for all Bachelor Degree examination courses irrespective of annual or semester pattern.

8. Scope of the subject for annual pattern examination and or semester pattern examination shall be as provided under the syllabus.

9. Common question paper for all courses covered under this Ordinance alongwith answer books shall be supplied by the University to the Colleges, Departments and Institutes for conducting the examination of the subject.

10. Valuation of the answer books relating to this subject shall be done at College/Department/Institution level only. Remuneration for valuation of answer books shall not be paid by the University. Provided that prescribed evaluation fee for evaluation of each answer Book/s of an external examinee/s appeared from the examination centre shall be paid to each examination centre.

11. It shall be obligatory on the part of the College/Department/Institute to submit candidate wise following information to the University on or before the date as may be prescribed by the University :-

Sr. No.	Grade/Category	Marks secured
1.	“A”	- 60 and above
2.	“B”	- 45 to 59
3.	“C”	- 35 to 44
4.	“D”	- 25 to 34
5.	“Fail”	- 24 and below
6.	“Absent”	

12. For the purposes of teaching, learning and examination, the Committee consisting of three teachers shall be appointed by the Principal/ Head of the Department/Head of the Institution under his/her Chairmanship/Chairpersonship. While appointing three teachers on the said committee, the Principal shall take care that the teachers to be appointed on the committee, if necessary, shall be from different faculty.
13. i) Duration of theory examination of this subject shall be three hour.  
 ii) For all Bachelor Degree examinations, common question paper of 100 marks shall be provided by the University.  
 iii) Distribution of these 100 marks shall be as follows :-  
 a) Part-A, Short Answer Pattern -25 Marks  
 b) Part-B, Essay type with inbuilt choice -50 Marks  
 c) Part-C, Essay on Field Work -25 Marks
14. Medium of instruction shall be English or Marathi or Hindi. Question paper shall be supplied in English and Marathi and Hindi. A candidate shall have option to write answers in English or Marathi or Hindi.
15. Examination for the subject Environmental Studies shall be compulsory for external candidates appearing as a fresh candidate at Winter and/or Summer examination.
16. For teaching of the subject, there shall be atleast two hour per week. For teaching the subject to the regular candidates, a full time approved teacher of the University and or a person having Postgraduate Degree in any faculty with second class shall be considered eligible.
17. For teaching of the subject, additional fee to be charged to regular candidate shall be as prescribed by the University.
18. Every College/University Teaching Department shall Charge additional fee of Rs. 100/- to every student of the subject Environmental Studies. Out of this Rs.100/-, the College/University Teaching Department shall have to pay Rs.25/- to the University as an examination fee of each candidate for the subject Environmental Studies.

19. The Grade secured by an examinee in the examination of this subject shall not be considered for providing the facility of A.T.K.T. in next higher class.
20. The provisions of Ordinance No. 18/2001 shall not be applicable for securing a grade or higher grade in the examination of this subject.
21. Result of the Final Year of the respective Degree shall not be declared of an examinee unless he/she secures any one of the grade in the examination of subject.  
 Provided an examinee admitted to Five Year LL.B. course desiring not to continue his/her education beyond Sixth Semester of the said course shall have to secure any one of the grade in the examination of the subject otherwise his/her result of Sixth Semester for awarding B.A. degree shall not be declared.
22. Certificates shall be issued, to the successful examinees in the subject Environmental Studies, after the examination.

\*\*\*\*\*

**SYLLABUS PRESCRIBED FOR B.Sc.  
PART-II SEMESTER-III &  
IV**

(Implemented from the Session 2011-2012)

**1. MATHEMATICS  
3S-Mathematics – Paper-V(  
Advanced Calculus)**

**Unit I** : Sequence : Theorems on limits of sequences, bounded and monotonic sequences, Cauchy's convergence criterion.

**Unit II** : Series : Series of non negative terms, convergence of geometric series and the

series  $\sum \frac{1}{n^p}$  Comparison tests, Cauchy's integral test, Ratio test, Root test.

**Unit III** : Limit and continuity of functions of two variables, Algebra of limits and continuity, Taylor's theorem for function of two variables. Maxima and minima, Lagrange's multipliers method. Jacobians.

**Unit IV** : Properties of Beta and Gamma functions. Double integral  
: Definition and Evaluations of double integral.

**Unit V** : Change of order of integration in double integral, triple integral (evaluation technique only). Double integral by transforming it into polar coordinates.

**Reference Books :**

- 1) T. M. Karade, M. S. Bendre : Lectures on Vector Analysis and Geometry, Sonu-Nilu Publication, Nagpur.
- 2) T. M. Karade, J. N. Salunke, A. G. Deshmukh, M. S. Bendre: Lectures on Advanced Calculus, Sonu-Nilu Publication, Nagpur.
- 3) Gorakh Prasad : Differential Calculus, Pothishala Pvt. Ltd., Allahabad.
- 4) Gorakh Prasad : Integral Calculus, Pothishala Pvt. Ltd., Allahabad.
- 5) Murray R. Spiegel : Theory and Problems of Advanced Calculus, Schaum Outline Series.
- 6) S. C. Malik and Arora : Mathematical Analysis, Wiley Eastern Ltd., New Delhi.
- 7) O. E. Stanaitis : An Introduction to Sequences, Series and

improper Integrals, Holden-Dey, Inc. San Francisco, California.

- 8) Earl D. Rainville : Infinite series, The Macmillan Co., New York.
- 9) N. Piskunov : Differential and Integral Calculus, Peace publishers, Noscov.
- 10) Shanti Narayan : A Course of Mathematical Analysis, S. Chand & Co., New Delhi.
- 11) D. Somasundaram and B. Choudhary: A First course in Mathematical Analysis, Narosa Publ. House.

**3S-Mathematics –  
Paper-VI (Partial  
Differential Equations )**

**Unit I :** Partial differential equations of first order. Lagrange's solutions. Some special types of equations which can be solved easily by methods other than general method. Charpit's general method of solutions. Jacobi's Method.

**Unit II :** Partial differential equations of second and higher orders. Homogeneous and non-homogeneous equations with constant coefficients. Partial differential equations reducible to equations with constant coefficients.

**Unit III :** Classifications of linear partial differential equations of second order.  
Monge's methods.

**Unit IV :** Calculus of Variation : Functional, continuity of functional, variational problems with fixed boundaries, Extremum of a functional.

**Unit V :** Method of separation of variables, method of separation of variable for wave equations and heat equation in one dimension.

**Reference Books :**

- 1) T. M. Karade : Lectures on Differential Equations, Sonu-Nilu Publication, Nagpur.
- 2) J. N. Sharma : Differential Equations, Krishna Prakashan

- Mandir, Meerut.
- 3) Ian N. Sneddon : Elements of Partial Differential Equations, McGraw Hill Book Company, 1988.
- 4) D. A. Murray : Introductory course on Differential Equations. Orient Longman (India), 1967.

- 5) Erwin Kreyszig : Advanced Engineering Mathematics, John Wiley and Sons, Inc. New York, 1999.
- 6) A. R. Forsyth : A Treatise on Differential Equations, Macmillan and Co. Ltd. , London.
- 7) Frank Ayres : Theory and Problems of Differential Equations. McGraw Hill Book Company, 1972.
- 8) B. Courant and D. Hilbert : Methods of Mathematical Physics, Vol. I & II, Wiley-interscience, 1953.
- 9) A. S. Gupta : Calculus of Variations with Applications, Prentice-Hall of India, 1997.
- 10) I. M. Gelfand and S. V. Fomin : Calculus of Variations, Prentice-Hill Englewood Cliffs ( New Jersey), 1963.
- 11) J. I. Oden and J. N. Reddy : Variational Methods in Theoretical mechanics, Springer Verlag, 1976.
- 12) Jane Cronin : Differential Equations, Marcel Dekkar, 1994.
- 13) G.S.Sharma, I.J.S. Saran, Engineering Mathematics, P.B.H. Publishing, New Delhi.
- 14) Rajsinghaniya M.D. : Ordinary and Partial Differential Equations, S.Chand and Co., New Delhi.
- 15) K.Shaukatrao Rao, Partial Differential Equations.

**4S-Mathematics – Paper-VII**  
**(Laplace Transforms and Fourier Series)**

**Unit I** : Laplace transform. Linearity of Laplace transform. Existence theorem for Laplace transform, Shifting Theorem, Change of scale property, Laplace transform of derivatives. Multiplication by power of  $t$ .

**Unit II** : Inverse Laplace transform, Shifting Theorem, Change of scale property, Inverse Laplace transform of derivative, division by  $s$ . Convolution theorem.

**Unit III** : Solution of integral equations and system of ordinary and partial differential equations using the Laplace transform. Solutions of simultaneous ordinary differential Equations using Laplace transform

**Unit IV** : Fourier Series, Fourier expansion of piecewise monotonic functions, Fourier series of Even and odd function. Half- range series..

**Unit V** : Bessel and Legendre functions and their Properties, recurrence relations and generating functions. Sturm-

Liouville problem. Eigen Function, Orthogonality of eigenfunctions.

**Reference Books :**

- 1) T. M. Karade : Lectures on Differential Equations, Sonu-Nilu Publication, Nagpur.
- 2) Erwin Kreyszig : Advanced Engineering Mathematics, John Wiley and Sons, Inc. New York, 1999.
- 3) A. R. Forsyth : A Treatise on Differential Equations, Macmillan and Co. Ltd. , London.
- 4) Frank Ayres : Theory and Problems of Differential Equations. McGraw Hill Book Company, 1972.
- 5) B. Courant and D. Hilbert : Methods of Mathematical Physics, Vol. I & II, Wiley-interscience, 1953.
- 6) I. N. Sneddon : Fourier Transforms, McGraw Hill Book Co.
- 7) Goel and Gupta : Integral Transforms, Pragati Prakashan , Merut.
- 8) Raisinghaniya, M.D., Integral Transform, S.Chand & Co., N.D.

**4S-Mathematics – Paper-VIII**  
**(Mechanics)**

**Statics :**

**Unit I** : Coplanar forces : Forces acting at a point, Triangle law of forces. Parallel forces.

Equilibrium of forces, Lami's theorem.  
Analytical conditions of equilibrium of coplanar forces.

**Unit II** : Virtual work. Uniform Catenary.

**Dynamics :**

**Unit III** : Velocities and accelerations along the coordinate axes, radial and transverse directions, tangential and normal directions. Projectile.

**Unit IV** : Constraints. Generalised Coordinates D'Alembert's principle and Lagrange's equations of motion.

**Unit V** : Central force motion : Areal velocity. Equivalent one body problem. Central Orbit . Virial theorem. Kepler's laws of motions (Statement Only).



**Reference Books :**

- 1) T. M. Karade, M. S. Bendre : Lectures on Mechanics, Sonu-Nilu Publication, Nagpur.
- 2) H. Goldstein : Classical Mechanics ( 2<sup>nd</sup> edition), Narosa Publishing House, New Delhi.
- 3) S. L. Loney : Statics, Mc-Millan and co., London.
- 4) R. S. Verma : A Text Book on Statics, Pothishala Pvt. Ltd. , Allahabad.
- 5) S. L. Loney : An Elementary Treatise on the Dynamics of a particle and of rigid bodies, Cambridge University Press, 1956.
- 6) D. K. Daftari, V. N. Indurkar : Elements of Statics, Published by Dattsons, J. Neharu Marg, Nagpur.
- 7) M. A. Pathan : A modern Text Book of Statics, Pragati Prakashan, Nagpur.

**PHYSICS3S PHY****Unit I : Mathematical background and Electrostatics (12**

Gradient, divergence and curl of a vector fields and their physical significance, line surface and volume integral. Gauss divergence theorem , Stocks theorem. Work done on charge in electrostatic field, flux of electric field, force on moving charge, Lorentz force equation and definition of B. Ampere's force law, Ampere's Law and its applications.

**Unit II : Magnetostatics and Maxwell's Equations (12**  
)

Faraday's Law, Integral and differential form of Faraday's law, displacement current and Maxwell's Equation , wave Equation satisfied by E and B. Plane electromagnetic wave in vacuum, Poynting vector and Poynting theorem.

**Unit-III : Solid State Electronics Devices-I – (12**  
)

Physics of semiconductors : Introduction to semiconductors ; Charge carriers & electrical conduction through semiconductors ; Doping , extrinsic semiconductors ; Fermi level & energy level diagrams ; Drift current in

semiconductor , mobility, conductivity ; Hall effect, Hall coefficient, Semiconductor diode & its biasing, LED, Varactor diode.

**Unit-IV : Solid State Electronics Devices-II – (12**

)

Introduction to BJT ; working of BJT ; modes of operation; Current gains  $\alpha$  and  $\beta$ , their relation ; CB & CE characteristics ; JFET- construction & working , characteristics of FET ; Basic concept of Difference amplifier, IC-OP AMP , electrical parameters of OP AMP, inverting & noninverting modes ; OP AMP as adder, subtractor, differentiator & integrator.

**Unit: V : Special Theory of Relativity (12**

)

Postulates of Special Theory of Relativity, Lorentz transformations, Length contraction, Time dilation, relativistic addition of velocities, relativity of mass, Einstein's Mass - energy relation, Numericals.

**Unit: VI : Atmosphere and Geophysics (12**

)

Structure of earth – The crust, mantle, core.

Part of the earth – As a planet; The Atmosphere, The lithosphere, The Hydrosphere Composition of Atmosphere

Earthquakes – Causes, terminologies associated with earthquakes. Type of earthquakes scale of intensity, recording of earthquakes.

Radiation in the atmosphere, Propagation of energy through vacuum, Intensity of radiation, Scattering,

absorption and reflection of solar radiation by the atmosphere. Moisture and clouds: mechanism that produces clouds , Cloud produced by mixing and by cooling.

**Practical :** The distribution of marks for practical examination will be as follows:

Record Book	10 marks
Viva-voce	10 marks
Experiment	20 marks
Assignment	10 marks
-----	
Total	50 marks
-----	

- a) A student will have to perform at least ten experiments per semester.
- b) The semester examination will be of Four Hour duration and student will have to perform one experiment in the semester examination.
- c) In assignment, every student should be asked to submit the detailed report on one of experiments he or she has performed. The detailed report should include the theoretical background of the experiment..

### **Evaluation of the student during the semester:**

The teacher should explain, discuss and demonstrate one experiment per turn in the first twelve turns of the semester. At the same time in every turn, a teacher will have to conduct a test in the first period of the turn, based on the experiment; he or she has explained in the previous turn. The test is to be carried out with the interest to make the student aware of the basics of the experiments. This will enhance the viva voce competence of the student. A record of these tests is to be maintained in the department duly signed by the teacher in-charge and head of the department. The record is to be maintained in the following format. Each assignment should be of at least 15 marks. Find the average and assign it in the end Semester practical examination.

#### **Record of Marks scored in the assignments during the semester**

Date											
Sr. No.	Name of the student	Expt1	Expt2	Expt 3	Expt 4	Expt 5	Expt 6	Expt7	Expt8	Expt9	Expt 10
1	ABC										
2	DEF										
3	GHI										
4	JKL										
Signature of the teacher incharge											

Once this part is over, actual experimentation work should begin.

The date-wise record is to be maintained in the following

format.

**Date-wise Record of the experiments**

Sr. No.	Name of the student	Expt1	Expt2	Expt 3	Expt 4	Expt 5	Expt 6	Expt7	Expt8	Expt9	Expt 10
1	ABC										
2	DEF										
3	GHI										
4	JKL										
Signature of the teacher incharge											

- a. Completion Certificate: is must for practical record book.
- b. The semester examination will be of Four Hour duration and the student will have to perform one experiment in the semester examination

**Experiments:-**

1. To determine characteristics of CB transistor
2. To determine characteristics of CE transistor
3. Measurement of magnetic field by Hall probe method
4. To study variation of gain of CE amplifier with load
5. To study Zener regulated power supply
6. To determine characteristics of FET
7. To study FET as a voltmeter
8. To study Weins bridge oscillator
9. To study phase shift oscillator
10. To study Wein's bridge oscillator
11. To study p-n diode as a rectifier
12. To determine characteristics of p-n junction.
13. Study of OPAMP as an inverting amplifier
14. Study of OPAMP as noninverting amplifier
15. Study of OP AMP as an adder
16. Study of OP AMP as subtractor
17. Study of OP AMP as differentiator
18. Study of OP AMP as an integrator
19. To determine characteristics of Phototransistor

20. Measurement of field strength its variation in a solenoid.

21. To draw the BH curve of iron by using a Solenoid and to determine the energy loss due to Hysteresis.

### Reference Books:--

1. Solid state Electronics Devices- B.G.Streetman (PHI)
2. Electronics Devices & Circuits – A. Mottershead (PHI)
3. Integrated Electronics—J.Millman ; C.Halkias (TMH)
4. Electronics Devices & circuits – Sanjeev Gupta (Dhanpat Rai Pub.)
5. Electronics Devices & circuits-I & II – Godse & Bakshi ( Tech. Pub. , Pune)
6. Solid State Devices & Electronics—Kamal Singh & S.P.Singh (S. Chand & Co.)
7. Electromagnetic theory and holography – satya parakash
8. A text book of geology – G.B. mahapatra
9. Engineering and general geology – parbin singh.
10. The atmosphere – Richard A. Anthes, Hans A. Panotsky, Jhon J Cahir, Albert Rango.
11. Relativity—Goyal and Gupta
12. Text book of Physics --- V. K. Sewane
13. Elements of Special theory of relativity—S.P.Singh and M.K.Bagde
14. A course in Electromagnetic field by S.W.Anwane, B.P.B. Publication, New Delhi.

## 4SPHY

### Unit I : Geometrical optics and interference (12)

Cardinal points of an optical system, equivalent focal length and power of coaxial lens system, Interference in thin films due to reflected and transmitted light, interference in wedged shaped thin film, Newton's ring by reflected light, measurement of wavelength of monochromatic light by Newton's, ring, determination of refractive index of liquid by Newton's rings.

### Unit II : Diffraction (12)

Fresnel and Fraunhofer Diffraction, Fresnel half period zone, zone plate construction and theory. Double slit diffraction,

Plane diffraction grating; construction and elementary theory, determination of wavelength of monochromatic light by using grating. Resolution of images, Rayleigh's criteria for resolution, R. P. of grating.

### Unit III : Polarization (12)

Concept of polarization, optic axis, double refraction, polarization by double refraction, phase retardation plate :- Quarter wave plate, half wave plate, (Nicol prism-production and analysis of polarized light). Theory of production of elliptically and circularly polarized light, production and detection of elliptically and circularly polarized light. Half shade polarimeter, blue of the sky.

### Unit IV : Laser (12)

Introduction to Maser, Absorption, spontaneous and stimulated emission, population inversion, pumping characteristics of laser beam. Main components of laser system, three level and four level laser system. Ruby laser, He-Ne laser, semiconductor laser, application of laser. Holography-principle.

### Unit V : Fiber optics (12)

introduction of fiber optics, total internal reflection, structure and classification of optical fiber. Propagation of light wave in an optical fiber, Acceptance angle and numerical aperture, dispersion, fiber losses, fiber optic communication. Advantages and Disadvantages of optic fibers, application of fiber optics.

### Unit VI : Renewable Energy Sources (12)

**Introduction** to various renewable energy sources – Solar energy, Wind energy, ocean energy- Waves & tides, geothermal energy, Hybrid Systems, Hydrogen energy systems, Fuel cells.

**Solar energy** - Solar radiations on earth - availability

**Solar Energy Storage** :- Methods of storage, properties of storage materials. Principle of Solar Thermal Applications, Solar water heater, Solar concentrating collectors - Types , applications.

**Solar Photovoltaic systems** -- Operating principle, Photovoltaic cell concepts , power of a solar cell and solar PV panel ; Applications.

**Practical** : The distribution of marks for practical examination will be as follows:

Record Book	10 marks
Viva-voce	10 marks
Experiment	20 marks
Assignment	10 marks
-----	
<b>Total</b>	<b>50 marks</b>
-----	

- A student will have to perform at least ten experiments per semester.
- The semester examination will be of Four Hour duration and student will have to perform one experiment in the semester examination.
- In assignment, every student should be asked to submit the detailed report on one of experiments he or she has performed. The detailed report should include the theoretical background of the experiment..

**Evaluation of the student during the semester:**

The teacher should explain, discuss and demonstrate one experiment per turn in the first twelve turns of the semester. At the same time in every turn; a teacher will have to conduct a test in the first period of the turn, based on the experiment; he or she has

explained in the previous turn. The test is to be carried out with the interest to make the student aware of the basics of the experiments. This will enhance the viva voce competence of the student. A record of these tests is to be maintained in the

department duly signed by the teacher in-charge and head of the department. The record is to be maintained in the following format. Each assignment should be of at least 15 marks. Find the average and assign it in the end Semester practical examination.

**Record of Marks scored in the assignments during the semester:-**

Date											
Sr. No.	Name of the student	Expt1	Expt2	Expt 3	Expt 4	Expt 5	Expt 6	Expt7	Expt8	Expt9	Expt 10
1	ABC										
2	DEF										
3	OHI										
4	JKL										
Signature of the teacher incharge											

Once this part is over, actual experimentation work should begin. The date-wise record is to be maintained in the following format.

**Date-wise Record of the experiments performed**

Sr. No.	Name of the student	Expt1	Expt2	Expt 3	Expt 4	Expt 5	Expt 6	Expt7	Expt8	Expt9	Expt 10
1	ABC										
2	DEF										
3	GHI										
4	JKL										
Signature of the teacher incharge											

- Completion Certificate: is must for practical record book.
- The semester examination will be of Four Hour duration and the student will have to perform one experiment in the semester examination

**Practicals :**

- To determine the wavelength of monochromatic light by Newton's rings.

- To verify the Brewster's law.
- To determine the refractive indices for ordinary and extra-ordinary rays using double image prism.

4. To determine the Concentration of sugar solution by half shade polarimeter.
5. To determine the wavelength of monochromatic light by plane diffraction grating.
6. To find the number of lines per centimeter of the given grating.
7. To determine the resolving power of plane diffraction grating.
8. To determine the resolving power of telescope.
9. To determine the wavelength of laser light.
10. Determination of refractive index of a prism by spectrometer.
11. Determination of dispersive power of prism material
12. To determine the resolving power of prism.
13. study of interference of light by bi-prism experiment and find the wavelength of sodium light.
14. To verify the law of Malus of plane polarized light.
15. Polarplots of solarpanel
16. Measurement of direct radiation using Pyrheliometer .
17. Measurement of global & diffuse radiation using pyranometer
18. Determination of solar constant
19. To determine frequency and phase of signal using CRO.
20. To determine capacitance by Scherring bridge method.
21. To determine self inductance by bridge rectifier method.
22. To determine frequency of AC mains by Sonometer.
23. To study and plot I-V characteristics of solar cell.
24. To study time constant of an RC circuit experimentally and verify the result theoretically.
25. Verification of Stefan's law of radiation by using an incandescent lamp as black body Radiator.
26. To study (a) Half-wave Rectifier and (b) Full-wave Bridge Rectifier and investigate the effect of C, L and  $\pi$  filters.

#### REFERENCE BOOKS:

1. Laser and non-linear optics – B B Laud.
2. Optoelectronics and fiber optics communication – C.K Sarkar, D.C. Sarkar.
3. An introduction to fiber optics – R. Allen Shotwell
4. Optics – Ajoy Ghatak.

8. Optics and atomic physics – D.P.Khandelwal.
9. Non Conventional Energy Sources, G. D. RAI(4th edition), Khanna Publishers, Delhi.
10. Solar Energy, S.P. Sukhatme (second edition), Tata Mc. Graw Hill Ltd, New Delhi.
11. Solar Energy Utilisation, G. D. RAI (5th edition), Khanna Publishers, Delhi.
12. Principles of Solar Energy - Kreith Kreider.
13. Renewable Energy - BentSarensen.

### 3.

#### Chemistry

#### 3S

#### Chemistry

(Effective from session 2014-15)

The examination in Chemistry of Third semester shall comprise of one theory paper, internal assessment and practical examination. Theory paper will be of 3 Hrs. duration and carry 80 marks. The internal assessment will carry 20 marks. The practical examination will be of 6 hours duration and carry 50 marks.

The following syllabi is prescribed on the basis of six lectures per week and 6 practical periods per batch per week. Each theory paper has been divided into 6 units. There shall be one question in every unit with internal choice for each of 12 marks & one compulsory question covering all the syllabus of Semester-III (8 marks).

#### B.Sc. Part- II

#### (Semester- III) 3S

#### Chemistry

**Total Lectures: 84**

**Marks: 80**

**Note:** Figures to the right hand side indicate number of lectures.

#### Unit I

**14L**

#### A] Covalent Bonding:

Molecular Orbital Theory. Postulates of MO theory. LCAO approximation. Formation of bonding and antibonding MOs. Rules for LCAO. MO energy level



diagram. Concept of bond order. MO structure of homonuclear diatomic molecules of namely He, H, N and

5. Optical fiber Communication – John M. Senior
6. Principles of optics – B.K.Mathur
7. Optics and laser – V.K. Sewane

O . Stability sequence of species of O i.e. O , O

$O_2^{2+}$ ,  $O_2^-$  and  $O_2^{2-}$ . Paramagnetic nature of  $O_2$ . MO structure of

heteronuclear diatomic molecules viz. NO, HF and CO (Coulson's structure). Explanation of important properties of CO viz. - triple

bond, almost nonpolar nature, electron donor and acceptor behaviour. Comparison of VB and MO theories. [6]

### B] Metallic Bonding:

Free electron theory and properties of metals such as electrical and thermal conduction, malleability, ductility and metallic lustre. VB theory or Resonance theory of metals. Band theory to explain nature of conductors, insulators and semiconductors (both intrinsic and extrinsic). [3]

### C] VSEPR Theory:

Various rules under VSEPR theory to explain molecular geometry (following examples may be taken to explain various rules-  $\text{BeCl}_2$ ,  $\text{BF}_3$ ,  $\text{CH}_4$ ,  $\text{NH}_3^+$ ,  $\text{PCl}_5$ ,  $\text{SF}_6$ ,  $\text{IF}_7$ ,  $\text{SnCl}_4$ ,  $\text{NH}_3$ ,  $\text{H}_2\text{O}$ ,  $\text{SF}_6$ ,  $\text{ClF}_3$ ,  $\text{BrF}_3$ ,

3 4 4 5 6 7 2 3 2 4 3 5

$\text{XeF}_6$ ,  $\text{SOF}_4$ ,  $\text{COF}_2$ ,  $\text{PCl}_3$ , ). Limitations of VSEPR theory. [5]

## Unit II - Theory of Quantitative Inorganic Analysis

14

### LA] Volumetric Analysis:

(a) **Introduction**:- Volumetric analysis, titrant, titrate, end point, equivalence point, indicator etc. Requirements of volumetric analysis. Definition of standard solution, primary standard substance. Requirements of primary standard substance. Terms to express concentrations namely- molarity, normality, molality, mole fraction and percentage. (Simple numericals expected).

(b) **Acid-Base titrations**:- Types of acid base titrations. pH variations during acid base titration. Acid base indicators. Modern theory (Quinoniod theory) of acid base indicators. Choice of suitable indicators for different acid base titrations.

(c) **Redox Titrations**:- General principles involved in redox titrations (redox reactions, redox potentials, oxidant, reductant, oxidation number). Brief idea about use of  $\text{KMnO}_4$ ,  $\text{K}_2\text{Cr}_2\text{O}_7$  as oxidants in acidic medium in redox titrations. Use of  $\text{I}_2$  in iodometry and iodimetry. Redox indicators-external and internal indicators. Use of starch as an indicator. Iodometric estimation of Cu (II). [8]

### B] Gravimetric Analysis:

Definition. Theoretical principles underlying various

## Unit III

14L

### A] Aldehydes and Ketones:

Preparation of acetaldehyde from ethanol, ethylidene chloride and acetylene. Preparation of benzaldehyde from benzene (Gattermann-Koch reaction) and toluene. Preparation of acetone from isopropyl alcohol, isopropylidene chloride and propyne. Preparation of acetophenone from benzene and ethyl benzene. Structure of carbonyl group, acidity of  $\alpha$ -hydrogen in carbonyl compounds. Reactions of aldehydes &/or ketones: Cannizzaro's, Reformatsky, Perkin with mechanism, Mannich reaction, Benzoin and Aldol condensations. Clemmensen, Wolf-Kishner, MPV and  $\text{LiAlH}_4$  reductions.

[8]

### B] Carboxylic acids:

Structure and reactivity of carboxylic groups. Acidity of

steps involved in gravimetric analysis with reference to estimation of barium as barium sulphate. Coprecipitation and post precipitation. (Definition, types and factors affecting).

[6]

carboxylic acids, effects of substituents on acids strength.  
 Oxalic acid: Preparation from ethylene glycol and cyanogen.  
 Reactions: Reaction with ethyl alcohol, ammonia, glycerol and  
 action of heat. Lactic acid: Preparation from acetaldehyde and  
 pyruvic acid.

Reactions: Reaction with ethanol,  $\text{PCl}_5$ , action of heat,  
 oxidation and reduction. Benzoic acid: Preparation from  
 toluene, benzyl alcohol, phenyl cyanide and benzamide.

Reactions : Reaction  
 with ethanol,  $\text{PCl}_5$  and ammonia. Salicylic acid:  
 Preparation by Reimer-Tiemann reaction. Reactions:  
 Reaction with  $\text{CH}_3\text{COCl}$ ,  $\text{CH}_3\text{OH}$  and  $\text{C}_6\text{H}_5\text{OH}$ . [6]

#### **Unit IV** **14L**

##### **A] Optical isomerism:**

Element of symmetry, chirality, asymmetric carbon  
 atom, enantiomers, diastereoisomers, relative and  
 absolute configurations, DL and RS nomenclature,  
 racemisation and resolution (by chemical method). [4]

##### **B] Geometrical isomerism:**

Cis-trans & E-Z nomenclature, Methods of structure  
 determination. [3]

##### **C] Conformational isomerism:**

Bayer's Strain theory and its limitations. Stability of  
 cycloalkanes, conformational isomers of ethane, n-  
 butane and cyclohexane, their energy level diagrams.  
 Newman & Sawhorse projection formulae. [7]

**Unit V****14L****A] Thermodynamics and Equilibrium:****[10]**

(i) Gibb's and Helmholtz's free energy function. Physical significance of Gibb's free energy, Change in free energy as a criteria of spontaneity and equilibrium. Variation of free energy  $G$  with  $P$  &  $T$ . Gibb's-Helmholtz's equation in terms of  $G$  and its application. (ii) Partial molal function, chemical potential, derivations of Gibb's-Duhem equation. Chemical potential of an ideal gas in gaseous mixture. Derivation of vant Hoff's isotherm and its application to equilibrium state. Derivation of vant Hoff's equation and its applications. (iii) Numericals.

**B] Phase Equilibrium:****[4]**

(i) Immiscible liquids, Nerst distribution law and its application to association and dissociation of solute in one of the solvent. Process of extraction, derivation of formula for the amount of solute left unextracted after  $n^{\text{th}}$  extraction. (ii) Phase transition - Clausius-Clyperon equation (only qualitative statement). (iii) Partially miscible liquids - Phase diagram of phenol-water, triethyl amine - water and nicotine-water systems. (iv) Numericals.

**Unit VI****14L****A] Liquid state:****[4]**

(i) Surface tension, determination and its S.I. Unit. Effect of temperature on surface tension, derivation of expression for relative surface tension by Drop number method. Application of surface tension. (ii) Viscosity, determination and its S.I. Unit. Effect

of temperature on viscosity, derivation of expression for relative viscosity by Ostwald's viscometer method. Applications of viscosity.

**B] Electrochemistry:****[10]**

(i) Conductance of electrolyte solution. Specific, equivalent and molar conductance. Determination of conductance of electrolyte solution, variation of specific and equivalent conductance with dilution for strong electrolyte. Conductometric titrations. Applications of conductometric titration. (ii) Migration of ions under the influence of electric field. Transport number of ions. Determination of transport number by Hottorf's method and Moving boundary method (iii) Kohlrausch's law of independent migration of ions. Determination of  $l_{\pm}$  and degree of dissociation  $\alpha$  of a weak electrolyte. Determination of dissociation constant of weak electrolyte. (iv) Numericals.

**Semester- III**  
**3S Chemistry Practicals****Total Laboratory sessions: 26**      **Marks: 50****Exercise I:****a) Volumetric Analysis**

(Standard solutions to be prepared by students only)

**16 Laboratory sessions**

- 1) Prepare 0.1N oxalic acid standard solution and find out the acid neutralizing capacity of an antacid using NaOH as an intermediate solution.
- 2) Prepare 0.1N  $\text{H}_2\text{SO}_4$  solution and find out its exact normality using NaOH as an intermediate solution and 0.1N oxalic acid as standard solution.
- 3) To determine the strength of oxalic acid by titration with  $\text{KMnO}_4$ .
- 4) To determine percentage purity of Ferrous Ammonium Sulphate (FAS) by titration with  $\text{KMnO}_4$ .
- 5) To determine strength of FAS by titration with  $\text{K}_2\text{Cr}_2\text{O}_7$  using internal indicator.
- 6) To determine strength of  $\text{K}_2\text{Cr}_2\text{O}_7$  by titration with FAS using internal indicator.
- 7) Estimation of copper (II) in commercial copper sulphate sample by iodometric titration.

**b) Gravimetric Analysis**

Estimation of  $\text{Ba}^{2+}$  as  $\text{BaSO}_4$ ,  $\text{Fe}^{3+}$  as  $\text{Fe}_2\text{O}_3$  using china  
and

silica crucible and  $\text{Ni}^{2+}$  as Ni-DMG using sintered glass crucible.

**Exercise II: Physical Chemistry****experiments 10 Laboratory sessions**

- 1) To determine refractive index by Abbe's refractometer.
- 2) To construct phase diagram of phenol-water system and to determine consolute temperature for the system.
- 3) To determine transition temperature of  $\text{MnCl}_2 \cdot 4\text{H}_2\text{O}$ .
- 4) To study kinetics of hydrolysis of methyl acetate catalyzed by acid.
- 5) To study kinetics of saponification of ethyl acetate by NaOH. (Equal concentration)
- 6) To determine partition coefficient of benzoic acid between benzene and water.

- 7) To determine partition coefficient of iodine between  $\text{CCl}_4$ /Kerosene and water.
- 8) To determine solubility of benzoic acid at different temperature and heat of solution.

### Distribution of Marks for Practical

#### Examination Time: 6 hours (One Day Examination)

#### Marks:

50

Exercise-I.....	18
Exercise-II.....	18
Viva-Voce .....	07
Record .....	07

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Total : 50

B.Sc.Part-II, Semester-IV4S  
Chemistry

Total Lectures: 84

Marks: 80

**Note:** Figures to the right hand side indicate number of lectures.

#### Unit I 14L

##### A] Chemistry of elements of transition series: [11]

Definition of transition elements. General characteristics of transition elements. Comparative study of first transition series elements (3d) with reference to following properties: (i) Electronic configuration (ii) Atomic and ionic size (iii) Ionization energy (iv) Metallic nature (v) Oxidation states (vi) Magnetic properties (vii) Color of salts (viii) Catalytic properties (ix) Complex formation behaviour. Study of 4d and 5d series elements-Electronic configuration. Comparison of 3d series elements with 4d and 5d series elements with respect to size, oxidation states,

magnetic properties and color.

#### B] Extraction of elements: [3]

Principles involved in extraction of elements. Major methods of extraction of elements. Factors affecting choice of extraction method. Thermodynamics of reduction processes-Ellingham diagrams for oxides and importance of this diagram (only preliminary ideas).

**Unit II 14L****A) Inner transition elements:**

Definition, Lanthanides and Actinides. Comparative study of Lanthanides with respect to following properties: (i) Electronic configuration (ii) Atomic and ionic radii lanthanide contraction- definition, cause and effect of lanthanide contraction (iii) Oxidation states (iv) Magnetic properties (v) Color of salts (vi) Complex formation behavior. Occurrence of lanthanides. Isolation of lanthanides by ion exchange method. Actinides- Electronic configuration and oxidation states. Comparison of lanthanides and actinides. [11]

**B) General Principles of Metallurgy:**

Definition of metallurgy, steps in metallurgy. Ore dressing by gravity separation, froth floatation and electromagnetic separation. Calcination, roasting, smelting and refining of metals. Meaning of term hydrometallurgy and pyrometallurgy. [3]

**Unit III 14L****A) Polynuclear hydrocarbons:**

Naphthalene - Haworth synthesis, orbital picture, Reactions  
– electrophilic substitution (orientation) Preparation of naphthols from naphthalene sulphonic acids and naphthylamines from naphthols. [4]

**B) Reactive methylene compounds:**

Malonic Ester: Synthesis from acetic acid, Synthetic applications- Synthesis of acetic acid, succinic acid, glutaric acid, crotonic acid and malonyl urea. Acetoacetic ester: Synthesis from ethyl acetate, Synthetic applications- Synthesis of acetic acid, propionic acid, isobutyric acid, succinic acid, glutaric acid, crotonic acid, acetyl acetone and 4-methyl uracil. [6]

**C) Carbohydrates:**

Constitution of glucose, cyclic structure, Pyranose and Furanose structure, Epimerization, conversion of

glucose to fructose and vice-versa, Introduction to fructose, ribose, 2- deoxyribose, maltose, sucrose. (their structures only- determination not needed). [4]

**Unit IV 14L****A] Aromatic nitro compounds:**

Nitrobenzene: Synthesis from benzene, Reduction of nitrobenzene in acidic, neutral and alkaline medium. [3]

**B] Amino Compounds:**

Basicity and effect of substituents. Methods of preparation of aniline from nitrobenzene, Reactions: with acetyl and benzoyl chlorides,  $\text{Br}_2(\text{aq})$  and  $\text{Br}_2(\text{CS}_2)$ , Carbylamine reaction, alkylation, Hoffmann's exhaustive methylation and its mechanism.

[4]

**C] Diazonium Salts:**

Preparation benzene diazonium chloride, Synthetic applications- Preparation of benzene, phenol, halobenzene, nitrobenzene, benzonitrile, coupling with phenol and aniline. [3]

**D] Amino acids and Proteins:**

Classification, Strecker and Gabriel phthalimide synthesis, Zwitterion structure, Isoelectric point, peptide synthesis, Structure determination of polypeptides by end group analysis.

[4]

**Unit V - Colligative Properties of Dilute Solutions: 14L**

(i) Definition and examples of colligative properties. (ii) Elevation of boiling point, thermodynamic derivation of the relationship between elevation of boiling point and molar mass of a non-volatile solute. Cottrell's method for determination of elevation of boiling point. (iii) Depression of freezing point, thermodynamic derivation of the relationship between depression of freezing point and molar mass of a non-volatile solute. Rast's method for determination of depression of freezing point. (iv) Abnormal behavior of solution. Van't Hoff's factor 'i'. Determination of degree of association and dissociation from Van't Hoff's factor. (v) Numericals.

**Unit VI- Crystalline state 14L**

Symmetry in crystal, plane of symmetry, axis of symmetry and point of symmetry. Law of constancy of interfacial angles. Elements of symmetry in cubic crystals. Laws of symmetry. Law of rational indices, Weiss and

Miller indices of a lattice planes,

calculation of interplaner distance  $d(h,k,l)$  from Miller indices in a cubic system. Seven crystal systems and fourteen Bravais lattices, Bravais lattices of cubic system. Simple cubic system (S.C.C.), body centered cubic system (B.C.C.) and face centered cubic system (F.C.C.). Calculation of number of constituent units in S.C.C., B.C.C. and F.C.C. Ratio of interplaner distances for 100, 110 and 111 lattice plane in S.C.C., B.C.C. and F.C.C. (No geometrical derivation). Derivation of Bragg's equation for X-ray diffraction, Bragg's X-ray spectrometer method for the determination of crystal structure of NaCl and KCl. Anomalous behaviour of KCl towards X-ray. Numericals.

#### **Semester- IV** **4S Chemistry Practicals**

**Total Laboratory sessions: 26**

**Marks: 50**

**Exercise I: Inorganic estimations 14 Laboratory sessions**

- 1) Chromatographic separation of binary mixture containing Cu(II), Co(II) and Ni(II) ions by paper chromatography and determination of  $R_f$  values.
- 2) Estimation of Zn(II) by complexometric titration.
- 3) To determine the strength of unknown calcium salt solution by complexometric titration.
- 4) Estimation of hardness of water by complexometric titration.
- 5) Colorimetric or spectrophotometric estimation of Cu(II) in commercial copper sulphate sample as ammonia complex.
- 6) To determination of concentration of unknown  $KMnO_4$  solution from standard solutions of  $KMnO_4$  by colorimetrically or spectrophotometrically.

**Exercise II: Organic Chemistry Practicals 12 Laboratory Sessions**

1. Isolation of casein from milk.
2. Isolation of nicotine from tobacco leaves.
3. Isolation of caffeine from tea leaves.

4. Isolation of lycopene from tomato juice.
5. Estimation of glucose.
6. Estimation of acetamide.
7. Determination of equivalent weight of an organic acid.



## Distribution of Marks for Practical Examination

**Time: 6 hours (One Day Examination)**

**Marks: 50**

Exercise-I	18
Exercise-II	18
Viva-Voce	07
Record	07
<b>Total:</b>	<b>50</b>

### Books Recommended: (Common for Semester III and Semester IV)

- Principles of Inorganic Chemistry by Puri, Sharma and Kalia- S. Naginchand & Co., Delhi.
- Text book of Inorganic Chemistry by A.K. De, Wiley East Ltd.
- Selected Topics in Inorganic Chemistry by Malik, Tuli and Madan- S. Chand & Co.
- Modern Inorganic Chemistry by R.C. Agrawal, Kitab Mahal.
- Instrumental Methods of analysis by Chatwal and Anand, Himalaya Publishing House.
- Concise Inorganic Chemistry by J.D. Lee, ELBS.
- Inorganic Chemistry by J.E. Huheey- Harper & Row.
- Fundamental concepts of Inorganic Chemistry by E.S. Gilreath, McGraw Hill book Co.
- Modern Inorganic Chemistry by W.L. Jolly, McGraw Hill Int.
- Chemistry Facts, Patterns & Principles by Kneen, Rogers and Simpson, ELBS.
- Theoretical Principles of Inorganic Chemistry by G.S. Manku, Tata McGraw Hill.
- Inorganic complex compounds by Murmann, Chapman & Hall.
- Text book of Inorganic Chemistry by K.N. Upadhyaya, Vikas Publishing House, Delhi.
- Advanced Practical Inorganic Chemistry by Gurdeep Raj, Goel Pulishing House, Meerut.
- Co-ordination Chemistry by D. Banerjee, TMH Publication.
- Text book of Inorganic Chemistry by Nema, Agrawal, Solanki, Morkhade, Meshram, Berad.
- Text book of Inorganic Chemistry by Bhadange, Pagariya, Deshmukh, Joshi, Bombatkar, Mandlik, Bokey Prakashan, Amravati.
- Organic Chemistry by R.T. Morrison & R.T. Boyd, 6<sup>th</sup> edition, PHI.
- Organic Chemistry by Pine, 5<sup>th</sup> edition.
- Organic Chemistry Vol. I, II and III by Mukharjee, Singh and Kapoor- Wiley Eastern.
- Organic Chemistry by S.K. Ghosh.
- Reaction Mechanism in Organic Chemistry by S.M. Mukharjee and S.P. Singh.
- Spectroscopy of Organic Compounds by P.S. Kalsi.
- Stereochemistry and mechanism through solved problems by P.S. Kalsi.
- Organic Chemistry by TWG Solomons, 4<sup>th</sup> edition, John Wiley.
- Hand Book of Organic Analysis by H.J. Clarke, Arnold Heinmen.
- Text book of Practical Organic Chemistry by A. I. Vogel.
- Text book of Organic Chemistry by Wadodkar, Raut, Dighade, Thakre, Kale, Kadu, Chincholkar.
- Text book of Organic Chemistry by P.S. Kalsi published by Macmillan India Ltd., 1999, Delhi.
- Practical Organic Chemistry by F.G. Mann, B.C. Saunders, Orient Longman.
- Comparative Practical Organic Chemistry (Qualitative Analysis) by V.K. Ahluwalia and Sunita Dhingra, Orient Longman.
- Comprehensive Practical Organic Chemistry (Preparation and Qualitative Analysis) by V.K. Ahluwalia and Renu Agrawal, Orient Longman.
- Text book of Organic Chemistry by Deshmukh, Awinashe, Tayade, Wadekar, Meshram, Parhate, Bokey Prakashan, Amravati.
- Physical Chemistry: Walter, J. Moore, 5<sup>th</sup> edn., New Delhi.
- Physical Chemistry: G.M. Barrow, McGraw Hill, Indian Edn.
- Principles of Physical Chemistry: Maron and Prutton.
- Principles of Physical Chemistry: Puri, Sharma and Pathaniya.
- Physical Chemistry: P.W. Atkins, 4<sup>th</sup> Edn.
- Text book of Physical Chemistry: P.L. Sony, O.P. Dharma.
- Physical Chemistry: Levine.
- Practical Physical Chemistry: Palit and De.
- Practical Physical Chemistry: Yadao.
- Practical Physical Chemistry: Khosla.
- Laboratory Mannual of Physical Chemistry: W.J. Popiel.
- Practical Chemistry: Dr. S.B. Lohiya, Bajaj publication, Amravati.
- Text book of Physical Chemistry: Satpute, Kabra, Raghuwanshi, Wankhade, Jumle and Murarka.



47. Text book of Chemistry, B.Sc.-II, Third Semester & Fourth Semester, Nabh Prakashan.

### List of equipments/apparatus required for the Chemistry Practicals for B.Sc.

1. Abbe's Refractometer	02 nos./batch
2. Viscometer	10 nos./batch
3. Stalagmometer	10 nos./batch
4. Melting Point Apparatus	10 nos./batch
5. Thermometer 0-360°C	20 nos./batch
6. Thermometer 0-110°C	20 nos./batch
7. Analytical balance	15 nos./batch
8. Weight box	15 nos./batch
9. Density Bottles	20 nos./batch
10. Kipp's Apparatus	02 nos./batch
11. Quick fit Distillation Assembly/ Multipurpose assembly	10 nos./batch
12. Sintered Glass Crucible	20 nos./batch
13. Silica Crucible	20 nos./batch
14. Vacuum Suction Pump	02 nos./lab.
15. Potentiometer	02 nos./batch
16. Metzer Electronic one pan balance	01 nos./lab.
17. Filtration flask with Buckner Funnels	10 nos./batch
100ml	05 nos./batch
250ml	05 nos./batch
500ml	02 nos./batch
18. Desiccators	10 nos./batch
19. Magnetic Stirrer	10 nos./batch
20. Water Suction	10 nos./batch
21. Conductometer with Conductivity Cell	04 nos./batch
22. Colorimeter	02 nos./batch
23. pH Meter	02 nos./batch
24. Chromatographic Jar	05 nos./batch
25. Separating funnels 250ml, 500ml	05 nos./batch
26. Hot Air Oven	02 nos./lab.
27. Hot-Cold Air Blower	01 no./lab.
28. Centrifuge machine (Electrically Operated)	02 nos./lab.
29. Deioniser/ Water Still (Electrically Operated)	01 no./lab.
30. Hot Plate/ Heating Mantle	05 nos./batch
31. Models of Elements (Seven Crystal types and their symmetry)	01 no./batch

32. Flame Photometer	2	02 nos./batch
33. Spectrophotometer		02 nos./batch
34. Shaking Machine		01 no./batch
35. Polarimeter		02 nos./batch

2

#### 4. INDUSTRIAL CHEMISTRY (REGULAR/VOCATIONAL)

The examination in Industrial Chemistry (Regular/ Vocational) of Third semester shall comprise of one theory paper, internal assessment and practical examination. Theory paper will be of 3 Hrs. duration and carry 80 marks. The internal assessment will carry 20 marks. The practical examination will be of 6 to 8 hours duration and carry 50 marks.

The following syllabi is prescribed on the basis of six lectures per week and 6 practical periods per batch per week. Each theory paper has been divided into 6 units. There shall be one question in every unit with internal choice for each of 12 marks & one compulsory question covering all the syllabus of Semester-III (8 marks).

#### 3S Industrial Chemistry (Regular/ Vocational) Unit Processes and Process Equipments

Total Lectures: 84

Marks: 80

Note: Figures to the right hand side indicate number of lectures.

#### Unit I

[14]

- A) **Nitration** – Introduction, nitrating agents, nitration of i) Benzene to nitrobenzene and m-dinitrobenzene. ii) Chlorobenzene to *o* and *p*- nitrochlorobenzenes. iii) Acetanilide to p-nitroacetanilide. Continuous and batch nitration.
- B) **Amination by Reduction** – Introduction, methods of reduction, Bechamp. Reduction (Iron and Acid Reduction), sulphide reduction, alkali sulphite reduction, metal hydrides, cathodic reduction. Factors affecting amination. Manufacturing of aniline, m-nitroaniline, p-aminophenol.
- C) **Alkylation** – Introduction, alkylating agents, mechanism of alkylation. Manufacturing of alkylbenzene, ethylbenzene.
- A) **Halogenation** – Introduction, halogenating agents, nuclear and side chain aromatic halogenation. Manufacturing of chlorobenzene, chloral, monochloro acetic acid.
- B) **Hydrolysis** - Introduction, mechanism and thermodynamics of hydrolysis, various hydrolyzing agents.

ethyl acetate, vinyl acetate, cellulose acetate.

#### Unit

III

[14]

- A) **Oxidation** – Introduction, various hydrolyzing agents, types of oxidative reactions, mechanism of oxidation, liquid and vapour phase oxidation. Manufacturing of benzoic acid, acetaldehyde and acetic acid.
- B) **Hydrogenation** - Introduction, various catalysts used for hydrogenation, Manufacturing of methanol from carbon monoxide and hydrogen, hydrogenation of vegetable oil.
- C) **Esterification** - Introduction, esterification of organic acids using unsaturated compounds. Manufacturing of

#### Unit IV: Process Equipments

[14]

- A) **Thermometer** – Glass, bimetallic, pressure spring, resistance and radiation pyrometer.
- B) **Pressure** – Manometer, barometer, pressure gauge, diaphragm, Maclean and Pirani gauge.
- C) **Liquid level** – Direct and indirect liquid level, measurement, float type liquid level gauge, ultrasonic level gauge, and bell type liquid level gauge.

#### Unit V

[14]

- A) **Corrosion**- Introduction, types of corrosion (galvanic, open air, underwater & underground). Mechanism of corrosion. Factors affecting corrosion.
  - a. **Passivity** – Introduction, chemical and mechanical passivity, oxide film
  - b. theory of passivity.
- B) **Methods adopted for preventing corrosion** (metal coating processes)

- a. i) Galvanizations of iron (ii) Electro plating (iii) Painting (iv) Plastic coating. Corrosion inhibitor.

- C) **Oil Paints and Varnishes** - Introduction, manufacture and their applications in preventing Corrosion.

**UNIT VI: Industrial solid waste and Treatment processes [14]**

- A) Introductions, types of solid wastes, methods of industrial solid waste treatment & disposal.  
i) Composting, ii) Sanitary Land-fills, iii) Thermal process (Incineration & pyrolysis) iv) Recycling & reuse.
- B) **Hazards waste –**  
Types, radioactive waste, biomedical waste and non radioactive waste containing toxic and heavy metals. Methods of their disposal.

**3S Industrial Chemistry  
Practical List of  
Experiments**

**Unit I**

- 1) Preparation of Benzoic acid from Benzaldehyde by Oxidation Method.
- 2) Preparation of Benzoic acid from Benzamide by Hydrolysis Method.
- 3) Preparation of m- nitroaniline from m-dinitrobenzene. (Reduction Method).
- 4) Preparation of Iodoform from Ethanol.
- 5) Preparation of p- bromoacetanilide from Acetanilide by Halogenation Method.
- 6) Preparation of Sulphanlic acid from Aniline by Sulphonation Process.
- 7) Preparation of p- nitroacetanilide from Acetanilide by Nitration Method.

**Unit II**

- 1) Preparation of m-dinitrobenzene from Benzene by Nitration Method.
- 2) Preparation of Acetanilide from Aniline.
- 3) Preparation of Acetylsalicylic acid (aspirin) from Salicylic acid.

(NaOH + Na<sub>2</sub>CO<sub>3</sub>) method.

- 6) Estimation of Calcium in Dolomite or Lime stone.
- 7) Determination of Iron in water sample by colorimetry.

### Distribution of Marks for Practical

**Examination Time: 6 – 8 hours (One Day**

**Examination) Marks: 50**

- |                    |   |                        |    |
|--------------------|---|------------------------|----|
| 1. Unit – I        | : | (Exercise No. 1) ..... | 15 |
| 2. Unit – II       | : | (Exercise No. 2) ..... | 15 |
| 3. Viva-Voce ..... |   |                        | 10 |
| 4. Record .....    |   |                        | 10 |

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**Total: 50**  
 -----

#### Books Recommended:

- 1) Unit processes in Organic Synthesis – P.H.Groggins.
- 2) Industrial Organic Chemistry - Peter Weismann (Elsevier publication)
- 3) Environmental Chemistry – S.S. Dara
- 4) Environmental Chemistry- A. K. De
- 5) Environmental Chemistry- Tyagi & Mehara
- 6) Industrial Chemistry – B. K. Sharma
- 7) Environmental Chemistry- S.S.Dara
- 8) Environmental Chemistry- Shashi Chawala, Dhanpat Rai, co.
- 9) Process instrumentation & control- A.P. Kulkarni
- 10) Industrial Chemistry – D. P. Eckman , Jon- Wiley & Sons.
- 11) Instrumentation and Control for the process Industries – S. Sorer, Elsevier applied Science.

### 4S Industrial Chemistry (Regular/ Vocational) Material Science and Industrial Pollution

**Total Lectures: 84**

**Marks: 80**

**Note:** Figures to the right hand side indicate number of lectures.

**Unit I A) Ceramics** – Introduction, types, raw materials, manufacturing processes. Properties and applications.

**B) Refractories** – Introduction, classification, manufacture, properties and applications of fire clay bricks, and high

alumina bricks.

C) **Glasses** – Introduction, types, compositions, manufacturing process. Properties and applications. [14]

**Unit II Cement-** Introduction, types of cement, raw materials, manufacturing processes- Wet, dry and semidry process. Setting and hardening of cement. Properties of cement. Specifications and testing of cement (tensile, compression, fineness, specific gravity). Additives for cement. Major engineering problems in cement manufacturing. [14]

**Unit III Polymers** – Introduction, classification (natural, artificial, inorganic, organic, thermosetting, thermoplastic). Classification of polymerization processes (addition and condensation polymerization without mechanism).

Manufacturing processes, properties and applications of – polyethylene, polystyrene, polyvinyl chloride (PVC), polyester (PET), nylon, teflon, phenol, phenol formaldehyde and urea formaldehyde resins. [14]

#### **Unit IV : Water pollution due to Industrial Effluents**

- A) **Classification of water** - sea water, surface water (river, lake, pond) and ground water (well, tube well, stream); their properties in brief.
- B) **Water quality parameters** – pH, hardness, alkalinity, acidity, TDS, DO, COD, BOD. IS and WHO standards of water quality.
- C) **Inorganic Pollutants** – Heavy metals, Pb, Hg, As, Cd, Cr, Ni, Cu, mineral acids, alkalis and their sources (inorganic based industries)
- D) **Organic pollutants** – Phenols, detergents, dyes, plastics, oils, greases etc. and their sources (organic based industries). Effects of these pollutants on water quality. Water pollution due to paper and sugar industries. [14]

**Unit V: Water and Waste Water Treatment** [14]

- A) **Water Treatment – Methods for water treatment** - Sedimentation, filtration, coagulation and sterilization.
- B) **Waste Water Treatment** – Industrial and sewage water treatments: Primary, secondary and tertiary treatment.

- C) **Biological Methods** - Aerobic, anaerobic, trickling filter and activated sludge.
- D) **Chemical Methods For Inorganic Chemicals**- Precipitation, electrolysis, ion – exchange, evaporation and adsorption.

**Unit VI : Air Pollution due to Industries**  
[14  
]

- A) **Classification of Air Pollutants** – Primary and secondary pollutants e.g. oxides of carbon, sulphur, nitrogen, hydrocarbon and particulates.
- B) **Industries as Source of Air Pollution** – Steel Industries, Fertilizer Industries, Thermal Power Plants, Refineries, paper and pulp industries, metallurgical and mining operations.
- C) **Methods of Control of Air Pollution** – Electrostatic precipitators, scrubbing, filters mist eliminator. Harmful Effects of Air Pollutants on human being, plants and materials. Green House Effect (Global Warming).
- D) **Air Pollution Monitoring** – Methods of collection of air samples, SPM and determination of air pollutants like  $\text{SO}_2$ ,  $\text{NO}_x$  and solid particulate matter (SPM). Sources of noise pollution, units of noise level and control.

**4S Industrial Chemistry**  
**Practical List of Experiments**

- Unit I**
- 1) To determine temporary and permanent hardness of water sample.
  - 2) To determine total dissolved solids, (TDS) of water sample.
  - 3) To determine acidity of water sample.
  - 4) To determine alkalinity of given water sample.
  - 5) To find out dissolved oxygen (DO) of given water sample.
  - 6) To find biological oxygen demand (BOD) of given water sample.
  - 7) To find out chemical oxygen demand (COD) of given water sample.
- Unit II**
- 1) To determine Ca in cement by sample complexometric method.
  - 2) To determine  $\text{SiO}_2$  in cement by gravimetric method.
  - 3) To determine Fe in cement gravimetrically.

- 4) Determination of  $\text{SO}_2$  in air sample by colorimetry.
- 5) Determination of SPM in a sample using high volume sampler.
- 6) Determination of Acid value of a Plastic material.
- 7) Preparation of Urea formaldehyde Resin.
- 8) Preparation of Phenol formaldehyde Resin.

**Distribution of Marks for Practical**

**Examination Time: 6 – 8 hours (One Day)**

**Examination) Marks: 50**

1. Unit – I: (Exercise No. 1) .....	15
2. Unit – II: (Exercise No. 2) .....	15
3. Viva-Voce .....	10
4. Record .....	10

**Total: 50**

**Books Recommended:**

- 1) Engineering Materials – Rangwala
- 2) Material Science and Metallurgy – O.P.Khanna
- 3) Unit Process in Organic Synthesis – P.H. Groggins
- 4) A Text Book of Engineering Chemistry – Shashi Chawala, Dhanpat Rai and Co.
- 5) A Text Book of Engineering Chemistry – S.S. Dara, S. Chand and Co.
- 6) Industrial Chemistry – B.K. Sharma
- 7) Dryden's Outline of Chemical Technology – M. Gopalrao and Marshall Sittig
- 8) Environmental Chemistry – S.S. Dara, S. Chand and Co.
- 9) Environmental Chemistry – Moor and Moor
- 10) Pollution Monitoring and Control – Dr. Priyaranjan Trivedi
- 11) Systems Approach to Air pollution Control – R.J. Bibbero and J.G. Young
- 12) Air Pollution Vol. I-IV – A.C. Stern
- 13) NEERI Manual.
- 14) A Text Book of Environmental Chemistry – O.D. Tyagi and M. Mehara, Anmol Publication Pvt. Ltd.



**5. PETROCHEMICALS**  
**ENCE3S Petrochemical**  
**Science**

The examination in Petrochemical Science of Third semester shall comprise of one theory paper, internal assessment and practical examination. Theory paper will be of 3 Hrs. duration and carry 80 marks. The internal assessment will carry 20 marks. The practical examination will be of 6 to 8 hours duration and carry 50 marks.

The following syllabi is prescribed on the basis of six lectures per week and 6 practical periods per batch per week. Each theory paper has been divided into 6 units. There shall be one question in every unit with internal choice for each of 12 marks & one compulsory question covering all the syllabus of Semester-III (8 marks).

**Semester-III**  
**3S Petrochemical Science**

**Total Lectures: 84**

**Marks: 80**

**Note:** Figures to the right hand side indicate number of lectures.

**Unit-I: Thermal Cracking [14]**

- Introduction to thermal cracking
- Thermal Cracking reactions
- Mechanism for thermal cracking
- Effect of operating variables on cracking
- Properties of cracked material

**Unit-II: Thermal Cracking Processes [14]**

- Vis-breaking: operation and description operating conditions and products
- Coking: Delayed and fluid coking
- Steam naphtha cracking: Various routes Chemistry, Process parameters, flow scheme.
- Physical, storage, and safety properties of ethylene
- Composition of pyrolysis products
- Break up of ethylene market
- Ethylene product tree

**Unit-III: Catalytic Cracking [14]**

- Introduction to catalytic cracking
- Reactions in catalytic cracking
- Mechanism for catalytic cracking

- Feed stocks and catalytic cracking conditions
- Composition and structure of cracking catalysts (Zeolites)

- Difference between amorphous silica-alumina and zeolites

#### **UNIT IV: Catalytic cracking processes [14]**

- Various cracking processes
- Type and working of catalytic processes
- Reaction variables
- Impact of catalyst to oil contact time on selectivity
- Houdray fixed bed cracking unit
- Modern fluid bed cracking unit
- Product profile of catalytic crackers
- Recovery of propane and propylene from cracked gases
- Relative yields of propylene and ethylene from various hydrocarbon feed stocks
- Market for propylene
- Tree diagram of propylene products

#### **UNIT V: Manufacture and recovery of butadiene [14]**

- Recovery of butadiene from naphtha steam cracking effluent stream
- Dehydrogenation of butane (Houdray process)
- Dehydration of ethyl alcohol
- Separation of butadiene using technique :selective extraction
- Separation of butadiene using techniques :extractive distillation
- Production of butanol through conventional (Oxo-process) process and BASF process
- Relative comparison based on operating parameters catalysts and its uses

#### **UNIT VI: Reforming process: recovery and manufacture of aromatics**

[1

4]

- Introduction to thermal reforming
- Catalytic reforming reactions process flow and description

- Reaction conditions: effect of temperature and pressure

- Reforming catalysts
- Separation of aromatics from reformat gasoline
- Udex process for separation of BTX aromatics
- Separation of Benzene, Toluene, Xylene and ethyl benzene from mixed aromatic stream
- Separation of mixed xylenes into their individual isomers

### Semester -III

#### 3S Petrochemical Science Practical

##### List of Experiments:

1. Simple distillation
2. Binary distillation
3. Steam distillation
4. Vacuum distillation
5. ASTM distillation of Petroleum Sample
6. Reid vapor pressure of volatile petroleum sample
7. Copper corrosion test for petroleum sample
8. Oil in wax determination in given oil sample
9. Water determination in given oil sample
10. Solubility diagram for acetic acid-water-benzene system

##### Distribution of Marks for Practical Examination Time: 6

hours	(One Day Examination)	Marks : 50
Exercise No. I: (Practical Expt.).....		15 Marks
Exercise No. II: (Practical Expt.).....		15 Marks
Viva-Voce.....		10 marks
Record.....		10 Marks

**Total : 50**

### Semester-IV

#### 4S Petrochemical Science

##### UNIT I: Ethylene Derivatives-I [14]

- Vinyl Chloride Monomer by direct chlorination of ethylene
- Vinyl chloride monomer by oxy-chlorination of ethylene
- Market for Vinyl chloride monomer
- Manufacture of Vinyl acetate monomer from ethylene and other sources

- Role of  $\text{PdCl}_2$  and  $\text{CuCl}_2$  in VAM synthesis
- Application and uses of VAM
- Acetaldehyde manufacture through oxidation of ethyl alcohol (Wacker's Process)
- Market for acetaldehyde
- Ethanol manufacture by direction of ethylene (Shell process)
- Market for ethanol

##### UNIT II: Ethylene Derivatives-II [14]

- Ethylene oxide by direct oxidation of ethylene
- Ethylene oxide through chlorohydrin process
- Comparison between direct oxidation and chlorohydrin routes for ethylene oxide manufacture
- Uses of ethylene oxide
- Production aspects of ethylene glycol
- Market for ethylene glycol
- Manufacture, chemistry, properties and uses of ethanol amine

##### UNIT III: Propylene Derivatives [14]

- Production of propylene through direct oxidation
- Production of propylene oxide by chlorohydrin process
- Halcon and oxirane process for propylene oxide manufacture
- Properties of propylene oxide like molecular formula, molecular weight, melting point, boiling point, density, solubility, flash point, ignition temperature, explosive limits
- Production aspects of Isopropyl alcohol by direct and catalytic hydration of propylene
- Sulfuric acid, Veba process, Tokayama, ICI, Taxaco process for Isopropyl alcohol
- Market for Isopropyl alcohol
- Manufacture of acetone from Isopropyl alcohol
- Acrylonitrile manufacture by amoxidation of propylene (Sohio process and other routes)
- Market for acrylonitrile

- Acrylamide manufacture with respect to chemistry catalyst and optimum conditions and market

**UNIT IV : Butadiene derivatives [14]**

]

- Synthesis of isoprene by various routes
- Good-Year Scientific design process, dehydrogenation of tert-amylenes (Shell process) /dehydrogenation of C<sub>5</sub> stream, acetone-acetylene route
- Manufacture of adipic acid, sulpholane, chloroprene from butadiene
- Chemistry process flow and market for above products

**UNIT V: Benzene derivatives [14]**

]

- Chemistry, operating conditions, flow scheme, description and market for the benzene derivatives
- Production of phenol by cumene route
- Phenol manufacture through chlorobenzene
- Aniline manufacture
- Caprolactum preparation

**UNIT VI: Xylene derivatives [14]**

- Chemistry, operating conditions, flow scheme, description and market for the xylene derivatives
- Terephthalic acid: para-xylene oxidation route, Toray industries process, Lummus process
- Di-methyl Terephthalate through para-xylene
- Phthalic anhydride from o-xylene and naphthalene
- Comparison of the o-xylene and naphthalene routes

**Semester IV**

**4S Petrochemical Science Practical**

**List of experiments:**

1. Viscosity index determination
2. Ductility of bitumen determination
3. Cone penetration index of grease
4. Needle penetration index of bitumen
5. Melting point determination of wax by various method

6. Viscosity determination of petroleum sample by Redwood method I

7. Viscosity determination of petroleum sample by Redwood method II
8. Proximate analysis of coal
9. Determination of carbon residue of lubricating oil using Conradson's apparatus
10. Determination of cloud and pour point of given petroleum sample

**Distribution of Marks for Practical Examination Time:**

<b>6 hours</b>	<b>(One Day Examination)</b>	<b>Marks :</b>
50	Exercise No. I: (Practical Expt.) .....	15 Marks
	Exercise No. II: (Practical Expt.) .....	15 Marks
	Viva-Voce .....	10marks
	Record .....	10 Marks

**Total: 50**

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**Books Recommended:**

1. Petroleum Refining and Petrochemicals, N.K. Sinha, Umesh Publications, Delhi
2. Advance Petrochemicals , Dr. G. N. Sarkar, Khanna Publications, Delhi
3. A Text on Petrochemicals , B.K. B Rao, Khanna Publications, Delhi
4. Introduction to Petrochemicals, S. K. Maiti, Oxford-IBH Publications
5. Fuels and Combustions, Sameer Sarkar, Orient- Longman Ltd. Hyderabad
6. Catalysis and Chemical Processes , Ronald Pearce and William Patterson, Leonad-Hill Publication, Glasgow
7. Systematic Experimental Physical Chemistry, S.W. Rajabhoj, Dr. T. K. Chondhekar, Anjali publications Aurangabad
8. Advanced Petroleum Refining, G.N.Sarkar, Khanna Publications, Delhi
9. Petroleum Refining Technology, Dr. Ram Prasad, Khanna Publications, Delhi
10. Unit Operations II , K.A. Gavane, Nirali prakashan, Pune
11. Modern Petroleum Refining Processes, Dr. B. K. Bhaskarrao, Oxford-IBH Publication New Delhi
12. Chemicals from Petroleum, A.L. Waddams, Murray, London

13. An Introduction to Industrial Organic Chemistry, P. Wiseman, Applied Science, London
14. Modern Petroleum Technology, J.D. Hobson, Jon-Wiley Chester
15. Chemicals form Synthesis Gas, R.A. Sheldon, B. Reidel Publishing Company. Dordrecht
16. Text book of Polymer, Volume I, II, III, M.S. Bhatnagar, S.Chand Publi., Delhi
17. Dryden's outline of Chemical Technology, M. Gopalrao, Marshall Stings, East-west Publications
18. Shreve's Chemical Process Industries, J. Austin, Mc. Grow Hill, New Delhi.

**LIST OF APPARATUS AND EQUIPMENTS FOR A BATCH OF 20 STUDENTS FOR B.SC. I, II, III PETROCHEMICAL SCIENCE**

Sr

No.	Item	Quantity
1.	Burette	20 Nos.
2.	Pipette 10ml, 25ml	20 Nos. each
3.	Mohr pipette 2ml, 5ml	10 Nos. each
4.	Conical flask with stopper	50 Nos.
5.	Standard volumetric flask	20 Nos.
6.	Density Bottle	20 Nos.
7.	Balance (Electronic/Digital)	02 Nos.
8.	Aniline Point Apparatus	01 No
9.	U-tube viscometer of different capillary size	02 Nos.
10.	Thermometer (0 to 110°C I P Grade)	10 Nos.
11.	Thermometer (0 to 360°C I P Grade)	10 Nos.
12.	Test tube (20 and 50 ml with rubber cork)	50 Nos.
13.	Smoke Point Apparatus (I P Grade)	01 No.
14.	Abel Flash Point apparatus (I P Grade)	01 No.
15.	Pensky Marten's Flash Point apparatus	01 No.
16.	Cleveland Open Cup Flash point Apparatus	01 No.
17.	Porceline dish	10 Nos.
18.	Constant Temperature bath	02 Nos.
19.	Hot Plate	01 No.
20.	Air condenser	20 Nos.
21.	Glass tubing 6mm, 10mm	20ft. Each
22.	Glass rod 4mm, 8mm	20 ft. Each
23.	Stop watches	04 Nos.
24.	LPG Cylinder with regulator	01 No.
25.	Refractometer	01 No.

26.	Refrigerator	01 No.
27.	Water Distillation Plant	01 No.
28.	Beaker 250 ml	20 Nos.
29.	Beaker 50, 100, 500, 1000 ml	07 Nos.
30.	.	Hot Air Oven 01
31.	No.	Heating Furnace 01
32.	.	Karl Fisher Auto 01 No.
33.	Titration Apparatus	Dean and Stark 01 No.
34.	.	Flame Photometer 01 No.
35.	No.	Colorimeter 01
36.	No.	Bomb Calorimeter 01
37.	.	Spectrophotometer 01 No.
38.	Oxygen Cylinder with pressure regulating valve	01 No.
39.	.	Vacuum Pump 01
40.	No.	Air source 01
41.	No.	Air Flow meter 01
42.	Nos.	Dessicators 06
43.	Nos.	Water Suction 04
44.	Buckner Funnel 100,250ml, 500ml	Filtration Flask with 20 Nos.
45.	Nos.	Heating Mental 06
46.	apparatus	ASTM Distillation 01 No.
47.	Constant temperature bath	Viscometr and 01 Set of viscometer
48.	Apparatus for oil determination in given sample as per I P norm	01 No.
49.	Vapor Pressure Apparatus with const.	Reid 01 No.

50	temp. Bath .	Ductility measuring 01 No.
51	meter .	Penetrometer 01 No.
52	Test Apparatus .	Copper Corrosion 01 No.
53	Dilution Apparatus .	Crankcase Oil 01 No.
54	Viscometer No. I & II .	Redwood 01 No. each

## 6.GEOLOGYB.Sc. II

### 3S- Geology

**UNIT I :** Ore forming minerals: Metallic and Nonmetallic, Ore, Oreminerals, Gangue, Tenor of Ore. Classification of Mineral Deposits. Metallogentic epochs and provinces. Processes of ore formation: Magmatic concentration deposits, Hydrothermal Deposits.

**UNITII :** Processes of ore formation: Contact metasomatism, Sedimentary deposits, Oxidation and supergene sulphide enrichment, Mechanical concentration deposits, Residual concentration deposits, Evaporites and Metamorphism as a process of ore formation.

**UNITIII :** Concept of Phase, Component and System. Phase Rule. One Component System – Quartz and Augite, Two Component System – Mixed Crystal-Plagioclase Feldspar, Eutectic- K-Feldspar, Three Component System – Diopside -Albite-Anorthite.

**UNITIV :** Distribution of igneous rocks in time and space. Consanguinity, Variation Diagram, kindred's of igneous rock, Granite-Granodiorite-Diorite, Syenite-Nepheline Syenite- Alkaline Rocks, Gabro-Anorthosite-Peridotite, Dolerite –Lamprophyre and their equivalents, Petrographic provinces and periods.

**UNITV :** Classification, diagnostic morphological characters, environment and geological distribution of Phylum Echinodermata and Foraminifera. Basic ideas about Micropaleontology and Microfossils.

**UNITVI :** Classification, diagnostic morphological characters, environment and geological distribution of Phylum Anthozoa and Trilobita. Applications of palaeontologic data in Evolution, Stratigraphy and Palaeogeographic and Palaeoclimatic reconstruction.

#### **PRACTICALS:**

1. Physical and Optical properties of rocks and rock forming minerals.(20 slides/specimens)
2. Morphological characters and Identification fossils listed in theory.
3. Identification of ore and industrial minerals.(20 specimens)
4. Field Work.

#### **PRACTICAL EXAMINATION:**

The Practical Examination will be four hour duration and carries 50 marks. The distribution of marks will be as follows-

A. I. Megascopic Identification of Igneous rocks	10 Marks.
II. Microscopic Identification of Igneous rocks	06 Marks
III. Identification of Ore Minerals and Industrial Minerals	10 Marks
IV. Identification of Fossils	10 Marks
B. Field work	04 Marks
C. Practical Record and Viva Voce	10 Marks
<b>Total :</b>	<b>50 Marks.</b>

B.

#### **Sc. II 4S- Geology**

**UNITI :** Mineralogy Uses, Geological occurrences, origin and geographical distribution in India of the mineral deposits like Iron, Manganese, Copper, Lead, Zinc and Aluminum

**UNITII :** Mineralogy Uses, Geological occurrences, origin and geographical distribution in India of the non-metal like Asbestos, Mica, Gypsum, Magnesite and Lime Stone.

Origin, classification and geographical distribution of Coal Deposits in India.

Origin, Traps and distribution of Petroleum Deposits in India

**UNITIII :** Environment of depositions: Aeolean, glacial, fluvial, lacustrine, near-shore and deep-sea environments.

Composition and paragenetic diagrams. Projective Analysis.

**UNITIV :** Cataclastic, Thermal, Dynamothermal and Plutonic Metamorphism and their products. Metasomatism-types and additive processes. Pneumatolytic metamorphism, Injection metamorphism and



Autometamorphism.

**UNITV :** Classification, geographic distribution, lithological characteristics, fossil contents and economic importance of Gondwana Supergroup and Deccan Traps. Intertrappean and Infra-trappean .

**UNITVI :** Jurassic of Kutch, Triassic of Spiti. Cretaceous of Narmada Valley and Trichanpally. Lameta Formation. Classification, geographic distribution, lithological characteristics, fossil contents and economic importance of Siwalik Supergroup.

### PRACTICALS:

1. Physical and Optical properties of Sedimentary and Metamorphic rock.
2. Exercises showing the major stratigraphic and litho tectonic units of India.
3. Laboratory exercises in graphic plots for petrochemistry and interpretation of petrogenetic diagrams.
4. Field Work.

### PRACTICALEXAMINATION:

The Practical Examination will be four hour duration and carries 50 marks. The distribution of marks will be as follows-

- |  |           |
|--|-----------|
| A. I. Megascopic Identification of Sedimentary and metamorphic rocks                                     | 12 Marks. |
| II. Microscopic Identification of Sedimentary and metamorphic rocks                                      | 08 Marks  |
| III. Exercises in showing the major stratigraphic and litho tectonic units of India.                     | 10 Marks  |
| IV. Laboratory exercises in graphic plots for petrochemistry and interpretation of petrogenetic diagrams | 06 Marks. |
| B. Field work  | 04 Marks  |
| C. Practical Record and Viva Voce  | 10 Marks  |

**Total : 50 Marks**

### Text Books for Sem III & IV:

1. Text Book of Engineering Geology - Parbin Singh, Katson Publishing, Ludhina.
2. Text Book of Geology - P.K. Mukerjee - World Press Pub., Calcutta.
3. Text Book of Geology - Santosh Garg - Khanna Publ., Delhi.
4. G. W. Tyrell (1998) Principles of Petrology B.I. Publications Pvt. Ltd., New Delhi.
5. F.H. Hatch, A.K. Wells and M.K. Wells (1984) petrology of Igneous Rocks. CBS Publishers, New Delhi.

6. F. J. Turner & J. Verhoogen (1987) Igneous and Metamorphic Petrology, CBS.
7. E.G. Ehlers and H. Blatt (1981) Petrology : Igneous, Sedimentary and Metamorphic. CBS Publishers, New Delhi.
8. N.W. Gokhale (1998) Fundamentals of Sedimentary Rocks. CBS Publishers.
9. W.W. Moorhouse (1985) The study of Rocks in Thin Sections. CBS Publishers.
10. H. Williams, F.J. Turner and C.M. Gilbert (1985) Petrography: An Introduction to the Study of Rocks in Thin Sections. CBS Publishers.
11. Jensen, M.L. and Bateman, A.M. (1981) Economic Mineral Deposits. John Wiley and Sons, New York.
12. Sharma, N.L. and Ram, K.S.V. (1964) Introduction to India's Economic Minerals, Dhanbad Publishers.
13. Prasad U. Economic Deposits of India. C.B S Publisher, New Delhi.
14. Deb, S. (1980) Industrial Minerals and Rocks of India. Allied Publishers, New Delhi.
15. Krishnaswamy, S. (1979) India's Mineral Resources. Oxford and IBH Pub. Co., New Delhi.
16. R.R. Shrock & W.H. Twenhofel (1999) Principles of Palaeontology. CBS Publishers.
17. Henry Woods (1985) Invertebrate Palaeontology. CBS Publishers.
18. R.C. Moore, C.G. Lalicker & A.G. Fisher (1997) Invertebrate Fossils. CBS Publishers.
19. R.M. Black (1970) The Elements of Invertebrate Palaeontology. Cambridge University Press.
20. M.A. Koregave (1998) Fundamentals of Invertebrate Palaeontology. Book World Enterprises, Mumbai.
21. Ravindra Kumar (1985) Fundamentals of Historical Geology and Stratigraphy of India. Wiley Eastern Ltd., New Delhi.
22. M. S. Krishnan (1982) Geology of India and Burma. CBS Publishers.
23. D. N. Wadia (1998) Geology of India. Tata McGraw Hill, India.
24. G. G. Deshpande (1998) Geology of Maharashtra Geological Society of India, Bangalore.

7.

**BOTANY**

3S-

**BOTANY****ANGIOSPERMSYSTEMATICS,ANATOMY&EMBRYOLOGY****UNITI: Angiosperm Systematics and Biodiversity.**

- 1.1 Angiosperms: Origin and Evolution (**Pteridospermean and Bennititalean Theory**)
- 1.2 Botanical Nomenclature: Principles of rules, Taxonomic Ranks, Type concept, Valid publication.
- 1.3 Herbarium – Concept & significance, Royal Botanical Garden, Kolkata.
- 1.4 Concept of biodiversity, Ex situ and In situ conservation
- 1.5 Concept & importance of Biodiversity.

**UNITII: Angiosperm Systematics**

- 2.1 Systems of Classification: Bentham and Hooker's System, Engler and Prantle's system.
- 2.2 Systematic studies & economic importance of following Families  
Dicotyledons (Polypetalae) : Malvaceae, Brassicaceae, Leguminosae, Apiaceae,

**UNIT III: Angiosperm Systematics**

- 3.1 Systematic studies & economic importance of following Families  
Dicotyledons (Gamopetalae): Asteraceae, Asclepiadaceae, Apocynaceae, Solanaceae, Verbenaceae, Lamiaceae.
- 3.2 Dicotyledons ( Monoclamydeae): Euphorbiaceae.
- 3.3 Monocotyledons: Liliaceae, Poaceae.

**UNITIV:Anatomy**

- 4.1 Types of Tissues:  
Meristematic – Types of meristems  
Permanent – Simple and complex.
- 4.2 Characteristics of growth rings, Sapwood and heartwood.
- 4.3 Anatomy of root: Primary structure in dicot and monocot root, normal secondary growth in dicot root.

**UNITV: Anatomy**

- 5.1 Anatomy of stem: Primary structure in monocot and dicot

stem, normal secondary growth in dicot stem.

5.2 Anomalies in primary structure in *Boerhavia* stem, secondary structure in *Bignonia* and *Dracaena* stem.

5.3 Leaf Anatomy: Internal structure in *Nerium* and *Maize* leaf.

### UNIT VI : Embryology

5.1 Microsporangium, microsporogenesis, development of male gametophyte.

5.2 Megasporangium, types of ovules, megasporogenesis, development of female gametophyte (monosporic, Bisporic & tetrasporic).

5.3 Double fertilization and triple fusion.

5.4 Embryo – Classification of embryo.

5.5 Endosperm types & significance, Suspended animation

### LABORATORY EXERCISES

- 1) Embryology of Angiosperms:
  - i) Observation of wide range of flowers available in the locality and methods of their pollination.
  - ii) Study through permanent slides of T.S. of anthers, microsporogenesis, L.S. of ovule, types of endosperms and embryo of *Capsella*.
  - iii) Mounting of T.S. of anthers, Pollen grains and pollinia.
- 2) Anatomy of angiosperms : Preparation of double stained slides of root, stem and leaves of angiosperms mentioned in the syllabus.
- 3) Taxonomy : Description of ten plants belonging to different families in technical language and identification upto family level.
- 4) Long and short excursion is essential

**Note :** Field tour reports should be supported by exhaustive field notes and photographic representation of plant species studied

**Brassicaceae-** *Brassica*, **Malvaceae-** *Hibiscus*, *Sida*, *Malvastrum*, **Fabaceae-** *Crotalaria*, *Indigifera*, *Tephrosia*, **Caesalpinoideae-** *Caesalpineae*, *Cassia*, **Mimosoideae-** *Prosopis*, *Acacia*, **Apiaceae-** *Corindrum*,

**Apocynaceae-** *Vinca*, *Thevetia*, **Asclepiadaceae-** *Cryptostegia*, *Calatropis*, **Solanaceae-** *Datura*, *Solanum*, *Withania*, **Euphorbiaceae-** *Croton*, *Jatropha*, *Euphorbia*, , **Lamiaceae-** *Oscimum*, *Hyptis*, **Asteraceae-** *Tridax*, *Lagasca* **Verbanaceae** – *Lantana*, *Clerodendron*

**PRACTICALEXAMINATION****Time;-5 Hours****Max. Marks- 50**

- Q.1 Preparation of double stained permanent micropreparation of given angiospermic Material  
Identification with reasons  
10 Marks
- Q.2 Description of given angiospermic plant in technical language, identification up to family, floral formula, floral diagram  
( two Plants) 20 Marks
- Q.3 Spotting ( taxonomy-1, anatomy-2, Embryology-2)  
10 Marks
- Q.4 Class record, Excursion report with plant photographic submission 06 Marks
- Q.5 Submission of micropreparation and viva voce 04 Marks

**Books Recommended :**

- 1) **A.C.Dutta** : Text Book of Botany.
- 2) **Andrews A.N.** : Studies in Paleobotany.
- 3) **Arnold C.A.** : Introduction of Paleobotany.
- 4) **Bhojwani & Bhatnagar** : Embryology of Angiosperms.
- 5) **Chandurkar** : Plant Anatomy
- 6) **Cutter E.G.**, 1971 : Plant Anatomy Experiment and Interpretation Part-II, Organs, Edward Arnold, London.
- 7) **Davis P.H.**, and Heywood V.H., 1993 : Principles of Angiosperm Taxonomy: Oliver and Boyd, London.
- 8) **Eames E.J.** : Morphology of vascular Plants. edition, prentice Hall of India Pvt.Ltd. New Delhi.
- 9) **Esau K.** : 1977, Anatomy of seed plant, 2nd Edition, John Wiley and Sons, New York.
- 10) **Gangulee & Kar** : College Botany Vol.II
- 11) **Gangulee Das and Dutta** : College Botany, Vol.I
- 12) **Giford E.M. and Foster A.S.**, 1988 : Morphology and Evolution of Vascular Plants, W.H. Freeman & Company, New York.
- 13) **Hartmann H.T. and Kestler D.E.**, 1976 : Plant Propagation

- Principles and practices, 3rd
- 14) **Heyhood V.H. and Moore D.M.** (Eds) 1984 : Current concepts in plant Taxonomy. Academic Press, London.
  - 15) **Jeffrey C.**, 1982 : An introduction to Plant Taxonomy, Cambridge University Press, Cambridge, London.

16)

**4S- BOTANY**  
**CELLBIOLOGY, GENETICS AND BIOCHEMISTRY**

**Unit – I: Cell Biology**

- 1.1 Cell concept – Prokaryotic and Eukaryotic cell
- 1.2 Cell wall – Structure and Functions
- 1.3 Plasma membrane – Structure (models) and Functions
- 1.4 Nucleus – Ultra structure (nuclear membrane, nuclear pore complex and nucleolus) and functions
- 1.5 Chloroplast- Structure and Functions

**Unit–II: Cell Biology Structure and functions of-**

- 2.1 Endoplasmic Reticulum
- 2.2 Golgi complex
- 2.3 Vacuole
- 2.4 Ribosome
- 2.5 Perixysome
- 2.6 Mitochondria
- 2.7 Cell cycle: Mitosis and Meiosis

**Unit – III : Genetics**

- 3.1 Chromosome- Morphology, Types, Centromere & Telomere
- 3.2 Chromosomal aberrations –
  - 3.2.1 Structural aberrations: Deletion, Duplication, Inversion and Translocation
  - 3.2.2 Numerical aberrations: Euploidy and aneuploidy

**Unit–IV: Genetics**

- 4.1 Mendellism: Mendel’s law of Dominance, Segregations and Independent assortment, Incomplete dominance
- 4.2 Interaction of genes- Complimentary, Supplementary and Epistasis
- 4.3 Problems based on Mendelism and Interaction of Genes

**Unit – V Genetics**

- 5.1 Linkage – Concept, Types and theories
- 5.2 Crossing over: Concept, Types and theories
- 5.3 Gene mutations- Spontaneous and Induced
- 5.4 Extra-nuclear Genome- Mitchondrial DNA and Chloroplast DNA

**Unit – VI Biochemistry**

- 6.1 Nomenclature of Enzymes
- 6.2 Characteristics of Enzymes
- 6.3 Concept of holoenzymes, coenzymes and cofactors
- 6.4 Theories for Mechanism of action of Enzymes
- 6.5 Structure and functions Carbohydrates: Monosaccharides (Glucose), Disaccharides (Galactose) and Polysaccharides (Starch)

**PRACTICAL :****I Cell Biology (Any Two)**

1. Isolation of mitochondria from plants
2. Isolation of chloroplast
3. Squash preparation for the study of various stages of mitosis
4. Smear preparation for the study of various stages of meiosis.

**II Genetics**

1. To prove Mendel’s Monohybrid ratio.
2. To prove Mendel’s Dihybrid ratio.
3. Problems based on Interaction of genes

**III Biochemistry**

1. To study the enzyme activity of catalase.
2. To demonstrate test for glucose in grapes, & sucrose in cane sugar / beet root.
3. To demonstrate test for protein.
4. To demonstrate the lipid test in oily seeds.
5. To demonstrate the test for starch / cellulose.
6. To demonstrate the activity of enzyme amylase from germinating Wheat grains.

**B. Sc. II : Semester****– IV Practical  
Schedule****Time : 4 hours****Marks : 50**

**Q.1: Squash/Smear preparation for study 10**  
**Marks of Mitosis/Meiosis stages**

**Q.2: Genetics : To perform given experiment 10 Marks**

**Q.3: Genetics problem 05 Marks**

**Q.4: Biochemistry : To perform given test (Any Two) 10**  
**Marks**

**Q.5: Spotting 05 Marks**

**Q.6: Class record and viva-voce 10 Marks**

**Suggested Readings :**

- 1) **Ahluwalia K.B** 2005 (First Edition). Genetics. New Age International Private Ltd. Publishers, New Delhi.
- 2) **Buchanan B.B, Gruissem W. and Jones R.L**(2000). Biochemistry and Molecular Biology of Plants. American Society of Plant Physiologists Maryland, USA.
- 3) **Dalela & Verma** : Cytology.





- 4) **Darnell J.** 2000. Molecular Cell Biology (Fourth Edition). W.H.Freeman and Company, New USA.
- 5) **De-Robertis** EDP: Cell Biology.
- 6) **Devi P.** 2008-Principle and Methods of plant Molecular Biology, Biochemistry and Genetics Agrobios, Jodhpur, India.
- 7) **Gardner and Simmons Snustad** 2005 (Eighth Edition). Principles of Genetics, John Wiley and Sons, Singapore.
- 8) **Gerald Karp** 1999 Cell and Molecular Biology- Concept and Expts. John Wiley and Sons Inc., USA.
- 9) **Gupta P.K** (1995) Genetics and Cytogenetics. Rastogi Publications, Meerut.
- 10) **Leninger A.C** (1987). Principles of Biochemistry, CBS Publishers and Distributors (Indian Reprint)
- 11) **Lodish Etal** 2004 (Fifth Edition). Molecular Cell Biology, W H Freeman and company, New York.
- 12) **Moore T.C.** 1989. Biochemistry and Physiology of Plant Hormones Springer – Verlag, New York, USA.
- 13) **P.S.Verma & Agrawal V.K.** : T.B. of Cytology.
- 14) **Pawar C.B** 2003 (First Edition). Genetics Vol. I and II. Himalaya Publishing House, Mumbai.
- 15) **Powar C.B** 2005 (Third Edition). Cell Biology, Himalaya Publishing, Mumbai.
- 16) **Roy S.C and KK De** 2005 (Second Edition). Cell Biology, New central Book Agency Private Ltd., Kolkata.
- 17) **Sharma J.R** 1994 Principles and practices of Plant Breeding. Tata McGraw-Hill
- 18) **Shrivastav H.N.** - Cell Biology and Genetics - New Millennium Edition - Pradip's.
- 19) **Singh B.D** 2004. Genetics. Kalyani Publication, Ludhiana.
- 20) **Strickberger** 2005. (Third Edition). Genetics. Prentice Hall of India Pvt. Ltd., New Delhi.
- 21) **Veebala Rastogi** : Introduction to cytology.
- 22) **Verma P.S and Agarwal V.K** 2006 Cell Biology, Genetics, Molecular Biology, Evolution, Ecology. S.Chand and Company, New Delhi.
- 23) **Verma P.S. and Agarwal V.K.** (1991), Genetics. S Chand Comp.Ltd. Ramnagar, New Delhi.
- 24) **Verma S.K. and Mohit Verma** 2007. A.T.B of Plant Physiology,

Biochemistry and Biotechnology, S.Chand Publications.

- 25) **Verma S.K. and Verma Mohit** (2007). A.T.B of Plant Physiology, Biochemistry and Biotechnology, S.Chand Publications.  
 26) Modern Practical Botany, Volume-I, Dr.B.P.Pande, S.ChandPublication, New Delhi.  
 27) Modern Practical Botany, Volume-II, Dr.B.P.Pande, S.ChandPublication, New Delhi.  
 28) Modern Practical Botany, Volume-III, Dr.B.P.Pande, S.ChandPublication, New Delhi.

## 8. ENVIRONMENTAL SCIENCE 3S- ENVIRONMENTAL CHEMISTRY

### UNIT I: A. Fundamentals of Environmental Chemistry-

(15 Lectures) Laws of Thermodynamics, Chemical potential, chemical equilibrium, acid base reaction, solubility of gases in water, saturated and unsaturated hydrocarbons.

### B. Chemistry of biologically important elements- sources, role and effects

- (1) Energy exchange elements – Oxygen, Hydrogen
- (2) Activators and Inhibitors – Na, K, P, Ca
- (3) Trace elements – Ni, Mg, Mo, Cu, Fe.

### UNIT II : Chemistry of Biomolecules – (15 Lectures)

- (1) Carbohydrates – Biological importance, classification, structure of Glucose & Sucrose
- (2) Oils & Fats (Lipids)- Biological importance, Fatty acids, properties of fatty acids
- (3) Proteins - Biological importance, types of proteins, Amino acids, properties of amino acids.
- (4) Enzymes – definition, classification, properties, mechanism of action

### UNIT III: Toxicology-I (15 Lectures)

### UNIT IV: Toxicology-II (15 Lectures)

- (1) Routes of exposure, mode of actions and physiological effects of – (a) aldrin, (b) BHC (c) DDT, (d) Synthetics detergents
- (2) Xenobiotics – definition & mechanism of Detoxification
- (3) Bioremediation – definition, types.

### UNIT V: Chemistry of Water : (15 Lectures)

- (1) Chemical structure of water, Physico-chemical properties of water.
- (2) Chemical speciation of heavy metals – Hg – Distribution and Identification. Pb- Distribution and Identification.

### UNIT VI: Renewable Energy Resources : (15 Lectures)

- (1) Solar Energy – Concept, Solar Collectors, Photovoltaics, Solar Water Heater, Solar Cooling, Solar Ponds, Solar Chimney
- (2) Hydro power - Concept & Mechanism, Significance

- (3) Wind Energy - Concept & Mechanism, Significance
- (4) Bioenergy – Biomass, Bioalcohol, Biogas
- (5) OTEC – Principles, mechanism and significance.

### Practical On paper 3S:-

1. Estimation of trace elements by paper chromatography.
2. Estimation of molarity, normality of given sample.
3. To study the property of enzyme by demonstrating any test.
4. Estimation of carbohydrates.
5. Estimation of proteins.
6. Estimation of amino acids by Ninhydrin test.
7. Demonstration of immobilization of enzyme.
8. Study of Bioaccumulation of pesticides in aquatic animals.
9. Study of Bioaccumulation of detergents in aquatic animals.
10. Demonstration of non-conventional energy sources by working models.  
(i) Solar cells, (ii) Solar cooker, (iii) Wind mills, (iv) Solar Heaters.
11. To study the activity of amylase.

**Note : Visit to non conventional energy plant.**

**Distribution of Practical Marks. (Max. Marks. – 50) Time : 6 Hrs.**

Q.1	Any one major experiment based on environmental Chemistry	10
Q.2	Any one minor experiment based on environmental Toxicology	09
Q.3	Any one experiment based on environmental Biochemistry	12
Q.4	Experiment on Renewable Energy	05
Q.5.	Practical record.	05
Q.6	Viva – voce	04
Q.7	Visit Report	05

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**Total Marks :50**  
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**Books Recommended :**

1. Environmental Chemistry by- Ayodhya Singh
2. Environmental Chemistry by- Reddy
3. Environmental Chemistry by- S.S. Dara
4. Environmental Chemistry by- H. Kaur.
5. Chemistry for Environmental Engg. And Science by – C. N. Swayer , P.L. Macclly, G. F. Parkin.
6. Environmental Chemistry by- Chandrashekhar Reddy.
7. Environmental Science – by S.C. Santra.
8. Environmental Chemistry by B.K. Sharma.
9. Environmental Chemistry by – A. K. Dey.
10. Concept of Environmental Chemistry – G. S. Soudhi ; Narosapublishing , New Delhi.
11. Environmental Chemistry by – R. C. Rsswell ; Edward Armolic Press.
12. Elements of Environmental Chemistry by – H. V. Jadhav ; Himalaya pub. House.

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**4S- ENVIRONMENTAL  
POLLUTION**

**UNIT I : Air pollution** – Classification , sources of air pollution, major air pollutants, types of air pollution, effects of air pollutants on plants , effects of air pollutants on human, effects of air pollutants on materials, status of air pollution in India.

(15 Lectures)

**UNITII : Water pollution** – Definition, sources of water pollution, major pollutants, types of water pollution – fresh water ( rivers, streams, ponds, lakes and underground water resources), marine water ( coastal and estuarine), effects of water pollution on plants, animals and human beings, eutrophication, water pollution status in India, drinking water quality standards. (15 Lectures)

**UNITIII : Land pollution** – Definition , causes of soil pollution, major soil pollutants, effects of soil pollutants on plants and animals, nutrients in soil (NPK), domestic, municipal, industrial, and agricultural wastes and their relation with soil degradation , soil salination (15 Lectures)

**UNITIV : Noise pollution** – Definition, sources, effects of noise pollution, psychological and physiological effects of noise pollution, unit of noise, monitoring of noise pollution, noise pollution standards, techniques of measurements of noise pollution, Indian scenario of noise pollution. (15 Lectures)

**UNITV : Radiation pollution** – Definition, sources, major radioactive isotopes, nuclear fusion & fission reactions, units of radiations, application of radioactive isotopes in various field, effects of radioactive pollution, effects of nuclear weapons, radioactive fallout, health and environmental effects of radioactive fallout. (15 Lectures)

**UNITVI : Major Environmental Issues :**

(A) Global Warming - causes, consequences and control measures.

Ozone depletion - mechanism, consequences and control measures.

(B) Case Studies and Episodes

- Bhopal Gas Tragedy
- London Smog
- Fluoride Pollution in India
- Chernobyl Nuclear Disaster.

**Experiments based on papers 4S :**

- To estimate settleable particulate matter, RSPM in industrial area.
- Measurement of noise level by noise level meter.
- Determination of physical and chemical properties of Solid waste from industries.
- Determination of chlorides in waste water sample.
- Qualitative analysis of coal.
- Analysis of chloride.
- Analysis of Sulphate
- Estimation of oil and grease.
- Determination of Hardness.
- Determination of D.O.
- Determination of Phosphate
- Identification and enumeration of bacteria from air and water.
- Determination of calorific value of biodegradable waste.
- Determination of available phosphorous by spectro photometric method.
- Determination of available phosphorous by spectro photometric method.
- Determination of Nitrogen from soil by Kjeldhals Method.
- Estimation of CO<sub>2</sub> and CO from air.

**Note :** (i) Visit to different industries.  
(ii) Study of pollution status in local area.

**Distribution of Practical Marks : (Duration 5 Hours)**

Q. 1 - Experiment on water pollution	10
Q. 2 – Experiments on air pollution	10
Q. 3 – Experiment on Noise pollution.	05
Q. 4 – Experiment on Soil pollution.	10
Q. 5. – Practical record .	05
Q. 6- Tour Diary	05
Q. 7 – Viva- voce	05

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**Total Marks - 50**

**Books Recommended:**

- Ecology and Environment – P.D. Sharma
- Environmental Chemistry – V.P. Khudesia
- Environmental Chemistry – B.K. Sharma
- Environmental Chemistry – Kaur.

5. Industrial Chemistry – B. K. Sharma
6. Environmental Biology & Toxicology – P.D.Sharma
7. Environmental Toxicology – Mido,
8. Biochemistry- Leninger
9. Biochemistry- Satyanarayan
10. Environmental Engineering – S.S.Deswal
11. Water supply & Sanitary Engineering – Rangawala
12. Environmental pollution control Engineering – C.S.Rao, New age international publication
13. Solar Energy – Sukhatme.
14. Indian Industry – A Geographical perspective- K. Siddhartha, S.Mukherjee
15. Renewable Energy – 2<sup>nd</sup> edition- Godfrey Boyle (Oxford)
16. Shreve's Chemical Process industries- George T. Austin
17. Environmental Chemistry – Chhatwal Anand
18. Plant Physiology – Salisbury & Ross
19. Non Conventional energy Resources – G. D. Rai
20. Experimental Methods For General & Environmental Chemistry – Dr. Anita Rajor
21. Environmental Guidelines and Standards in India – P. K. Goel & K.P. Sharma, Techno Science Publications, Jaipur
22. Environmental Sciences, Daniel Botkin & Edward Keller, John Wiley & sons, New York
23. Environmental Sciences, Eldon D. Enger and Bradley F. Smith, WCB Publishers, Boston
24. Environmental Chemistry – A.K. De, Wiley Eastern Ltd. New Delhi
25. Physico Chemical Examination of Water, Sewage, and Industrial Effluent, Pragati prakashan, Meerut

9.

**SEEDTECHNOLOG  
Y(VOCATIONAL)  
Semester-III**

**3S : Seed Technology (Vocational)**

There shall be one theory paper of 80 marks and practical examination of 50 marks for each semester. Duration of theory papers shall be 3 hours and practical examination shall be of 4 hours duration.

The syllabus is based on 6 lectures and 6 practical periods per week.

**Hybrid Seed Production and Vegetable Seed Production**

**Unit-I : Introduction:**

Definition of heterosis and inbreeding depression and brief history of the development of these concepts.

Genetic, physiologic and Biochemical basis of heterosis. Exploitation of heterosis at commercial scale in Crops : Maize, Pearl millet, Sorghum, Sunflower, Pigeonpea and Cotton.

Fixation of heterosis – an approach.

Apomixes and its exploitation Hybrid Sorghum, Rice.

**Unit-II : Devices for Hybrid Seed Production :**

Genetic male sterility and hybrid seed production. Advantages and disadvantages of genetic male sterility.

Role of marker genes linked with genetic male sterility.

Procedure of hybrid seed production and maintenance of seed parent – Pigeonpea, cotton and sunflower.

Cytoplasmic and Genetic male sterility.

Introduction to the system. Synchronisation

**Unit-III : Hybrid Seed Production in Different Crops :**

Floral biology, seed production planning, Land and isolation requirement, wild pollinators, special agronomic practices, maintenance of varietal purity, field inspection, harvesting and threshing in the following crops-

(1) Maize, (2) Pearl millet, (3) Sorghum, (4) Sun flower, (5) Pigeonpea, (6) Cotton, (7) Hybrid Rice, (8) Hybrid Mustard, (9) Safflower.

Economics of hybrid seed production. Seed Planning.

**Unit-IV : History and Objectives of Vegetable****Breeding : History of vegetable crop improvement.**

Objectives of vegetative breeding.

Reproduction, pollination control mechanisms. A – Asexual reproduction.

- Vegetable propagation
- Apomixis
- Artificial seeds.

B - Sexual Reproduction

Male gamete formation, female gamete formation, fertilization.

C. Pollination Control Mechanisms :

- a) Flowering habit : Cucurbits, Asparagus, Spinach.
- b) Self incompatibility  
Gametophytic : in *Lycopersicon* sp and *Solanum* sp  
Sporophytic : Heteromorphic, Homomorphic
- c) Male Sterility  
Genetic male sterility in tomato, brinjal and muskmelon.

**Unit-V : Hybridization Techniques in Vegetables.**

Raising of crop, equipment required, emasculation and use of gametocide.

Pollination Methods in Vegetables –

Hand Pollination, rubbing and hooking – use of electric bees.

**Breeding Methods in Vegetables –**

1. Role of introduction and their utilization collection, maintenance, evaluation, storage.
2. Selection : (a) Pureline selection – Definition, method, achievements.  
(b) Single Plant Selection – Procedure, achievements.  
(c) Clonal Selection – Collection of clones, testing of clones, achievements.
3. Hybridization with reference to vegetable crops crosses between parents, single cross, double cross, back crosses, triple cross.  
Selection procedure in segregation progenies.  
Pedigree selection, Bulk method, pure line family method (PLF), single seed descent method.

**Unit-VI : Vegetables Seed Production :**

Introduction, importance, present status and future prospectus.

Classification of vegetable crops.

Root crops, Bulbous crops, leafy crops, flowering and fruit crops.

Methods of seed production of the under mentioned crops dealing with the aspect of –

Land requirement, seedling/root production, nursery management, planting cultural practices.

Breeding method used, plant protection, seed harvesting vegetable cum seed production, drying, grading, seed extraction method, wet-dry methods.

(a) Tropical Crops :-

Solanaceous : Brinjal, Potato, Chillies,

Tomato. Root Crops :- Radish, Carrot,

Colocacea.

Leaf Vegetable – Spinach (Palak), Trigonella (Methi) etc.

Bulb Crops – Onion etc.

(b) Temperate Vegetables : Cauliflower, cabbage.

**Practicals :****Hybrid Seed Production :**

- (1) Studies on inflorescence, floral arrangement floral morphology of some important crop plants cotton, pigeonpea, pearl millet, and maize.





- (2) Artificial emasculation and pollination studies in maize and cotton.
- (3) Studies on protogynous and protandrous nature of flowers in Pearl millet and Sunflower.
- (4) Studies on synchronisation problems in Pearl millet, maize and Sunflower.

### Vegetable Seed Production :

- (1) Raising of nursery and planting. Nursery requirement and management for different vegetables. Seedling age for transplanting, precautions, irrigation etc.
- (2) Floral Biology of Vegetables : Time for opening of flower, time for another maturity, Dehiscence of another hermaphrodite flower.
- (3) Study of Pollen grains of Vegetable : Collection of pollen, germination of pollen grains in water, sugar solution, pollen gelly.
- (4) Selfing and Crossing techniques in vegetables, cucurbits, solanaceous crops, onion, carrot.
- (5) Identification of vegetable seeds. Temperate vegetable, tropical vegetables, temperate-tropical vegetables.
- (6) Visit to vegetable breeding farm. Experiments on vegetable seed production. Collection of seeds, separation from pulp, drying etc.

### Practical Examination :

#### Distribution of Marks :

Marks : 50

- |   |    |
|---|----|
| 1. Describe in details the floral biology of the specimen 'A' classify upto family level. | 10 |
| 2. Raise a nursery bed for the given vegetable sample and describe.                       | 05 |
| 3. Identify and describe vegetable seeds, specimen and equipments A, B, C, D, E.          | 10 |
| 4. Study of pollen germination in Sugar Solution.   | 10 |
| 5. Submission of field report   | 05 |
| 6. Submission seed specimen and viva-voce.  | 05 |
| 7. Record book  | 05 |

### Books Recommended :-

1. Principles of Plant Breeding field crops : R.W.Allard
2. Plant Breeding : B.D. Singh
3. Practices in Plant Breeding : M.M.Bhandari

4. Cytogenetics and Plant Breeding : Chandrasekharan andParthasarathi
5. Male Sterility in higher Plants : M.L.H.Kaul.
6. Heterosis reappraisal theory and Practice : R.Frankel.
7. Sun flower Science and Technology : Jack F.Carter.
8. Seed Production manual : N.S.C. and Rock feller Publication.
9. Seed Technology : R.L.Agrawal
10. Vegetable Breeding : Bassett M.J. (1986)
11. Vegetable Breeding : Kaloo R.P. (1985)



**Practicals :- Seed Testing :**

1. Obtaining working sample, making separation, weighing, identification of purity components and reporting results.
2. Testing of germination substrata and determination of moisture holding capacity of sand.
3. Plotting the seeds for germination, seedling evaluation and reporting of the results.
4. Tetrazolium testing of agricultural, vegetable and forestry seeds.
5. Moisture testing by oven drying method.
6. Handling of moisture meter and determination of relative efficacy of moisture meter.

**Seed Quality Control :**

1. Filling of application form for seed certification.
2. Exercise in field area measurement and field map preparation.
3. Checking of seed source, isolation requirements.
4. Observation in field inspection.
5. Identification of objectionable weed plants and inseparable other crop plants.
6. Study of varietal purity through examination of seeds, seedling and plants, recording of data and filling result forms.

**Practical Examination :****Distribution of Marks : Marks : 50**

- |   |    |
|---|----|
| 1. Filling of seed certification form in detail.                | 10 |
| 2. Moisture testing by oven dry method / seed germination test. | 10 |
| 3. Identify and describe specimen A, B, C, D and E.             | 10 |
| 4. Determination of physical purity of seeds                    | 05 |
| 5. Preparation of seed samples by using seed triers.            | 05 |
| 6. Submission of field visit report and viva-voce.              | 05 |
| 7. Record book  | 05 |

**Books Recommended :-**

1. Seed Technology : R.L.Agrawal
2. Seed Biology : K.K.Kozlowski
3. Seed Production Manual : National Seed Corporation and Rockefeller publication.
4. Techniques in seed science and technology : P.K.Agrawal and

5. A Handbook of Seed Inspectors : Central Seed Committee Ministry of Agriculture.
6. Indian Minimum Seed Certification Standards : N.S.Tunwar,S.V.Singh.
7. Principles of Seed Certification and Testing : N.P.Nema.

### **BSc.II Semester III**

#### **10.ZOOLOGY**

There shall be the following paper and practical for B.Sc. Part-II Semester III examination. The syllabus is based on 6 theory periods and six practical periods per week (Total 75-80 theory sessions and 25 practical sessions during the complete semester). There shall be one compulsory theory paper of 3 hours duration, as stated below and a practical examination extending for four hours. Every examinee shall offer the following paper of 100 marks (80 for written examination and 20 marks for internal assessment) and a practical examination of 50 marks. Candidates are required to pass separately in theory and practical examination.

#### **Semester III**

1) Paper-I: Life and diversity of Chordata and concepts of evolution	<b>Marks Allotted</b>
Written examination.....	80
Internal assessment.....	20
2) Practical:	50
<b>Total: .....</b>	<b>150 Marks</b>

### **Paper -3 S-Zoology**

#### **LIFE AND DIVERSITY OF CHORDATA AND CONCEPT OF EVOLUTION**

**Unit I : Phylum Chordata;**

Origin of Chordata.

**Protochordates:**– Type study: Amphioxus: Habits and habitat , External Characters - Digestive system and feeding, Excretory organs, gonads- Affinities of Amphioxus.

**Affinities of Agnatha:****Series Pisces:**

Type study: *Scoliodon sarrokawah* (Dogfish) – Habits and habitat, External Characters, Digestive system: alimentary canal and digestive glands, Respiratory system: respiratory organ and mechanism of respiration, circulatory System: Structure and working of Heart, major arteries and veins, Lateral line receptors, Migration in fishes-Types, causes and significance.

**Unit II : Class Amphibia:**

Type Study – *Rana tigerina*, Habits and habitat, external, characters. Respiratory organs- Circulatory system; Structure of Heart, major arteries and veins, urinogenital system.. Parental care in amphibia.

**Class Reptilia:**

Type study- *Calotes versicolor*- Habits and habitat, External characters, circulatory system- Structure of Heart, major arteries and veins. Urinogenital system, snake venom and anti-venom,

**Unit III : Class Aves:**

**Type study:** Pigeon-*Columba livia* Habits and habitat, External characters, Respiratory system, urinogenital system. Flight adaptations, Migration in birds.

**Class Mammalia:**

Primitive mammals: salient features of Prototheria and Metatheria, Morphology of mammalian endocrine glands. Aquatic mammals.

**Unit IV : Evolution: Meaning and scope,**

**Indirect Evidences of evolution:** Evidences of organic evolution- morphological and anatomical, physiological and biochemical, embryological.

**Unit. V : Evolutionary Processes: Natural selection: Darwinism. Lamarckism.**

Speciation - definition of species – mode of speciation – Allopatric and Sympatric speciation.

Modern concept of organic evolution- Neo Darwinism. Population Genetic : Hardy – Weinberg equilibrium, Gene pool, Gene frequency, Genetic drift, Convergent, Divergent and Parallel evolution, Coevolution

**Unit VI : Adaptive radiations in mammals.**

Evolution of Man- brief accounts of Parapithecus, Dryopithecus, Ramapithecus, Australopithecus, Homo creatus Neanderthal man, Cro-Magnon man and modern man.

Evolution of heart, aortic arches, and urinogenital systems of vertebrates

Animal Adaptation: Desert aquatic and terrestrial.

**REFERENCE BOOKS:**

1. Integrated Principles of Zoology, 7th Edition, Hickman, C.P. Jr., F.M. Hickman and L.S. Roberts, 1984. Times Mirror/Mosby College Publication. St. Louis. 1065 pp.
2. A life of Vertebrate – K.Z. Young, ELBS Oxford University Press.
3. A Text Book of Chordates – H.S. Bharmah and Kavita Juneja.
4. Modern Text Book of Zoology Vertebrate – R.L. Kotpal, Rastogi Publication Meerut.
5. A Text Book of Chordates – A. Thangamani, S. Prasannakumar, L.M. Narayanan and
6. Arunmugam Saras Publication, Nagercoil.
7. A Text Book of Chordate Zoology – R.C. Dalela – Jaiprakashnath Publication Meerut.
8. Chordate Zoology – E.L. Jordan and P.S. Verma, S. Chand and Company New Delhi.

9. A Text book of Practical Zoology Vertebrate – S.S.Lal, Rastogi. Publication, Meeru
10. Manual of Zoology Vol. II (Chordata), S. Viswanathan (Printers and Publishers) Pvt Ltd., Madras, 891p.

11. Chordate Zoology and Elements of Animal Physiology, Jordan, E.K. and P.S. Verma, 1995. 10th edition, S. Chand & Co Ltd., Ram Nagar, New Delhi, 1151 pp.
12. Zoology of Chordates, Nigam, H.C., 1983. Vishal Publications, Jalandhar - 144 008, 942.
13. The Phylum Chordata, Newman, H.H., 1981. Satish Book Enterprise, Agra - 282 003, 477 pp.
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15. Chordate Structure and Function, Waterman, Allyn J. et al., 1971. Mac Millan & Co., New York, 587 pp.
16. Simpson, G.C. 1967 - The meaning of Evolution. Revised Edition – New Haven, Yale University Press.
17. Colbert, E.H. 1969 - Evolution of Vertebrates, Wiley, New York.
18. Mayr, Ernst, 1973 - Animal Species and Evolution. The Belknap Press of Harvard University, Cambridge.
19. Dobzansky, T. 1976 - Genetics and the Origin of Species. Oxford and TBH Publishing Co. New Delhi.
20. Savage, J.M. 1976 - Evolution. Amerind Publishing Co. Pvt. Ltd. New Delhi.
21. Elic. Minkoff, 1983 - Evolutionary Biology, Addison Wesley.
22. Life, Origin, Evolution and Adaption (2002) - Sanjib Chattopadhyay. Books and Allied (p) Ltd.
23. P.S. Verma & V.K. Agrawal. (2008) Cell Biology, Genetics, Molecular Biology, Evolution & Ecology – S. Chand Publications.
24. Dhabade. D.S. I. A. Raja. R.A. > Gulhane. A.P. Charjan. A.K. Patki., And P.S. Patil., A Text Book of Evolution: Sanket Publicatin. Washim
25. Zoology for Degree Students, Prof. Dr. V.K. Agrawal.

**Practical:-**

Two practical per week of 3 periods duration. Examination shall be of 5Hrs duration and of 50 marks.

**A) Taxonomy of Chordata:**

1. **General characters and classification of Phylum Chordata:**
2. **General characters and Classification up to orders of the following chordates or as per the availability in the laboratory from the major orders, (Specimens or Models):**

**Protochordata:** Herdmania, Doliolum Salpa, Amphioxus.

**Agnatha:** Petromyzon, Myxine.

**Pisces:** Scoliodon, Torpedo, Acipenser, Exocoetus. Hippocampus

**Amphibia:** Ichthyophis, Salamander, Bufo, Hyla.

**Reptilia:** Varanus, Phrynosoma, Chameleon, Cobra, krait, Russell's viper, Typhlops, Hydrophis

**Aves:** Duck, Woodpecker, Kingfisher, Parrot.

**Mammalia:** Mongoose, Squirrel. Manis. Bat., monkey,

**B) Dissections:**

1. Dissection - afferent and efferent branchial vessels, cranial nerves, internal ear of scoliodon.
2. Dissection - Digestive system, Arterial system, venous system, reproductive system of rat.
3. Permanent micro-preparations .a. Fish scales. b. Ampullae of Lorenzini. c. Eyeball muscles.
4. Observations of air bladder in air breathing fishes.

**C) Osteology.** Rabbit, Varanus (excluding loose bones of skull).**D) Evolution:**

1. Study of fossils, including living fossils.
2. Study of Evidences of evolution.
  - i) Analogous and Homologous organs.
  - ii) Connecting links (Peripatus, Archaeopteryx, Limulus)
  - iii) Embryological evidences
3. Application of Hardyweinberg's law
4. Study of Mesozoic Reptiles (By Models/Charts).
5. Mimicry, coloration in animals.
6. Beak and Leg modifications with reference to: Parrot, Woodpecker, Kingfisher, Heron, Duck, Sparrow/Pigeon Hawk/Kite, Owl.

**E) Histological Slides :-** Amphioxus, Frog, Rat**Slides :**

**Amphioxus:** T.S, Oral hood, Pharynx, Tail

**Frog :-** T.S. lung, Stomach, Kidney, T.S. Intestine,

**Rat :-** T.S. Liver, Pancrease, Ovary, Testies, Pituitary, Thyroid, Adrenal

**DISTRIBUTION OF  
MARKS FOR  
PRACTICAL EXAMINATION.**

1.	Dissection: -	10
2.	Permanent stained micro preparation.	05
3.	Spotting. (Specimens, Slides, bones, fossil)	10
4.	Practical on evolution -	10
5.	Class record	05
6.	Viva - Voce	05
7.	Submission of study tour report.	05

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**Total Marks: 50**  
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**BSc.II  
Semester IV  
ZOOLOGY**

There shall be the following paper and practical for B.Sc. Part-II Semester IV examination. The syllabus is based on 6 theory periods and six practical periods per week (Total 75-80 theory sessions and 25 practical sessions) during the complete semester. There shall be one compulsory theory paper of 3 hours duration the semester, as stated below and a practical examination extending for four hours. Every examinee shall offer the following paper of 100 marks (80 for written examination and 20 marks for internal assessment) and a



practical examination of 50 marks. Candidates are required to pass separately in theory and practical examination.

**Semester IV**

1) Paper-I:	Marks Allotted
Advanced Genetics and Animal Ecology.	
Written examination.....	
	8
0	
Internal assessment .....	20
2) Practical:	50
<b>Total: .....</b>	<b>150 Marks</b>

**ZOOLOGY Paper 4S****ADVANCED GENETICS AND ANIMAL ECOLOGY**

**UNIT I :** Concept of genes.

Mendel's laws of hereditary – Monohybrid – Laws of dominance, law of segregation. Dihybrid cross – Law of

independent assortment. Interactions of genes: , Supplementary factor, complementary factor, duplicates factor, inhibitory factors, and lethal factors – dominant and recessive.

**UNIT II :** **Linkage** - Types of linkage, linkage group, arrangement of linked genes, and significance of linkage.

Crossing over – Mitotic and meiotic crossing over, Mechanism of crossing over, theories of crossing over – Darlington's theory, breakage and exchange theory, and copy choice theory. Types of crossing over – Single, double and multiple crossing overs. Factors affecting crossing over, Significance of crossing over.

Multiple alleles. Multiple alleles in relation to eye color in *Drosophila*. Blood group in man, Erythroblastosis foetalis

**UNIT III :** **Sex determination:** Autosomes and sex chromosomes, Sex determination in animals,

Chromosomal Theory. Genic Balance Theory. Environmentally and hormonally controlled sex determination, Gynandromorphs.

Genetic disorders; Sickle cell anemia, , Huntington's chorea. Diabetes mellitus. Non-disjunction: Turner's syndrome, Klinefelter's syndrome, Down's syndrome. Edward's

Syndrome, Biochemical genetics; Cystic fibrosis, Phenylketonuria, Albinism, Alkaptonuria, Goiters, cretinism. Sex linked genetic disorders and their inheritance in man; Hemophilia and color blindness.

**UNITIV : Genetic Screening and parental diagnosis:** - Parental, Carrier, Predictive, CVS (Chorionic Villous Sampling), Amniocentesis, Gene probe and DNA analysis. Genes in Human Heredity: - Inheritance of eye color. Skin color. Recessive genes and consanguineous marriages Genetic counseling: - Risk of marriages in affected family. Birth control measures (male and female).

Kinds of twins: - Identical, Fraternal, Siamese twins.  
.Significance of twins study

**UNITV : Ecology:** concept and scope:

#### **Abiotic factors:**

**Water:** Properties, water problem in terrestrial and aquatic habitat. **Temperature:** Temperature range, Temperature tolerance, Effects of temperature on animals. Homeotherms, poikilotherms. Dormancy, hibernation, aestivation & diapause. **Light:** Spectral

distribution, Biological effects of light on aquatic and terrestrial animals: Reproduction, Metamorphosis, pigmentation, vision, photokinesis, phototropism, photoperiodism, migration.

#### **Biotic factors:**

Intra specific and interspecific associations, Predation, parasitism, Antagonism, commensalisms, mutualism, competition, (Gauze's Principle).

**UNITVI : Ecosystem:** *Relationship between habitat and ecological niche* - Autotrophic and heterotrophic producer, consumer

- trophic level - energy flow in an ecosystem - food chain - food web - pyramids - Ecotypes. Homeostasis of ecosystem.

Terrestrial ecosystem: Classification and Biomes, Aquatic ecosystem: Fresh water ecosystem-Lentic and lotic ecosystem,



Marine ecosystem: Characteristics, salinity, temperature - pressure, zonation and stratification  
 Estuarine ecology: Characteristics types, fauna and their adaptations.

### REFERENCEBOOKS:

1. Cell Biology, Genetics, Molecular Biology, Evolution & Ecology – P.S.Verma & V.K.Agrawal.
2. Principles of Genetics – S.K.Jain
3. Genetics – P.K.Gupta
4. Applied Genetics – C.Pmmanuol.
5. Genetics: M.W.Strickberger, New York.
6. Principles of Genetics: Sinnott, Dunn and Dobzansky.
7. Principles of Genetics: Edidon Gardner.
8. Genetics. Verma, P.S. and V.K. Agarwal.. S.Chand & co. New Delhi
9. Gene VI.Lewin, B. 1998. Wiley Eastern Ltd., New Delhi.
10. Human Genetics. Rothwell, N.V.1979. Prentice Hall of India, New Delhi

### Practical:-

Two practical per week of 3 periods duration. Examination shall be of 5Hrs. duration and of 50 marks.

#### A) Genetic experiments:

1. Recording of Mendelian traits in man.
2. Detection of monohybrid and dihybrid cross with the help of plastic beads.
3. Culturing *Drosophila* using standard methods .*Drosophila* – male and female identification, Mutant forms (from pictures)
4. Demonstration of bar bodies.
5. Preparation of human Karyotypes from Xerox pictures.
6. Photo slides for, Turner’s syndrome, Klinefelter’s syndrome, Down’s syndrome
7. Detection of syndrome from chromosome spread picture.
8. Study of following human genetic traits and application of Hardy-Weinberg Principle to them – Baldness, length of index and ring Finger, attached and free earlobes, rolling of tongue, PTC taste. Other notable traits.

### B) Ecology

1. Use of pH meter for estimation of pH in soil samples, b. Use of pH meter for estimation of pH in water samples
2. Estimation of Dissolved oxygen, salinity, pH, free CO<sub>2</sub>, carbonates and bicarbonates, calcium in water samples.
3. Adaptations of aquatic and terrestrial animals based on a study of museum specimens. Such as rocky, sandy, muddy shore animals, flying and burrowing animals.
4. Study of natural ecosystem and field report of the visit.
5. Field collection methods;
6. Identification of common animals - Soil invertebrate diversity, diversity of birds and mammals in parks/ botanical gardens, threats to local biodiversity.
7. Construction of a food web diagram based on a field visit.
8. Mounting of plankton.
9. Qualitative analysis of fresh water plankton

### C) General:-

1. Visit to a National park or sanctuary, and submission of report.

### DISTRIBUTION OF MARKS FOR PRACTICAL EXAMINATION.

1. Ecological: Estimations -/Analysis	10
2. Spotting. (2Spot from Sec.A & 3 Spot from Section B of 2 Marks each)	10
3. Micro preparation.	05
4. Genetic experiment -	10
5. Class record	05
6. Viva- Voce	05
7. Submission of study tour report.	05

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**Total Marks : 50**  
**BSc. Part II. Semester III.**

**11. INDUSTRIAL FISH AND FISHERIES (VOCATIONAL)**

There shall be a following paper and practical for B.Sc. Part-II Semester III examination. The syllabus is based on 6 theory periods and six practical periods per week (Total 75-80 theory periods and 25 practical during the complete semester). There shall be one compulsory paper of 3 hours duration, in theory as stated below and practical examination extending for six hours. Every examinee shall offer the following paper of 100 marks, (Out of which 80 marks will be for written examination and 20 marks for internal assessments) and practical examination of 50 marks. Candidates are required to pass separately in theory and practical examination.

1) Paper-I: FISH BIOLOGY	Marks
Theory (Written) .....	80
Internal assessments .....	20
2) Practical: .....	50
<hr/> <b>Total: 150 Marks</b> <hr/>	

**Paper 3S- INDUSTRIAL FISH AND  
FISHERIES FISH BIOLOGY  
(SEED PRODUCTION AND FISH PATHOLOGY.)**

**Unit-I :** Principles of fish breeding, Different stages of seed- Eggs, Spawn, fry and fingerlings Riverine collection. Transportation of fish seed and brood fish. Life cycle of penaeid and non-penaeid prawn.

**Unit-II :** Pituitary gland and its role in fish breeding. Methods of fish and prawn breeding; induced breeding, bundh breeding, ovulating agents used (fish pituitary glands, HCG, pheromones and new generation drugs). Factors influencing fish breeding.

**Unit-III :** Hatching techniques. Different types of hatcheries; hatching hapa, vertical jar hatchery, chinese hatchery, D- variety hatcheries, prawn hatcheries and their management.

**Unit-IV :** Different types of farms and ponds. Topography, design, layout and construction of a fish seed farm. Nursery, rearing ponds, their preparation and management; harvesting of fry and fingerlings.

**Unit-V :** Principles of disease diagnosis and fish health management. Pathogens, symptoms and treatment of infectious diseases; bacterial, fungal, viral, protozoan, helminthic, crustacean. Abolishing, pathogens and controlling its spreading.

**Unit-VI :** Non-infectious and nutritional diseases and their treatment. Fish immunization and vaccines. Important disease problems of prawns, cultured shellfishes and their control. Environment in relation to diseases.

**Practicals.**

1. Methods of isolation and culture of bacteria and fungi.
2. Identification methods for common bacterial and fungal pathogens of fish.
3. Examination and identification of common fish parasites.
4. Fish disease diagnosis.
5. Study of normal histology of gills, skin, kidney, spleen and liver and related histopathology.
6. Assessment of water quality.
7. Experimental treatments, case studies and field visits.
8. Characteristics of gravid fishes and selection for induced breeding.
9. Anatomy (Dissection) and Histology of fish endocrine glands.
10. Collection and preservation of pituitary glands;
11. Preparation of extract; hypophysation.
12. Study of different hatchery system.
13. Water quality monitoring in hatcheries.
14. Fish seed and brood fish transportation.

**Practical Examination**

Practical Examination will be of six hours duration and for total 50 marks.

**Distribution of marks for the practical examination.**

Q.1	Identification of spots I to X	15 Marks
Q.2	Water analysis experiment.	10Marks
Q.3	Dissection of pituitary gland OR Preparation and administration of pituitary extract	10 Marks
Q.4	Identification of fish pathogens.	05 Marks
Q.5	Record and field diary	05 Marks
Q.6	Viva voce	05 Marks

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**Total : 50**  
**Marks**  
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**REFERENCES**

1. Principles and practices of pond aquaculture. A state of the art review. Lennan, J.F., R.O., Smitherman and G. Tehobanglous (Eds.), 1983, Oregon State University, U.S.A.
2. Giant Prawn farming, New, M.B.(Ed.) Elsevier Scientific Publishing Co., Amsterdam.
3. Freshwater prawn farming : A manual for the culture of *M. Rosenbergii* new, M.B. and S. Sngholka, 1982, FAO, Fish.Tech.Pap225, FAO, Rome.
4. The Biology and culture of Tilapias, Pullin, R.S.V. and R.H. Lowe-Mcconel (Eds.), 1982. ICLARM Conference Proceedings, 7, ICLARM, Manila, Philippines.
5. Standard methods for the examination of water and waste water. APHA, 1981, American Public Health Association, Washington, D.C.
6. The theory and practice of induced breeding in fish. Harvey, B.J. and W.S. Hoar, 1979, IDRC-TS 21e. IDRC, Ottawa, Canada.
7. Bivalve Culture in Asia and the Pacific. Davy, F.B. and M. Graham (Eds.) 1982, IDRC-200e. IDRC-Asia Regional Office, Singapore.
8. Fish and Fisheries of India, Jhingram V.G., 1982. Hindustan Publishing Corporation, New Delhi.
9. Coastal aquaculture in the Indo-Pacific region, 1972. Pillay, T.V.R.(Ed.). Fishing News.
10. Handbook of Tropical aquaculture. Bard, J. 1976. Centre Technique Forestier Tropical. Nogent-Sur-Marne, France.
11. Farming Marine fishes and shrimps; a multidisciplinary treatise. Korringa, P. 1976. Elsevier Scientific Publishing company, Amsterdam.

12. Prawn farming today: Opportunities, techniques and development. Wickins, J.F. 1986. Outlook on Agriculture, 15(2):52-60.
13. Fish Pathology. Robers, R.J.(Edd.) 1978. Bailliere Tindall, London.
14. Parasites and diseases of fish cultured in the tropics. Kabata, Z. 1985. Taylor and Frances, London.
15. Integrated agriculture farming systems. Pullin, R.S.V. and Z.H. Shehades (Eds.), 1980. ICLARM Coonference Proceedings, 4, ICLAR. Manila, Philippines.
16. A hatchery manual for the common Chinese and Indian major carps. Jhingran, V.G. an R.S.G. Pullin, 1985, ICLARM. Studies and Reviews 11. ICLARM, Manila, Philippines.
17. Principal diseases of marine fish and shellfish. II Edition, 1990, Vol.1. Diseases of marine fish, Vol.2. Diseases of marine shellfish. Sindermann, C.J. Academic Press, London.
18. Wyonarovich, E. and L. Horvath, 1980. The artificial propagation of warm water fin fish - A manual for extension. FAO Fisheries Technical paper- 201.
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20. Planning of aquaculture development - an introductory guide, 1977, FAO, Fishing News.
21. Handbook of Mariculture: Crustacean aquaculture, 1986. McVey James, P.(Ed.), CRC, Florida.
22. Selection, Hybridization and genetic engineering in aquaculture, 1987. Tiews, K.(Ed.), Heenemann, Berlin.
23. Aquaculture in Asia, 1990. AFSIB, Mangalore.
24. Fish culture, 1962. Hickling, C.F. Faber & Faber.
25. Practical approach to Fresh Water Culture, 1985, Malu R.A., Bharati Publication, Akola.
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28. Backyard fish farming, 1990. Bryant, P. and others. Prism Press.
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30. Perspective in aquaculture development Southeast Asian and Japan, 1988. South Asian Fisheries Development Centre, Aquaculture Deptt. Soafdec.

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35. Project report on breeding of carps with ovaprim in India. Nandeeshha,M.C.& Others. AFSIB, Mangalore.
36. Salmon and trout farming, 1988. Laired. L.M. and T. Needham (Eds.), John Wiley & Sons.
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39. Aquaculture of Fresh water Prawns/Macrobrachium species, Goodwin, H.J. and I.A.Hanson. United States Department of Commerce, NTIS.
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41. Problems in prawn culture, 1978. Shigeno, K.Amerind Publications.
42. Pond culture of the Malaysian Prawn, Macrobranchaya Rosenbergii. Theodore, I.J.S. and Others, USDC, NTIS.

**BSc. Part II. Semester IV**  
**INDUSTRIALFISHAND**  
**FISHERIES(VOCATIONAL)**

There shall be a following paper and practical for B.Sc.Part-II Semester Four examination. The syllabus is based on 6 theory periods and six practical periods per week (Total 75-80 theory periods and 25 practical during the complete Semester). There shall be one compulsory paper of 3 hours duration, in theory as stated below and practical examination extending for six hours. Every examinee shall offer the following paper of 100 marks, (Out of which 80 marks will be for written examination and 20 marks for internal assessments) and practical examination of 50 marks. Candidates are required to pass separately in theory and practical examination.

**Marks**

Paper-I:	<b>AQUACULTURE</b>	
	1) Theory(Written) .....	80
	Internal assessments .....	20
	2) Practical:	50

**Total : 150 Marks**

**PAPER-4S INDUSTRIALFISHANDFISHERIES**  
**(VOCATIONAL) (AQUACULTURE)**

**Unit I** : Definition, history, scope and importance of aquaculture, Status of aquaculture in different countries, Extensive, semi- intensive and intensive culture.

Different systems of aquaculture-monoculture, polyculture, integrated farming, pond culture, cage culture, pen culture, raft culture, raceway culture, culture in recirculatory watersystem, warm water and cold water aquaculture, sewage-fed fish culture.

**Unit-II** : Concept and principle of aquafarm management, Preparation of stocking pond; Prestocking management, predators and their control. Aquatic weeds, algal blooms and their control. Liming and fertilization.

**Unit-III** : Selection of species for culture, seed procurement and stocking. Post-stocking management, supplementary feeds and feeding. Nutritional requirement and formulation of artificial diets. Storage of feeds. Feeding techniques. Natural food an its importance in aquaculture.

**Unit-IV** : Characteristics of brackish water. Brackish water resources of India. Existing culture practices in bheris, pokkali paddy fields and kharlands. Breeding and culture of brackish water fins fishes milkfish, gray mullets, pearls- spot ,cock-up, etc.



**Unit-V :** Mari culture-culture of edible oysters, mussels, clams, cockles, sea urchins, sea cucumber, etc. Pearl oyster culture. Culture of sea weeds. Important species of cultivable penaeid and non-penaeid.

**Unit-VI :** prawns. Tiger prawn culture, fresh water prawn culture. Polyculture of prawns with finfish. Air-breathing fish culture.

### PRACTICALS

- 1) Collection and analysis of soil and water, samples for physicochemical characteristics;
- 2) Study of food cycle in a pond,
- 3) Collection and identification of fish food organisms.
- 4) Visits to farms to study different systems of aquaculture.
- 5) Maintenance of brood fish.
- 6) Preparation of Nursery, rearing and stocking ponds,
- 7) Identification of aquatic insects, weeds and predators and their control.
- 8) Water quality analysis,
- 9) Feed preparation and feeding. Identifications of seed of cultivable fish species.
- 10) Seed stocking.
- 11) Examination of plankton from culture ponds.
- 12) Fish growth, survival and production analysis.
- 13) Identification of important species of brackish water fishes and shellfishes and their seed.
- 14) Collection and rearing of brackish water shrimps and fishes.
- 15) Identification of cultivable species of prawns oysters, mussels, clams, sea weeds, etc.
- 16) Visits to prawn hatcheries and marine culture centers.

### Practical Examination

Practical Examination will be of six hours duration and for total 50 marks.

### Distribution of marks for the practical examination.

Q.1	Identification of spots I to X	- 15Marks
Q.2	Soil analysis experiment.	- 10 Marks
Q.3	Identification. of plankton from culture ponds	- 10 Marks
Q.4	Submission of collection, food preparation, permanent slides	- 05 Marks
Q.5	Record and field diary	- 05 Marks
Q.6	Viva voce	- 05 Marks

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**Total : 50 Marks**

### EQUIPMENTSANDFACILITIES

1.	Earthen ponds (0.05-0.1ha)	- 2
2.	Cement cisterns (25 m <sup>2</sup> )	- 4
3.	Portable Chinese hatchery	- 1
4.	Breeding haps	- 4
5.	Hatching haps	- 6
6.	Drag net	- 1
7.	Hand nets	- 3
8.	Compound microscopes	- 4
9.	Ocular micrometers	- 4
10.	Centrifuge	- 2
11.	Homogenizers	- 6
12.	Syringes	- 12
13.	Needles	- 24
14.	Catheter	- 3
15.	Droppers	- 12
16.	Beakers (assorted)	- 12
17.	Enamel trays	- 6
18.	Plastic drays	- 6
19.	Refrigerator	- 1
20.	Hot air oven	- 1
21.	Hand mince	- 1
22.	Water analysis kit	- 1
23.	pH meter	- 1
24.	O <sub>2</sub> analyzer	- 1
25.	Spectrophotometer	- 1
26.	Colorimeter	- 1
27.	Plankton nets	- 3
28.	Plastic pools	- 6
29.	Sieves for soil texture analyses	- 1 set
30.	Sedgwick Rafter Cells	- 2
31.	Glass troughs	- 12
32.	Pressure cooker	- 1
33.	Millipore filters	- 6
34.	Autoclave	- 1
35.	Phase contrast microscope	- 1
36.	Microtome	- 1

Facility for tissues block making, staining and mounting, glassware for Analysis of carbon dioxide, alkalinity and ammonia, petri dishes, test tubes, etc.

## REFERENCES

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8. Fish and Fisheries of India, Jhingram V.G., 1982. Hindustan Publishing Corporation, New Delhi.
9. Coastal Aquaculture in the Indo-Pacific region, 1972. Pillay, T.V.R. (Ed.). Fishing News.
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## 12.

### BIOLOGICAL TECHNIQUES AND SPECIMEN PREPARATION (VOCATIONAL)

There shall be a following paper and practical for B.Sc. Part-II Semester III examination. The syllabus is based on 6 theory periods and six practical periods per week (Total 75-80 theory periods and 25 practical during the complete semester). There shall be one compulsory paper of 3 hours duration, in theory as stated below and practical examination extending for 6 hours. Every examinee shall offer the following paper of 100 marks, (Out of which 80 marks will be for written examination and 20 marks for internal assessments) and practical examination of 50 marks. Candidates are required to pass separately in theory and practical examination.

1) Paper-I: LABORATORY TECHNIQUES	Marks
Theory (Written) .....	80
Internal-assessments .....	20
2) Practical: .....	50
<b>Total:</b>	<b>150 Marks</b>

### Paper 3 S. BTSP. LABORATORY TECHNIQUES

**UNIT-I :** Distilled Water - Types of distilled water and their uses, distillation stills, construction and functioning of metal stills, solar stills and glass stills (including triple distilled water stills) proper collection and storage. Amount and types of impurities. What are ion-exchanges and how they work; regeneration of ion exchangers, uses of ion-free water.

**Unit-II :** Cleaning agents (composition) for various types of dirty glassware: pipette cleaners (construction and proper use); removal of hard water marks from glassware; storing of glassware. What is standard joint equipment; proper usage and cleaning; Utility of standard joint equipment.

**Unit-III :** Methods of sterilization of glassware and storage of sterilized glassware. Steriware disposable plastic petridishes and injection syringes and their uses. Glass blowing-equipment for glass blowing-safety in handling; cutting and glass blowing.

**Unit-IV :** Solutions- Definition of solute, solvent, molar, molal, normal, weight percent, ppm/ppb; calculation of molecular weight, interconversion between percent molar and normal; methods of dilution and sources of error. pH-What is pH? Methods of determining pH; pH paper; pH indicators and their range and uses in the Biology laboratory. Buffer Solutions-theory of buffering; some standard buffers Acetate, Phosphate,

TRIS, TRIS glycine calculation of pH of buffer-solutions.

**Unit-V :** Balances:- Chemical, Physical, analytical, beam, single pan, double pan, top pan, torsion, electrical, spring, parts and working, degree of accuracy and sources of errors. Temperature sensing control devices: thermometer, thermocouples, thermostat-construction,

**PRACTICAL COURSE**

1. Preparation of various grades of distilled water.
2. Cleaning of glass wares, microscope slides etc.
3. Use and maintenance of standard joint equipment
4. Sterilization of glassware
5. Glass blowing, cutting glass plates, tubes and rods, bending tubes, drawing Capillary, sealing vials.
6. Use and care of balances.
7. Preparations of solutions, buffers as per theory.
8. Use and care of pH meter.
9. Acid base titration.
10. Preparation and maintenance of aquarium, terrarium.
11. Maintenance of living organisms, plants & animals.
12. Maintenances of museum and herbarium.
13. Water analysis DO, CO<sub>2</sub>, BOD, COD, pH, Salinity, Chlorides, nitrates, phosphates, fluorine, silicates, Alkalinity, hardness.
14. Analysis of heavy metals in soil and water -Hg, Cd, Pb.
15. Estimation of plant and animal population in aquatic and terrestrial Ecosystem.
16. Use and maintenance of colorimeter, spectrophotometer and flame photometer

**DISTRIBUTION OF MARKS  
FOR PRACTICAL EXAMINATION**

Q1.	Estimation of heavy metals in Soil/water	12
Q2.	Water analysis, any one DO, CO <sub>2</sub> , alkalinity, Hardness, pH, salinity, Chlorides, Phosphates, nitrates.	10
Q3.	Identification of Phytoplankton/Zooplanktons OR Acid-base titration OR Glass blowing, cutting glass plates	10
Q4.	Minor experiment on Colorimeter/photometer	08
Q5.	Practical record	05
Q6.	Viva-Voce	05
	<b>Total :</b>	<b>50</b>

**BOOKS RECOMMENDED**

1. Limnology: Welch, McGraw Hill Book Co. N.Y. 2. Principles of Biochemistry: Lehninger A.L., Warth Publisher N.Y.
2. Methods for Physical and Chemical analysis of Fresh waters: Golterman, Clymo and Ohnstand, IBP hand book No. 8 Blackwell Scientific Publications.
3. Fresh water animals of India (An ecological approach) : G.T.Tonapi, Oxford & IBH Publishing Co. New Delhi.
4. Text Book of Physiology and General Biology: Dr. R.R.Dhande and G.N.Vankhede, Bajaj Publications, Amravati.
5. Work book on Limnology: A.D.Adoni, Publication MAB Committee, Department of Environment, Govt. of India.
6. Fundamentals of Aquatic Ecosystem : Barnes, A.K. & K.H.Mann., Balckwell scientific Publications, Oxford.
7. Quantitative inorganic analysis: A.I.Vogel, ELBS publisher.
8. Essentials of plant techniques: Dwivedi J.N., Scientific Publishers, Jodhpur.
9. Introduction to plant tissue culture : Dey Dalyankumar, Central Book Agency, Calcutta.
10. Plant Cell and tissue culture : Narayan Swami S. Tata McGraw Hill.
11. An introduction to plant tissue culture: Razdan M.K., Oxford & IBH, New Delhi.
12. Plant Biotechnology: Trevan M.D., TMH, Delhi.
13. Biotechnology: Trehan Keshao, Wiley Est. Ltd.
14. Fundamentals of Biotechnology: Purohit S.S., Agro Biotechnical Publisher, Bikaner.
15. Elements of Biotechnology: P.K.Gupta, Rastogi Publications.

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**BSc. Part II. Semester IV  
BIOLOGICAL TECHNIQUES AND SPECIMEN PREPARATION  
(VOCATIONAL)**

There shall be a following paper and practical for B.Sc. Part-II Semester-IV examination. The syllabus is based on 6 theory periods and six practical periods per week (Total 75-80 theory periods and 25 practical during the complete Semester).

There shall be one compulsory paper of 3 hours duration, in theory as stated below and practical examination extending for 6 hours. Every examinee shall offer the following paper of 100 marks, (Out of which 80 marks will be for written examination and 20 marks for internal assessments) and practical examination of 50 marks. Candidates are required to pass separately in theory and practical examination.

1)	Paper-I: <b>BIOLOGICAL ELECTRONIC AND TISSUE CULTURE TECHNIQUE</b>	Marks
	Theory (Written)	..... 80
	Internal assessments	..... 20
2)	Practical:	..... 50

**Total : 150 Marks**

**PAPER-4S BTSP  
BIOLOGICAL ELECTRONIC AND  
TISSUE  
CULTURE TECHNIQUES**

**UNIT-I** : Organization of teaching laboratory-chemicals & reagents

/ glassware / specimens / living organisms / equipment / purchase and maintenance of living organisms including- aquarium, terrarium, animal house, garden.

**Unit-II** : Abiotic pollutants of water and their indicators and assay techniques. Distribution of plants and animals- Methods of survey, determination of frequency dominance etc. Air pollution determination of abiotic and biotic components.

**Unit-III** : Simple circuits - how to read a circuit diagram; parallel and series connections; fuses, plugs, wires for common electrical equipments; voltage stabilizers; safety in handling electrical equipments.

**Unit-IV** : Chromatographic techniques: theory, methods and application of paper chromatography; TLC, ion-exchange, gel-filtrations and other types, fraction collector; gradient elution techniques.

Electrophoresis-theory, methods and applications- paper and gel electrophoresis.

**Unit-V** : Tissue culture techniques and their application- Cellular components-identification, separation for in vivo & in vitro Studies-applications.

**Unit-VI** : Immunological techniques-antigen antibody, reactions; monoclonal antibodies; blood grouping. Isolation and characterization of molecules of the cell: sugars, proteins, amino acids, lipids, RNA, DNA.

### PRACTICAL COURSE

1. Study of effect of pollutants on aquatic fauna.
2. Study of air pollution.
3. Simple circuits, soldering, changing plugs, wires, fuses, voltage stabilizers, rheostats.
4. Repair and maintenance of oven, incubator, electrical water bath, shakers.
5. Purification of organic solvents.
6. Paper chromatography (one & two dimensional)
7. Thin layer chromatography.
8. Electrophoresis, gel and paper techniques and maintenance of equipments.
9. Column chromatography including ion-exchange and gel filtration.
10. Plant and animal tissue culture techniques.
11. Separation of cellular components, use of centrifuge and high speed centrifuge.
12. Enzyme action and factors affecting enzyme action
13. Still reaction of isolated chloroplast.
14. Immunological techniques.
15. Isolation of proteins and DNA (as per theory)
16. Quantitative determination of glucose, proteins, amino acids, DNA, chlorophyll.
17. Tissue culture techniques.

### DISTRIBUTION OF MARKS

#### FOR PRACTICAL EXAMINATION

Q 1. Estimation of glucose/proteins/DNA/chlorophylls. By Chromatography - Thin layer or paper	....	15
Q 2. Soldering of wires	....	07
Q 3. Enzyme action or Identification of blood groups.....	....	10
Q 4. Minor experiment on Electrophoresis or Tissue Culture.....	.....	08
Q 5. Practical record .....	.....	05
Q 6. Viva-Voce.....	.....	05

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**Total...50**

student for practical work.

### BOOKSRECOMMENDED

1. Fundamentals of Aquatic Ecosystem : Barnes, A.K. & K.H.Mann., Balckwell Scientific Publications, Oxford.
2. Quantitative Inorganic Analysis : A.I.Vogel, ELBS publisher.
3. Essentials of Plant Techniques: Dwivedi J.N., Scientific Publishers, Jodhpur.
4. Introduction to Plant Tissue Culture : Dey Dalyankumar, Central Book Agency, Calcutta.
5. Plant Cell and Tissue Culture : Narayan Swami S. Tata McGraw Hill.
6. An Introduction to Plant Tissue Culture: Razdan M.K., Oxford & IBH, New Delhi.
7. Plant Biotechnology: Trevan M.D., TMH, Delhi.
8. Biotechnology: Trehan Keshao, Wiley Est. Ltd.
9. Fundamentals of Biotechnology: Purohit S.S., Agro Biotechnical Publisher, Bikaner.
10. Elements of Biotechnology: P.K.Gupta, Rastogi Publications.

### 13. STATISTICS

The examination in Statistics of third and fourth Semester will comprise of one theory paper each, internal assessment and practical examination. Theory paper will be of 3 Hrs duration and carry 80 marks. The internal assessment will carry 20 marks. The practical examination will be of 4 Hrs duration and carry 50 marks.

The distribution of marks for practical will be as follows :

- |                        |          |
|------------------------|----------|
| 1. Practical record    | 08 marls |
| 2. Practical Viva Voce | 12 marks |
| 3. Practical problems  | 30 marks |

The following syllabi is prescribed on the basis of 6 lecturers per week and 6 practical periods per batch per week. Each theory paper has been divided into 6 units. There shall be one question in every Unit with internal choice for each of 12 marks and one compulsory question covering all the syllabus of Semester III & IV( 8 marks)

The College imparting instructions in Statistics should provide 12 digit desk model electronic calculators to the every



### 3S – STATISTICS

#### Unit–I : Indian Applied Statistical System

- 1.1 Present official statistical system in India
- 1.2 Methods of collection of official statistics, its reliability and limitations
- 1.3 De-Jure and De-Facto methods of census, its merits and demerits
- 1.4 Principal publications on Statistics such as - Population, Agriculture, Industry, Trade, Labour & Employment, Prices, Transportation and Communication, Banking & Finance

#### Unit–II : Demographic Methods

- 2.1 Definition of vital statistics and vital events
- 2.2 Sources of demographic data: - Registration method with its shortcomings, census, adhoc survey, hospital records and demographic profiles of Indian census
- 2.3 Measurement of Mortality: -
  - 2.3.1 Crude death rate (CDR) with merits & demerits
  - 2.3.2 (SDR) specific death rate, Age – SDR with merits and demerits
  - 2.3.3 Infant mortality rate with limitations
- 2.4 Standardized death rate: Direct & Indirect methods

#### Unit–III: Fertility and Life Table

- 3.1 Life table: Assumption, Description & main features
- 3.2 Relations between various elements of life table
- 3.3 Construction of life table, uses of life table
- 3.4 Definition of stable & stationary population
- 3.5 Measurement of Fertility: -
  - 3.5.1 Crude birth rate (CBR) with merits & demerits
  - 3.5.2 General and total fertility rate (GFR & TFR)
  - 3.5.3 Specific fertility rate, Age – Specific fertility rate with merits & demerits
- 3.6 Measurement of Population Growth: -
  - 3.6.1 Crude rate of natural increase & vital index
- 3.7 Gross and net reproduction rate (GRR & NRR) with merits and demerits

**Unit IV : Estimation and Testing of Hypothesis**

- 4.1 Point and Interval estimation & estimate of a parameter
- 4.2 Properties of estimator: - Unbiased ness, Consistency, efficiency and sufficiency.
- 4.3 Concept of bias & standard errors of an estimate, standard errors of sample mean and proportion.
- 4.4 Concept of Hypothesis: - Null and Alternative hypothesis
- 4.5 Types of Errors: - Type – I and Type – II , critical region
- 4.6 Level of significance, p – values, power of test.

**Unit –V : Sampling from a Distribution**

- 5.1 Definition of a random sample
- 5.2 Drawing random samples from standard distributionas Binomial, Poisson, Normal distribution.
- 5.3 Concept of statistics and its sampling distribution
- 5.4 Independence of sample mean and variance in random sampling from normal distribution (without derivation)
- 5.5 Sampling distribution of sum of Binomial, Poisson and mean of Normal Distribution

**Unit – VI : Sampling Distributions**

- 6.1 Chi-square distribution & derivation of p.d.f.
- 6.2 MGF of chi-square distribution & cumulant generating function
- 6.3 Limiting form of chi-square distribution for large degrees of freedom
- 6.4 Additive property of  $\chi^2$  variates
- 6.5 Conditions for the validity of  $\chi^2$  test
- 6.6 Applications of  $\chi^2$  distribution: - Assumptions of  $\chi^2$ 
  - 6.6.1 Chi-square test for population variance.
  - 6.6.2 Chi-square test for Goodness of fit
  - 6.6.3 Chi-square test for Independence of Attributes
- 6.7 2X 2 contingency table and Yate's correction

**B.Sc. II (3S)****List of Books : 3S**

- 1) Goon A.M. Gupta M.K. Dasgupta B. (1991): Fundamentals of Statistics, Vol. 1 World Press, Calcutta
- 2) Gupta S.C. and Kapoor V.K. : Fundamentals of Mathematical Statistics, Sultan Chand.
- 3) J.D. Gibbons : Non-parametric Statistical Inference.
- 4) Croxton F.E. and Cowden D.J. (1969) : Applied General Statistics, Prentice Hall of India.
- 5) Goon A.M., Gupta M.K. Dasgupta B.( 1986): Fundamentals of Statistics, Vol.II, World Press Calcutta.
- 6) Guide to current Indian Official Statistics : Central Statistical Organisation. Govt of India, New Delhi.
- 7) Saluja M.P.: Indian Official Statistical Systems, Statistical Publishing Society, Calcutta
- 8) Shrivastava O.S. (1983) : A Textbook of Demography, Vikas Publishing.
- 9) Gupta S.C. and Kapoor V.K. : Fundamentals of Applied Statistics, Sultan Chand.
- 10) Gupta and Mukhopadhyay P.P. : Applied Statistics, Central Book Agency.

**List of Practicals :3S**

- 1) Drawing random samples from Binomial & Poisson, distributions.
- 2) Drawing a random sample from a Normal distribution.
- 3) Test of significance based on Chi-Square test, - Text for population variance.
- 4) Testing of significance of sample correlation coefficient and uses of Z transformations.
- 5) Testing of equality of means and variances in sampling from a bivariate Normal distribution.
- 6) Chi-square test for goodness of fit.
- 7) Chi-square test for Independence of attributes in contingency tables
- 8) Computation crude death rates.
- 9) Computation of age specific death rates.
- 10) Computation of Standardised death rate by direct and indirect method.
- 11) Construction of life table
- 12) Computation of various measures of fertility.
- 13) Computation of G.R.R. and N.R.R.

## 4S – STATISTICS

### Unit – I : Sampling Distributions [t and F]

- 1.1 Student's t-distribution: definition, derivation its p.d.f.
- 1.2 Importance of student's t-distribution and confidence limits for  $\mu$
- 1.3 Limiting form of t-distribution
- 1.4 Applications of t-distribution: Assumptions for t test.
  - 1.4.1 test for single mean
  - 1.4.2 t-test for difference of means
  - 1.4.3 Paired t-test for difference of means
- 1.5 Snedecor's F-statistics: definition, derivation of p.d.f.
- 1.6 Applications of F-distribution: Assumption
  - 1.6.1 F-test for equality of population variance
- 1.7 Relation between t and F distribution and F &  $\chi^2$

### Unit – II Large Sample Tests

- 2.1 Statement of central limit theorem and its uses
- 2.2 Fishers z-transformation and its uses
- 2.3 Large sample test for single mean and single proportion
- 2.4 Large sample test for difference of two means and two proportions
- 2.5 Sampling from Bivariate normal distribution: concept & definition
  - 2.5.1 Test for significance of sample correlation coefficients
  - 2.5.2 Test for equality of means and equality of variances.

### Unit – III Non-Parametric Tests

- 3.1 Definition: Non-Parametric Tests & its assumptions, order statistics
- 3.2 Sign test for Univariate and Bivariate distribution
- 3.3. Wilcoxon – Mann – Whitney test
- 3.4 Run test and Median Test
- 3.5 Spearman's Rank Correlation test
- 3.6 Kolmogorov – Smirnov one sample & two sample tests

### Unit – IV : Economic Statistics (Index Number)

- 4.1 Definition of Index number and problems in construction of index numbers
- 4.2 Simple aggregate and weighted average methods
- 4.3 Price and Quality index number: Laspeyre's, Paasche's Walsh, Marshal – Edworth, Dorbish – Bowley's and Fisher's
- 4.4 Value Index, Uses of index numbers
- 4.5 Price Relatives, Quantity Relatives and values relatives
- 4.6 Time and Factor reversal tests
- 4.7 Consumer Price Index (cost of living index): its concept, methods of construction; Limitations and its uses

### Unit – V : Time Series Analysis

- 5.1 Concept of time series, its components and uses
- 5.2 Illustration of Trend, Seasonal and cyclic variations, random components (Fluctuations)
- 5.3 Additive and Multiplication models of time series
- 5.4 Measurement of Trend
  - 5.4.1 Graphical and semi – average method
  - 5.4.2 Least square and moving average method
- 5.5 Measurement of Seasonal variations
  - 5.5.1 Meaning of deseasonalisation
  - 5.5.2 Simple average and link relative method
  - 5.5.3 Ratio – to – trend and Ratio – to – Moving average method

### Unit – VI : Demand Analysis

- 6.1 Concept of demand and supply, Necessities and luxuries
- 6.2 Law of demand and supply, Equilibrium price
- 6.3 Price elasticity of demand
- 6.4 Price elasticity of supply
- 6.5 Income elasticity
- 6.6 Cross elasticities of demand
- 6.7 Types of data required for estimating elasticities.
- 6.8 Pareto's law of income distribution.

**List of Books : 4S**

- 1) Goon A.M. Gupta M.K. Dasgupta B. (1991): Fundamentals of Statistics, Vol. I World Press, Calcutta
- 2) Gupta S.C. and Kapoor V.K. : Fundamentals of Mathematical Statistics, Sultan Chand.
- 3) J.D. Gibbons : Non-parametric Statistical Inference.
- 4) Croxton F.E. and Cowden D.J. (1969) : Applied General Statistics, Prentice Hall of India.
- 5) Goon A.M., Gupta M.K. Dasgupta B. (1986): Fundamentals of Statistics, Vol.II, World Press Calcutta.
- 6) Guide to current Indian Official Statistics : Central Statistical Organisation. Govt of India, New Delhi.
- 7) Saluja M.P.: Indian Official Statistical Systems, Statistical Publishing Society, Calcutta
- 8) Shrivastava O.S. (1983) : A Textbook of Demography, Vikas Publishing.
- 9) Gupta S.C. and Kapoor V.K. : Fundamentals of Applied Statistics, Sultan Chand.
- 10) Gupta and Mukhopadhyay P.P. : Applied Statistics, Central Book Agency.

**List of Practicals : 4S**

- 1) Test of significance based on t-test
- 2) Test of significance based on F-test
- 3) Large sample test for single mean and difference of means
- 4) Large sample test for single proportion and difference of proportions
- 5) Non-Parametric Test : Sign test for Univariate and Bivariate distributions.
- 6) Non-Parametric Test : Wilcoxon-Mann-Whitney test.
- 7) Non-Parametric Test : Run test and Median test
- 8) Non-Parametric Test : Kolmogorov- Smirnov Test
- 9) Computation of index number by simple aggregate and Weighted average method.
- 10) Construction of price and quantity index numbers by Laspeyre's Passche's and Fisher's Method
- 11) Applications of time reversal test and factor reversal test
- 12) Construction of cost of living index numbers

- 13) Measurement of linear trend by—
  - i) Graphical Method
  - ii) Method of Semi averages.
  - iii) Method of least squares
  - iv) Method of moving averages
- 14) Measurement of seasonal variations by-
  - i) Method of simple averages
  - ii) Ratio to trend method
  - iii) Ratio to moving average method
  - iv) Method of link relative
- 15) Estimation of price elasticity of demand, income elasticity of demand and cross elasticity of demand.

**List of Equipments and instruments required for a batch of students at under graduate statistics laboratory for B.Sc. I, II & Final**

- |   |   |         |
|---|---|---------|
| 1) Twelve digits desk model electronics calculator  | – | 25      |
| 2) Biometrika tables Vol.I and Vol.II   | – | 05 each |
| 3) Seven figure logarithmic tables  | – | 10      |
| 4) Statistical Tables (Compiled)  | – | 10      |
| 5) Random number tables   | – | 10      |
| 6) A mathematical typewriter  | – | 01      |
| 7) A duplicating machine  | – | 01      |
| 8) Personal Computer  | – | 05      |
| 9) Printer  | – | 01      |
| 10) Statistical posters and charts  | – | 01      |
| 11) Software packages, Like Stastat, Stat Lab., SPSS/OR other useful packages may be provided in laboratory for practical purpose |   |         |

**14. COMPUTER****SCIENCE/COMPUTER APPLICATION /INFORMATION TECHNOLOGY**

The examination in Computer Science/Computer Application /Information Technology will comprise one theory paper and practical examination for each semester. The theory paper will be of 3 hour duration and carry 80 marks. The Practical examination will be of 4 Hrs. duration and carry 50 marks.

The distribution of marks in practical examination will be as follows :

- |  |          |
|--|----------|
| 1. Programm writing/execution (on group A & B) | 30 Marks |
| 2. Practical Record                            | 10 Marks |
| 3. Viva-Voce                                   | 10 Marks |

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**Total : 50 Marks**  
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### 3S- COMPUTER SCIENCE/COMPUTERAPPLICATION/ INFORMATIONTECHNOLOGY

**Object-Oriented Programming with C++ and Web Technology.**

**Unit-I** : Concept of OOP, Comparison with POP, features of OOP, advantages and applications of OOP, Introduction to C++, structure of C++ program, tokens, keywords, identifiers, basic data types & user defined data types, Constants, variables, declaration of variables, dynamic initialization of variables, types of symbolic constants.

**Unit-II** : Operators : Scope resolution operator, member dereferencing operator, implicit & explicit conversions.

Control structures : if, switch, do..while, while, for statements  
 Functions: Function prototype, Function calling and returning, their types, inline functions, default arguments, constant arguments, function overloading.

**Unit-III** : Classes and objects : Data abstraction and, Encapsulation, Data Hiding, class specification, defining objects, accessing class member, defining member functions, Nesting of member function, friend functions, passing objects as arguments, Returning objects from functions.

Constructors : Defining constructor, parameterized constructor, multiple constructors in a class, constructor with default argument, copy constructor,

destructor.

**Unit-IV** : Basic elements of communication system, Network concept, advantages, goals, network topologies : Star, ring, completely connected N/W, Hybrid N/W, multipoint n/w, LAN, WAN, OSI model.

**Unit-V** : HTML: Introduction, Need of HTML application of HTML, Basic structure of HTML, HTML tags and attributes : Adding tags, include attributes < HTML >, < HEAD >, < TITLE >, < BODY >, < P >, < Br >, < HR >, Heading tags, table tags, < LINK >, < IMG >, < ROWSPAN >, < COLSPAN

>, < MARQUEE >, <

BLOCKQUOTE >, < A >, < I >, < B >, list tag, Attributes : align, background colour, text color.

**Unit-VI** : Style sheet : advantages of style sheet & applications of style sheet, CSS : Introduction, CSS stylesheet properties : Units, classes and ID attributes. Properties : Text, font, colour, background, border, display, height, line, margin, width, CSS with HTML.

#### **Book recommended :**

- 1) Object Oriented Programming with C++ : E Balgurusamy TMH.
- 2) Mastering C++ : K.R. Venugopalan
- 3) Programming with C++ : Robert Lafore
- 4) Programming with C++ : R.S. Nisar Ali
- 5) Computer Fundamental and Networking : P.K. Sinha
- 6) Local Area Network : Keiser, TMH, Publication
- 7) Computer Networks : Andrew S. Tanenbaum, PHI.
- 8) HTML in 21 days : Tech media publication
- 9) HTML4 for dummies Mastering by Ed Tittel, IDG Publications.
- 10) HTML4 Unleashed, Professional Reference Edition by Rick Darnell
- 11) C++ for beginners : by B.M. Harwani, SPD Publications

**Practicals** : Minimum 16 practicals based on

- A. Unit - I, II, III (Minimum 8 practicals)
- B. Unit - IV, V, VI (Minimum 8 practicals)

**4S: COMPUTERSCIENCE/  
COMPUTERAPPLICATION/  
INFORMATIONTECHNOLOGY  
Advanced C++ and Web Designing**

**Unit I** : Arrays and Pointers : one-dimensional, two-

dimensional arrays, Defining Pointers, arrays of objects, Pointer to objects, this pointer operator overloading : Defining operator overloading, overloading arrays, Binary, and assignment operators, rules for overloading operators.



**Unit-II** : Inheritance : Introduction, derived classes, Single inheritance, multiple inheritance, Hierarchical and Hybrid inheritance.

Templates : Function, class, members and Function templates.

**Unit-III** : Virtual Functions and Polymorphism :- Introduction, Pointersto derived class, dynamic binding, defination of Virtual Function, pure Virtual Functions, Rules For Virtual Functions.

Working with Files : Introduction, Hierarchy of File Stream Classes, opening and closing of Files, File modes, File pointers and their manipulations, File Input/Output with Fstream class.

**Unit-IV** : Introduction to XML : History of Markup languages, features of XML, Simple XML document, logical structure of XML elements, Components of XML documents : The document prolog and document instance. CSS with XML.

**Unit-V** : Document type Defination (DTD): Introduction, need of DTD, declaring elements, element content models, declaring attributes, attribute types : internal and external DTD, entities and their types.

**Unit-VI** : XML Schemas : Introduction, features, Comparison with DTD, Schema elements, element type element attributes, XML schema data types, converting DTD to schema, Namespaces : Introduction, declaration, default & prefix namespaces, scope of namespaces collusion & Applications.

**Books Recommended :-**

1. Object Oriented Programming with C<sup>++</sup> : E Balguruswamy- THM
2. Mastering C<sup>++</sup> : K.R. Venugopalan
3. Programming with C<sup>++</sup> : R.S. Nisar Ali
4. Mastering XML, Ann Navaro, Chuck White, Linda Burman, BPB Publication.
5. Applied XML Solutions, BPB Publications.
6. Inside XML, BPB Publication
7. Essential XML. Box
8. XML and Related Technology, Kahate
9. XML How to Program Deitel.



**Practicals :-**

Group A : Minimum 08 practicals based on Unit I to III. Group B : Minimum 08 practicals based on Unit IV to VI

**15. COMPUTERAPPLICATION (VOCATIONAL)**

The examination in Computer Application (Vocational) will comprise one theory paper and practical examination for each semester. The theory paper will be of 3 hour duration and carry 80 marks. The Practical examination will be of 4 Hrs. duration and carry 50 marks.

The distribution of marks in practical examination will be as follows :

- |                                       |          |
|---------------------------------------|----------|
| 1. Practical based on Computer Lab I  | 15 Marks |
| 2. Practical based on Computer Lab II | 15 Marks |
| 3. Viva-Voce (based on lab I & II)    | 10 Marks |
| 4. Record/Practical Journal           | 10 Marks |

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**Total : 50 Marks**  
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**3S: COMPUTERAPPLICATION (VOCATIONAL)****Visual Basic and RDBMS**

**Unit-I** : Introduction to VBm, Integrated Development, Environment, Tool bar, Menu Bar, Project explorer, tool box, Property window, form designers, form layout, Immediate windows, Project Objects, Event Properties and Methods.

**Unit- II** : Selecting and using controls, command buttons, text box, labels, option buttons, list box, check box, combo box, imageobject, picture box, line object data control.

**Unit- III** : Working with variables, storage of variables, operators, order of operators, conditional and logical operators, Control Structures : IF--then, ENOZF, IF-- ELSE, nested if..Else, SELECT case, goto, I I F ( ), do loop, for loop, Nested for loop.

**Unit- V** : SQL: Components of SQL, Data types, DDL  
 Commands : create, Alter, Drop, for tables and Views,  
 DML Commands : Select, Insert, Update, Delete, DCL  
 Command :  
 Commit, Rollback. ORDER By, GROUP By and  
 Havingclause.

**Unit- VI** : Functions : Numeric Functions, Character  
 Functions, Conversion Functions, Group  
 Functions.

Joins : Equi-join, Non-equi join, Selfjoin, Outerjoin,  
 Unions.

Data Integrity : Types of Integrity Constrains,  
 Displaying integrity Constraints:

**Books**

- i) Guide to VB - Peternorton-Techmedia
- ii) Mastering VB - Evangelous Petroustos
- iii) Visual Programming 6.0 -Microsoft press programming guide.
- iv) Introduction to DBMS : Majumdar & Bhattacharya
- v) Database Concepts and : Ivon Bayross  
 System for students.
- vi) Programming with SQL : Ivon Bayross
- vii) Understanding Oracle : James Perry, J.Q. Lateer.

**Practicals** : Minimum 08 practicals on Unit I to Unit III and  
 Minimum 08 practicals on Unit IV to VI.

**4S : COMPUTERAPPLICATIONS (Vocational)****Advance VB and RDBMS**

**Unit-I** : VB Programms : Programme structure, procedure & Functions, private and public procedure, variables Code, Passing data by reference and value, passing control as argument, design time and runtime properties.

**Unit-II** : Interacting with Data; Database and Visual basic, data Control, advance data Control usage, advanced database control using VB application Wizard.

**Unit-III** : Printing output in VB : Printing information using print collection, controlling output, scaling output, formatting with fonts, simple VB programs, connection with database.

**Unit-IV** : PL SQL PL SQL block, architecture, data types, type declarations, Control Structure.

Cursor : Types of Cursors, Creating, Opening and fetching cursors, cursor attributes, closing cursors.

Transaction : SET TRANSACTION Command, Savepoint and Rollback segments.

**Unit-V** : Security concepts, Types of Security, User ID, Security Object, Privileges : types of privileges : GRANT, REVOKE privileges, column passing privilege, Database triggers, procedures.

**Unit-VI** : Dynamic SQL : Limitations of Static SQL, Basic concept of Dynamic SQL, Dynamic statement execution, Dynamic Queries.

SQL \*Forms; creating forms, entering data, running forms, editing forms, creating and running reports.

#### **Books Recommended :**

- i) Introduction to DBMS : Mujumdar & Bhattacharya.
- ii) Database Concepts and Systems for students : Ivan Bayros
- iii) Programming with SQL: Ivon Bayros
- iv) Understanding oracle : James Perry, J.Q. Lateer.
- v) Visual Programming 6.0 : Microsoft press Programming guide.
- vi) Guide to VB : Peternorton (Techmedia)
- vii) Mastering VB : Evangelous Petroustos - BPB.

**Practicals** : Minimum 08 practicals on Unit I to Unit III and Minimum 08 practicals on Unit IV to Unit VI.

## **16.ELECTRONICS**

### **General Provisions/Instructions**

#### **Part A**

- (i) The Examination in Electronics of each semester shall comprise of one theory paper of 80 marks of three hours duration and internal assessment of 20 marks.

- (ii) Theory paper of each semester shall comprise of six units. Each unit shall be completed in maximum 15 teaching periods of 48 minutes duration.

- (iii) There shall six questions of twelve marks on each unit with alternate choice and One compulsory question (08 subquestions of 01 mark each) of 08 marks covering syllabi of all units (short answer type).

### Part B

- (i) The Practical examination of each semester of the B. Sc. (Electronics subject) shall be of 50 marks of 4 hours duration and shall be held at the end of each semester at the places as decided by the university.
- (ii) Distribution of 50 marks assigned to practical for (Semester I to V) is as under-
- |   |   |          |
|---|---|----------|
| 1. Experiment (Construction, testing and performance) | : | 30 Marks |
| 2. Practical record                                   | : | 10 Marks |
| 3. Viva-voce  | : | 10 Marks |

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Total : 50 Marks

- (iii) Project will be given to a group of not more than four students.
- (iv) Teacher may adopt any innovative practice for demonstration of practicals on the aspects given.
- (v) College/ Department may prepare laboratory manuals of experiments

## 3S-Electronics Electronic Devices and Circuits

### Unit I : Hybrid-parameters & Cascaded amplifiers:

Hybrid-parameters, transistor equivalent circuit of CE,CB, Analysis of small signal CE amplifiers. Concept of cascaded amplifier, Types of coupling, RC Coupled Amplifier, Single Tuned amplifiers,

### Unit II : Power Amplifier:

Classification of power amplifier, Class A, Class B, Class C and Class AB amplifiers, Class A - transformer coupled amplifier, Class-B push-pull amplifier (Construction, working and efficiency of each). Distortion, complementary symmetry Class-B push-pull amplifier.

### UNITIII: Feedback amplifiers and Oscillators:

Concept of feedback, feedback theory, positive and negative feedback, advantage of negative feedback,

physical idea of feedback,(Block diagram only),concept

of oscillator, basic elements of oscillator, Barkhausen Criteria of oscillation, concept of tank circuit. RC oscillator-Phase shift and Wein bridge oscillator, LC oscillator- Colpitts and Hartley oscillator, Crystal oscillator.

**UNITIV: Operational amplifier and applications:**

Difference amplifier(concept, construction and working),block diagram of operational amplifier, characteristics of ideal op amp, concept of virtual ground, parameter of op amp (input impedance, output impedance, open loop gain, close loop gain, CMRR, slew rate, input offset voltage and current, input bias current). Applications: Op amp as inverting and non inverting amplifier, adder, Subtractor, Differentiator and Integrator.

**UNITV : Advance applications of Op- Amp:**

Solution to simultaneous equation, differential equation for harmonic, damped harmonic oscillator, regenerative comparator, logarithmic amplifier, Astable, Monostable and Bistable multivibrator and its time period (construction and working).

**UNITVI: A/D and D/A converter:**

Need of A/D and D/A converter.

D/A converter: R-2R ladder type, Weighted resistor, sample and hold circuit, IC ADC, DAC specification.

A/D converter: Single and Dual slope, counter type, successive approximation type, specification, Numerical based on A/D and D/A Converter

**Books Recommended:**

1. Integrated Electronics by Millman Halkias
2. Principle of electronics by V.K.Mehta
3. Element of electronics by Bagde and Singh
4. Linear integrated Circuits by Ramakant Gaikwad
5. Digital principle and application by Malvino and Leach

6. Basic electronics by B.L. Thereja (S.Chand and Company)
7. Op-Amp Theory and application by Ramakant Gaikwad

**Practicals:** Minimum Ten experiments at least one on each of the following aspects.

1. CE, CB and CC amplifiers, cascaded amplifiers.
2. Power amplifiers.
3. Oscillators.
4. Op-Amp applications.

5. Op-Amp in Astable, Monostable and Bistable mode.
6. ADC and DAC converter

### **4S-Electronics**

#### **Communication Electronics & Microprocessor 8085**

#### **Unit I : Modulation and Demodulation:**

Need for modulation, AM theory, Power relation, Theory of FM, Numerical on AM and AM Systems, frequency spectrum of FM. Generation of AM and FM. Collector modulator, diode reactance modulator. Demodulator: diode detector, slope detector.

Transmitter and receiver: Block diagram and working of AM and FM transmitter and receiver.

#### **UNIT II : Fiber Optic Communication :**

Introduction, advantages of OFC, types of fibers, internal reflections, numerical aperture. Optical Sources: Semiconductor injection LASER, LED, (power and efficiency characteristics). Optical detectors: Photodiode, PIN diode, Phototransistor.

Optical fiber connection: Jointer and coupler, fiber alignment and joint losses, connector couplers.

#### **UNIT III : Pulse Modulation and Digital Communication**

Pulse Modulation, Sampling Theorem PAM, PWM, PPM and PCM (Bandwidth of PCM, Quantizing Noise), application of PCM, Multiplexing Principles: TDM and FDM, Comparison of FDM and TDM.

#### **UNIT IV : Architecture and timings of 8085:**

Evolution of microprocessor, microcomputer (Block diagram with function of each block), architecture of Intel 8085 microprocessor, function of each block of 8085, Functional pin diagram and function of all pins of 8085, instruction format. Instruction cycle, fetch and execute operation, machine cycle and state, timing diagram of MOV and MVI instructions.

#### **UNIT V : Instruction and programming of 8085:**

Addressing mode, classification of instruction set of 8085 with examples, concept of stack and stack pointer, PUSH and POP instruction, Concept of subroutine: CALL and RET instruction, Delay subroutine (using one register and register pair).

Programming: Algorithm, Flowchart, Assembly and machine language, assembly language program such as programme for addition, subtraction, multiplication, division, finding maximum and minimum numbers etc.

**UNITVI : Interfacing:**

Basic interfacing concept, memory mapped I/O and I/O mapped I/O Schemes, data transfer schemes. 8255PPI: block diagram, function of each block, Functional pin diagram, , function of each pin, operating modes of 8255PPI, control word format in I/O and BSR mode, illustrative example.

**Books recommended:**

1. AText Book of Communication Engineering by A.Kumar
2. Electronics communication by Roddy and Coolean
3. Telecommunication principle circuit and system S.Rambhadran
4. Modern digital and analog communication system by B.P.Rathi
5. Communication electronics by N.D.Deshpande
6. Microprocessor and microcomputer By B.Ram
7. Microprocessor architecture, programming and applicationby Ramesh Gaonkar
8. Introduction to Microprocessor by A.P. Mathur

**Practicals:** Minimum Ten experiments at least one on each of thefollowing aspects.

1. AM and FM ( Transmitters and Receivers) TRF and superheterodyne receivers, collector modulator
2. OFC system.
3. Pulse Modulation and Digital Communication.
4. Microprocessor 8085 and its study.
5. Programming on microprocessor 8085.
6. Interfacing techniques.

## 17. BIOCHEMISTRY Semester-III

### Biochemistry

The examination in Biochemistry will comprise of two theory papers, one in each semester and one practical in each semester. Each theory paper will be of 3 hours duration and shall carry 80 marks each. The internal assessment will carry 20 marks. The practical examination will be of 6 to 8 hrs duration in one day & shall carry 50 mks.

The following syllabus is prescribed on the basis of six lectures per paper per week and six practical periods per batch per week. Each theory paper has been divided into 6 units. There shall be one question on every unit with internal choice for each of 12 mks & 1 compulsory question covering all the syllabus of semester I (8 marks).

### 3S-Biochemistry

#### (Intermediary

- UNIT-I :** a) Glycogen Metabolism in liver and muscles, Glycolysis and its regulation, Glycogenolysis, TCA and its regulation.  
b) HMP pathway, Gluconeogenesis, Glyoxalate bypass.  
c) Mitochondrial ETC, Oxidative phosphorylation.
- UNIT-II :** a) Introduction to lipid metabolism, hydrolysis of triacylglycerols, transport of fatty acid into mitochondria.  
b) B- Oxidation of saturated fatty acids, ATP yields from fatty acid oxidation, biosynthesis of saturated and unsaturated fatty acid.  
c) Metabolism of Ketone bodies, biosynthesis of triglycerides.
- UNIT-III:** a) Biosynthesis of Phospholipids, glycolipids, sphingolipids.  
b) Cholesterol; regulation of cholesterol metabolism.
- UNIT-IV:** a) General reactions of amino acid metabolism such as transamination, oxidation deamination and decarboxylation.  
b) Urea cycle and its regulation.  
c) Degradation and biosynthesis of amino acids- Glycine, serine, Cysteine, Methionine, Phenylalanine and Tyrosine.

- UNIT-V:** a) Sources of atoms in purines and pyrimidine molecules.  
Biosynthesis and degradation of purines and pyrimidines.  
b) Regulation of purines and pyrimidine biosynthesis.
- UNIT-VI:** a) Biosynthesis and degradation of porphyrins.  
b) Production of bile pigments.

#### PRACTICALS: 3S Biochemistry

- 1) Estimation of blood glucose by GOD/POD Method.
- 2) Isolations of glycogen from liver and estimation by GOD/POD method.
- 3) Determination of achromic point of salivary amylase.
- 4) Demonstration of effect of temperature on enzyme catalysed reaction.
- 5) Demonstration of urease activity on urea.
- 6) Demonstration of immobilization of enzyme.
- 7) Estimations of vitamin c by dye method.

#### Distribution of Marks : Semester III Biochemistry

##### Practicals

1. Long experiment(One)	:	15 marks
2. Short experiment	:	10 marks
3. Short experiment	:	10 marks
4. Viva voce	:	8 marks
5. Class work and Practical Record	:	7 marks

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**Total : 50 marks**  
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#### Semester- IV Biochemis try

The examination in Biochemistry will comprise of two theory papers, one in each semester and one practical in each semester. Each theory paper will be of 3 hours duration and shall carry 80 marks each. The internal assessment will carry 20 marks. The practical examination will be of 6 to 8 hrs duration in one day & shall carry 50 mks.

The following syllabus is prescribed on the basis of six



lectures per paper per week and six practical periods per batch per week. Each theory paper has been divided into 6 units. There shall be one question on every unit with internal choice for each of 12 mks & 1 compulsory question covering all the syllabus of semester I (8 marks).

**4S-  
Biochemistry  
(Enzymology  
)**

- UNIT-I:** a) General characteristics, nomenclature, IUB classification of enzymes.  
 b) Definition with examples of holoenzymes, apoenzymes, coenzymes, cofactors, activators, inhibitors, active site, metalloenzyme, marker enzyme, monomeric and oligomeric enzymes.  
 c) Unit of enzyme activity, isoenzyme, multienzyme complexes, enzyme specificity.

- UNIT-II:** a) Isolation, purification and crystallation of enzymes, test for homogeneity.  
 b) Enzyme assay, factors affecting enzyme activity- Substrate concentration, enzyme conc., pH, temp.  
 c) Derivation of Michaelis-Menten equation for unisubstrate reaction,  $K_m$  and its significance, Lineweaver-Burk plot and its limitation.  
 d) Bisubstrate reactions- sequential and ping-pong mechanism with examples.

- UNIT-III:** a) Kinetics of zero and first order reaction.  
 b) Significance of energy of activation and free energy.  
 c) Reversible and irreversible inhibition, competitive, non-competitive and uncompetitive inhibition.  
 d) Determination of  $K_m$  and  $V_{max}$  in presence and absence of inhibitors.

- UNIT-IV:** a) Allosteric enzymes, role of cofactors in enzyme catalysis- NAD/NADP, FAD/FMN, Coenzyme-Q, Biotin, Cobamide, Lipoamide, TPP, THF, Pyridoxalphosphate.  
 c) Role of metal ions in enzyme catalysis with special emphasis on coenzyme function.

- UNIT-V:** a) Acid-base catalysis, covalent catalysis.  
 b) Proximity and orientation effect, strain and distortion thesis.  
 c) Mechanism of action- Lock and Key hypothesis, Induced fit model.

- UNIT-VI:** a) Application of immobilized enzymes in industry.  
 b) Production of glucose from starch, glucose-fructose syrup from sucrose.

- c) Use of lactose in dairy industry. Use of proteases in food, detergents and leather industry  
 d) Medical applications of enzymes such as use of glucose oxidase in enzyme electrodes.

**Practical : 4S Biochemistry**

1. Estimation of DNA by Diphenylamine reagent.
2. Estimation of RNA by Orcinol reagent.
3. Estimation of amino acids by Ninhydrin method.
4. Estimation of protein by Folin-Lowry method.
5. Estimation of Cholesterol in given sample by Libermann-Burchard reagent.
6. Separation of chlorophylls by column chromatography
7. Estimation of inorganic phosphorus by Fiske-Subbarao method.

**Distribution of Marks : Semester IV Biochemistry**

**Practicals**

1.	long experiment(One)	:	15 marks
2.	Short experiment	:	10 marks
3.	Short experiment	:	10 marks
4.	Viva voce	:	08 marks
5.	Class work and Practical Record	:	07 marks

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**Total 50 marks**

**18.  
MICROBIOL  
OGY  
Semester-III  
MICROBIOLOGY**

The examination shall comprise of two theory papers, one in each semester and one practical in each semester. Each theory paper will be of 3 hours duration and carry 80 marks. The internal assessment will carry 20 marks. The practical examination will be of at least 4 hours duration in one day and shall carry 50 marks.

The following syllabus is prescribed on the basis of six lectures per week and 6 practical periods per batch per week. Each theory paper has been divided into 6 units. There shall be one question on every unit with internal choice for each of 12 marks & one compulsory question covering all the syllabus of semester-

III (8 Marks).

### 3 S-Microbiology

#### Molecular Biology and Genetic Engineering

#### Unit I: Gene multiplication and expression

- Concept of gene – Definition of Gene, Muton, recon, cistron, gene within gene, split gene.
- Replication of DNA- Modes of replication, (Conservative, Semiconservative and Dispersive). Experiment of Meselson and Stahl to prove semiconservative mode of replication. Mechanism of replication with enzymes involved, models of replication: Knife and fork, rolling circle.
- DNA repair mechanisms- light and dark.
- Genetic code- Characteristic features of genetic code.
- Out line of Protein synthesis- Transcription and Translation.

#### Unit II : Gene : Regulation and Mutation

- Gene regulation Mechanisms - *lac* operon , *trp* operon.
- Mutation- Definition & types of mutations - Base pair substitution, frame-shift, point, missense, nonsense & silent mutations, Random Vs. Directed mutation,  
Rate of mutation, Effect of Mutation on Phenotype,
- Genetic suppressions:- Intragenic (Intracodon suppression, reading frame Suppression) and extragenic suppression (Non sense and Missense Suppression).
- Molecular basis of spontaneous and induced mutations - Spontaneous mutation (Tautomerism), Induced Mutation (Chemical Mutagens) e.g. Base analogues, Nitrous Oxide, Hydroxylamine, Acridine dyes, Physical mutagens e.g. X-rays, Gamma rays, U.V. light.

#### Unit III : Genetic recombination:

##### Mechanism of recombination:

Breakage and reunion, breakage and copying, completecopy choice.

#### Transfer of genetic material in prokaryotes:

- Transformation: Experiment of Griffith. Avery, MacLeod and McCarty experiment to prove Genetic Transformation. Mechanism of Transformation.
- Transduction: Experiment of Zinder and Lederberg. General mechanism of Transduction. Types of Transduction: Generalized and Restricted, Complete and Abortive, Low Frequency and High Frequency Transduction. Comparison between Transformation and Transduction.
- Conjugation: Experiment of Lederberg and Tatum, Experiment of Davis, Nature and function of F- Plasmid. Hfr formation. Various Mating types. Mechanism of conjugation: i)  $F^+ \times F^-$  ii)  $Hfr \times F^-$ .  $F'$  Plasmid and Sexduction.

#### Unit IV : Tools of Genetic Engineering:

- Introduction to basic technique of genetic engineering.
- Enzymes for splicing: Restriction endonucleases.
- Range of DNA manipulating enzymes: Nucleases, Ligases, Polymerases, DNA modifying enzymes, Topoisomerases.
- Vectors: Ideal characters and types: Plasmid, Cosmid and Bacteriophage.

#### Unit V : Techniques of genetic engineering:

- Isolation of Genomic and Plasmid DNA from bacteria, Analysis of DNA fragment size by agarose gel electrophoresis.
- Introducing  $\lambda$  DNA into host cell, competent cells, transduction of cells and identification of transformed cell (e.g. Antibiotic resistance gene in Plasmid) Selection of clones: Direct (colony hybridization) and Indirect method (southern blotting).
- Definition, method and applications of gene mapping, DNA sequencing (by microarray) and PCR.
- Introduction to expression of cloned genes. Construction of gene library. Cells for cloning.

**Unit VI : Applications of Genetic Engineering:**

- a) Health care biotechnology: - Recombinant Insulin, Recombinant Hepatitis vaccine, Gene therapy, DNA probes in diagnosis.
- b) Agricultural biotechnology: - Transgenic plants.
- c) Environmental biotechnology: - Genetically engineered microbes for pollution control.
- d) Industrial biotechnology: - Strain improvement for industrial product.

**Practicals**

1. Isolation of genomic DNA from bacteria.
2. Demonstration of agarose gel electrophoresis.
3. Genetic recombination in bacteria.
  - a) Transformation b) Conjugation
4. Estimation of DNA and RNA.
5. Isolation of fermentative mutant using physical mutagen (U.V. radiation).
6. Detection of streptomycin (antibiotic resistant mutant) by replica plating technique.
7. Transformation of plasmid DNA using CaCl<sub>2</sub>.

**Distribution of marks****III Semester Microbiology practicals**

1.	Major experiment	-	15 Marks
2.	Minor experiment	-	10 Marks
3.	Viva-Voce	-	10 Marks
4.	Spotting	-	10 Marks
5.	Laboratory journal	-	05 Marks

**TOTAL 50 Marks**

**Books Recommended For SEM-III:-**

1. Recombinant DNA:-James. D. Watson, John. Tooze, David.Kutz
2. Introduction to Genetic Engineering: - Nicholas
3. An Introduction to Genetic Analysis: - David Suzuki, Anthony. Griffiths

4. Biochemistry: - Lehninger
5. General Microbiology. Vol 1& II. : - Powar & Dagainawala
6. Molecular Biology of the Cell: - J. D. Watson, D. Bray
7. The DNA Story: - J. D. Watson
8. Genetics of Prokaryotes: - Srivastava et.al
9. Genes: - Pramod Kumar
10. Genetic Engineering and its Applications -Joshi P.
11. Gene Transfer and Expression a Laboratory Manual: - Michael Kriegler
12. Concept in biotechnology: - D. Balasubramaniam
13. Essential Genetics: - Daniel. Hartl.

**PRACTICALS:**

1. Microbes in Action : Saley, Wandermark, Tarporewala, Bombay.
2. Medical Microbiology Vol.II : R.Cruickshank.
3. A manual of Microbiological : A.J.Salle. Methods.
4. Microbiological Methods : Collins
5. Difco manual

**Semester-IV  
MICROBIOLOGY  
GY**

The examination shall comprise of two theory papers, one in each semester and one practical in each semester. Each theory paper will be of 3 hours duration and carry 80 marks. The internal assessment will carry 20 marks. The practical examination will be of at least 4 hours duration in one day and shall carry 50 marks.

The following syllabus is prescribed on the basis of six lectures per week and 6 practical periods per batch per week. Each theory paper has been divided into 6 units. There shall be one question on every unit with internal choice for each of 12 marks & one compulsory question covering all the syllabus of semester-IV (8 Marks).

**4 S-  
Microbiology  
Medical  
Microbiology**

**Unit I : Epidemiology**

- a) Definition, classification and scope of epidemiology.
- b) Infection- Types of infection and modes of transmission.

- c) Normal flora of human body.
- d) Infection process, pathogenicity and virulence,  
Microbial virulence factors: toxins, enzymes
- e) Control of communicable diseases.

### Unit II : Immunology

- a) Organs and cells of immune system
- b) General Nonspecific factors- Physiological barriers,  
Natural cellular factors, Natural humoral factors.
- c) Immunity- Definition and classification
- d) Innate immunity- Species, Racial, Individual, Herd  
immunity.
- e) Acquired immunity- Active and passive immunity,

- f) Immune response and hypersensitivity

### Unit III : Serology

- a) Antigens- Definition, types and factors determining  
antigenicity, Bacterial antigens.
- b) Antibodies- Definition, Structure, classification,  
Properties and differences, monoclonal antibodies.
- c) Antigen Antibody reactions- Agglutination,  
Precipitation, Complement fixation test, ELISA and  
RIA.

### Unit IV : Pathogenic Bacteria

Study of following bacteria with respect to their morphology, cultural and biochemical properties, antigenic structure, pathogenesis, laboratory diagnosis and prophylaxis:

- a) *Staphylococcus aureus*.
- b) *Clostridium tetani*.
- c) *Salmonella typhi*.
- d) *Mycobacterium tuberculosis*.
- e) *Treponema pallidum*.
- f) *Vibrio cholerae*.

### Unit V : Other Pathogenic organisms

- a) Viruses- AIDS, Hepatitis, Polio, Rabies.
- b) Rickettsias- *R. prowazekii*
- c) Protozoa- *E. histolytica*
- d) Fungi- *C. albicans*

### Unit VI : Antimicrobial chemotherapy

- a) Ideal characters of chemotherapeutic agents
- b) Major antimicrobial agents and its clinical uses:

- i) Antibacterial agents: Rifampicin,  
Chloramphenicol, Streptomycin and  
Ciprofloxacin
- ii) Antiviral agents: Azidothymidine, Amantadine.
- iii) Antifungal agents: Griseofulvin, Amphotericin B,  
Imidazoles.
- c) Basic mechanism of antibiotic action
- d) Antimicrobial susceptibility testing: Introduction to  
CLSI(NCCLS), MIC.  
Disc diffusion, agar dilution, broth dilution  
(macro and micro).

### Practicals

1. Studies of microbial enzymes and biochemical tests:
  - a) Urease b) Coagulase c) Oxidase d) IMViC e) Sugar  
fermentation
2. Isolation and Identification of following bacteria:
  - a) *Staphylococcus aureus* b) *E. coli* c) *Salmonella typhi*
3. Serological Tests:
  - a) Widal b) Pregnancy test c) VDRL
4. Antibiotic sensitivity by Disc diffusion method.
5. Clinical investigations:
  - a) Blood grouping and Cross matching
  - b) TLC, DLC
  - c) Hemoglobin estimation
  - d) Test for carbohydrates and Proteins in Urine
  - e) Blood glucose and cholesterol
6. Cultural examination of Urine, Blood, Sputum, Stool, Pus, CSF.
7. Isolation of pathogenic fungi
8. Study Tour.

### Distribution of marks

#### IV Semester Microbiology practicals

- |                       |   |          |
|-----------------------|---|----------|
| 1. Major experiment   | - | 15 Marks |
| 2. Minor experiment   | - | 10 Marks |
| 3. Viva-Voce          | - | 10 Marks |
| 4. Spotting           | - | 10 Marks |
| 5. Laboratory journal | - | 05 Marks |

**TOTAL : 50 Marks**

**Books Recommended For SEM- IV :-**

1. Medical Bacteriology : Dey N.C. & Day T.K.
2. Medical Microbiology Vol. I & II : Cruickshank K.R.
3. Text Book of Microbiology : Ananthanarayan R. & C.E. Panikar
4. Medical Parasitology : Dey N.C. & Dey T.K.
5. Dorland's Pocket Medical Dictionary
6. Microbiology : Zinsser W.
7. Preventive & Social Medicine : Park & Park
8. General Microbiology & Immunity : S.G.Wilson. Vol. I & II
9. Medical Microbiology : R. Anantnarayan
10. Fundamental Principles of : A.J.Salle.  
Bacteriology
11. Microbes & Diseases of Man : W.C.Deb.  
(Helminthology)
12. Microbiology : B.D.Davis, R.Dulbecoco, H.N.Eisen,  
H.S.Ginsburg.
13. Parasitology : K.D.Chatterjee
14. Text Book of Medical Microbiology: H.L.Chopra.

**PRACTICALS :**

1. Microbes in Action : Saley, Wandermark, Tarporewala, Bombay.
2. Medical Microbiology Vol.II : R.Cruickshank.
3. A manual of Microbiological Methods. : A.J.Salle.
4. Microbiological Methods : Collins
5. Difco manual

**19. FOOD SCIENCE****Semester III****3S: Food Microbiology**

**UNIT-I :** Introduction to microbiology, Brief History, Food Microbiology, Microorganisms and its relation with food, various type of microorganisms; Bacteria Algae; fungi, viruses Protozoa etc.

Taxonomy; Definition taxonomic ranks, Classification ,major characteristics used for classification eukaryotes and prokaryotes three domain system Microbial cell, Structure important organs of cell.

**UNIT-II :** Growth of microorganisms; Age of cell, synchronized and balanced growth generation time exponential growth and rate constant, Microbial growth curve, method of measurement of growth, cell mass and its determinant intrinsic factors affecting growth, mode of nutrition in microorganisms, nutritional requirement of microorganisms.

**UNIT-III :** Bacteria; introduction general characteristics, Size , Shape, Colony Characteristics, Classification of bacteria Gram positive Gram negative bacteria, Group of Bacteria important in food, such as acid forming bacteria Proteolytic bacteria Lipolytic bacteria Saccharolytic bacteria, Pectinolytic bacteria, Thermophilic, Thermotolerant bacteria, Psychrotrophic, Halophilic, Rope forming, etc. Genera of bacteria important in food and their application such as *Acetobacter*, *Aeromonas*, *Alkaligenes*, *Bacillus*, *Clostridium*, *Erwinia*, *Escherichia*, *Lactobacillus*, *micrococcus*.

**UNIT-IV :** Yeast, Moulds, Size, shape, Structure, important organs sexual and asexual spores. Genera of yeast and Moulds important in food A glance at classification of yeast and mould .Genera of moulds important in food such as *Mucor* *Rhizopus* *Aspergillus*, *Penicillium* *Trichothecium* etc. and their application A short introduction to Algae viruses Actinomyces, Protozoa.

**UNIT-V :** Cultivation of microorganisms; pure culture, isolation of pure culture, Media; type of media, composition and preparation of media, maintenance and preservation of culture, sterilization processes, staining and observation, type of staining simple differential staining gram staining spore staining. Enumeration of microorganisms various method of enumeration.

**UNIT – VI :** Microbiology of some important basic foods; normal microflora in milk, milk products, eggs, meat and other animal products, fruit and fruit products, vegetable and vegetable



products,cereals,etc.

Microbial contamination, causes of contamination,  
prevention of contamination, prevention, common  
food borne pathogenic microorganisms.

Fermentation; definition, types; Batch, Continuous, Aerobic and Anaerobic fermentation. Methods of microbial examination of food.

### Practicals

1. Simple laboratory techniques.
2. The working and handling of microscope
3. Preparation and sterilization of nutrient media
4. The techniques of aseptic transfer of microbes
5. Isolation of bacteria by streak plate technique and other
6. Identification of microorganisms by simple staining
7. Identification of microorganisms by gram staining
8. Staining of yeast.
9. Staining of Mould.
10. Enumeration of microorganisms with serial dilution techniques
11. Enumeration of microorganisms with MPN method.
12. Microbial analysis of water.
13. Useful and harmful microorganisms in food stuff
14. Preparation of staining solution.

### Books Recommended

1. Microbiology Vol.I &II by C.B. Powar and H.F.Daginawala.
2. Microbiology by M.A. Pelezar, R.D. Reid & C.S. Chan, Tata Macgraw Hill Publication Co limited, New Delhi.
3. Food Microbiology by W.C. Fraizer, Tata Macgraw Hill Publication.
4. Introduction to Microbiology by A.S. Rao
5. Food Microbiology by Adam Moss
6. Dairy Microbiology by Prohit
7. Food Microbiology by Prohit
8. Food Microbiology by Bohra Pradeep.

**The distribution of marks in practical shall be as follows:**

A) Two short experiment	-	20marks (10 Each)
B) One long experiments	-	15 marks
C) Viva voce	-	10marks
D) Practical records	-	05 marks

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**Total - 50 marks**  
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### Semester-IV

#### 4S : Food Preservation and Quality Control

**Unit I** : Quality factors in food; Appearance factors, Textural factors,

flavor factors, other quality factors, food spoilage; Definition, causes of food spoilage, factors affecting food microbiology, major types of food microbiology, (microbiological, biochemical, physical and chemical), common spoilage in basic food stuffs.

**Unit II** : Food preservation, principal of food preservation, importance and for food preservation, methods of food preservation, food preservation by low temperature, refrigeration, freezing, freeze drying, difference between refrigeration and freezing, changes during freezing and application.

**Unit III** : Food preservation by high temperature, sterilization, pasteurization (HIST, LTLT, etc.), canning. Blanching, drying; advantages, changes during drying, methods of drying; sun drying, hot air drying, drum drying, spray drying, etc.

**Unit IV** : Preservation by irradiation; effect of irradiation, microwave heating, advantages and disadvantages. Preservation by concentration; by heating and reserve osmosis.

Preservation by chemicals:

Class I, class II preservatives, examples in food preservation and application example salting, pickelling, smoking, acidification, addition of sugar etc.

**Unit V** : Food adulteration; various techniques of detection. Food laws; examples PFA, ECA (essential commodity act) FPO, MMPO (milk and milk product order), agmark, BIS, CPA (consumer protection act), food safety act, HACCP.

**Unit VI** : Packaging; functions of packaging, types of

packaging materials; metal, glass, flexible films, single films, edible, biodegradable films, paper, board, latest trends in packaging. Classification of packages, food labeling; definitions, principle, categories, mandatory requirements in labeling; labeling laws.

Hygiene and sanitation:

Imp. and definitions, cleaning, cleaning agents, types of sanitizers, personal hygiene, pest control.

### Practicals:

1. Estimation of calcium.
2. Estimation of iron.
3. Estimation of vitamin C.
4. Estimation of fats in milk.
5. To determine adulterants by physical methods.
6. To determine the food adulterants chemically in fats and oil.
7. To determine the food adulterants chemically in sugars.
8. To determine the food adulterants chemically in species.
9. To determine the food adulterants chemically in tea and coffee.
10. To determine the food adulterants chemically in milk and milk products.
11. Effect of germination on vitamin C in legumes and cereals.
12. Effect of germination on reducing sugars in legumes and cereals.

### Books Recommended:

1. Microbiology Vol. I & II - C.B. Powar And H.F. Daginawala.
2. Food Microbiology - W.C. Frazier, Tata McGraw Hill Publication.
3. Preservation of Fruits and Vegetables - Girdharilal & Sidappa, ICAR, New Delhi, 1967.
4. Manual of Analysis of Fruits & Vegetable Products - Ranaganna S., Tata McGraw Hill Publishing Co. New Delhi.
5. Foods: Facts & Principles - N. Shakuntala Manay And M. Shadaksharwamy, Published - Wiley Eastern Ltd.
6. Food Science and Nutrition - Sunetra Roday Publisher, Oxford University Press.
7. Food Science - Sumati, R. Mudmbi, 2<sup>nd</sup> Edition, New Age International Publisher.
8. Food Science - B. Shrilaxmi, 3<sup>rd</sup> Edition New Age International Publisher.
9. Laboratory Techniques in Food Analysis - D. Pearson, Pub. Butterworth's.

10. Curricula on Food Safety - Directorate General Of Health Services Ministry of Health & Family Welfare Govt. of India Nirman Bhawan New Delhi.
11. Food Storage and Food Preservation - Vijiya Khader.
12. Nutrition and Dietetics - Shubhangi Joshi, 2<sup>nd</sup> Edition.
13. Food Science - Norman Potter 5<sup>th</sup> edition.

### The distribution of marks in practical shall be as follows:

A)	Two short experiment	-	20 marks (10 Each)
B)	One long experiments	-	15 marks
C)	Viva voce	-	10 marks
D)	Practical records	-	05 marks

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**Total - 50 marks**  
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## 20. INDUSTRIAL MICROBIOLOGY Semester-III Industrial Microbiology

The examination shall comprise of two theory papers, one in each semester and one practical in each semester. Each theory paper will be of 3 hours duration and carry 80 marks. The internal assessment will carry 20 marks. The practical examination will be of at least 4 hours duration in one day and shall carry 50 marks.

The following syllabus is prescribed on the basis of six lectures per week and 6 practical periods per batch per week. Each theory paper has been divided into 6 units. There shall be one question on every unit with internal choice for each of 12 marks & one compulsory question covering all the syllabus of semester-III (8 Marks).

3

### S – Industrial Microbiology (Industrial Fermentation, Metabolism and Bioinstrumentation)

**Unit-I : Fermentation, Metabolism and Enzymology**

- A] a) General concept of fermentation and respiration.  
b) Metabolism – definition and general strategy.  
c) Metabolic pathways – (EMP, TCA, Oxidative phosphorylation and ETC)

B] Enzyme–Definition, nature, terminologies used in enzymology, classification and nomenclature of enzyme.

Enzyme active site, mechanism of enzyme action (lock and key model and induced fit model.)

### Unit-II : Industrial production of ;

- A] Biomass production (bacterial, fungal and yeast)
- B] Biofertilizer production (bacterial, algal, mycorrhizal)
- C] Microbial insecticide (bacterial, viral and fungal)

### Unit-III : Industrial production of ;

- A] Enzyme Amylase (bacterial and fungal)
- B] Vitamins (Riboflavin)
- C] Alcohol Ethanol (Molasses and waste sulphite liquor)
- D] Organic acids (acetic acid, lactic acid, citric acid)
- E] Amino acid (glutamic acid)
- F] Beverages (Wine and Beer)

### Unit-IV : Downstream processing of above fermentation products;

- a) Pretreatment (cell disruption and flocculation)
- b) Solid liquid separation (filtration, sedimentation, centrifugation)
- c) Concentration (membranes, salt and solvent precipitation, evaporation, liquid-liquid extraction and distillation)
- d) Purification (Precipitation, chromatography, adsorption and elution)
- e) Formulation (drying, extrusion, granulation and tableting) to be added.

### Unit-V : Antibiotic and Vaccine Production;

- a) Antibiotics (Penicillin and Streptomycin)
- b) Vaccine (BCG, Salk, recombinant Hepatitis vaccine)
- c) Toxoid (Diphtheria, tetanus)
- d) Control, testing and standardization of vaccine.

### Unit-VI : Introduction to:

- a) Spectroscopy, (Beer Lambert's Law) components, working and Applications of colorimeter and UV-Visible spectrophotometers.
- b) Chromatography (paper and Thin layer)

- c) Electrophoresis ( Paper and Gel)
- d) Role of radio- active isotopes in Microbiology.

### Practicals

1. Microbiological examination of raw milk by plate count test, for coliform (MPN) and Yeast and molds
2. Microbiological examination of vegetables and fruits by plate count test for coliform (MPN) and test for yeast and molds
3. Production and estimation of Alcohol (ethanol)
4. Methods for detection of food adulteration
5. Methylene blue reduction test and Phosphatase test.
6. Demonstration of Mushroom cultivation
7. Test of sterility of food products (Milk and food)
8. Estimation of Riboflavin
9. Isolation of antibiotics producing microorganisms from soil
10. Demonstration of enzyme production by microorganisms (Amylase and caseinase)
11. Isolation and study of food spoilage microorganisms from sweets and bakery products
12. Organization of one study tour (short / long)

### Distribution of Marks :

#### Semester III Industrial Microbiology Practicals

1. Major experiment (any one)	10
2. Minor experiment (Any two)	10
3. Viva-voce	10
4. Spotting	10
5. Laboratory Journal	05
6. Study tour report	05

**Total**

**50**

### List of the recommended books;

1. Lehninger's principles of Biochemistry, by Nelson, Cox (M. M. Macmillan, New York)
2. Fundamentals of Biochemistry by Donald Voet, Judith's Voet, Charlotte Oratt (John Wiley and Sons New York)

3. Text book of Biochemistry by, O. P. Agrawal,
4. Text Book of Biochemistry By, West and Todd
5. Text Book of Biochemistry by, J. L. Jain
6. Text Book of Biochemistry by, U. Samarayan

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### **Semester-**

### **IV**

### **Industrial Microbiology**

The examination shall comprise of two theory papers, one in each semester and one practical in each semester. Each theory paper will be of 3 hours duration and carry 80 marks. The internal assessment will carry 20 marks. The practical examination will be of at least 4 hours duration in one day and shall carry 50 marks.

The following syllabus is prescribed on the basis of six lectures per week and 6 practical periods per batch per week. Each theory paper has been divided into 6 units. There shall be one question on every unit with internal choice for each of 12 marks & one compulsory question covering all the syllabus of semester-IV (8 Marks).

#### **4 S – Industrial Microbiology (Food, Dairy Microbiology and Biostatistics)**

#### **Unit I : Food Microbiology:**

1. Sources of contamination of fresh food.
2. Microbial spoilage of food
3. Preservation of food materials
  - a. Low and High temperature
  - b. Dehydration
  - c. High osmotic pressure
  - d. Chemical preservatives
  - e. Radiations
  - f. Canning
4. Food poisoning:
  - a. Food infection
  - b. Food intoxication

#### **Unit II : Milk Microbiology:**

- A) Definitions
- B) Sources of Microorganisms in milk

- C) Types of microorganisms from milk

- D) Pasteurization of milk- LHT, HIT, UHT
- E) Phosphatase test and its applications
- F) Quality and grades of milk

**Unit III : Fermented milk products:**

- A) a. Introduction
  - b. Selection of food for manufacturing of fermented food products
- B) Fermented food products:
  - a. Sauerkraut
  - b. Pickles
  - c. Idli
  - d. Bread
  - e. Oriented food products

**Unit IV : Fermented milk products:**

- A) Introduction
- B) Selection of raw milk for manufacturing of fermented milk products
- C) Production of Yoghurt, Dahi, Cheese
- D) Cultured butter milk: Lassi, Chhach
- E) Acidophilus milk products
- F) Production of Kefir, Kaumiss and Leben
- G) Nutritional and therapeutic values of fermented milk products
- H) Defects and spoilages of fermented milk products
- I) Tests and standards for fermented milk products
- J) Pathogens in fermented milk products

**Unit V : Meat and Fishery Products:**

- A) Spoilage of fresh and Processed meat
- B) Fermented sausage and country cured hams
- C) Fish sausages
- D) Microbiological quality of various sea food products
- E) Preservation of meat/ Fish and Poultry products

**Unit VI : Biostatistics**

1. Importance and applications:
  - a. Tabulation and classification of data
  - b. Frequency distribution
  - c. Graphical presentation of data
2. Measures of Central tendency



- a. Mean
- b. Median
- c. Mode
3. Co-relation and their linear regression:
  - a. Coefficient of correlation
  - b. Linear least square
  - c. Fil method of regression
4. Hypothesis testing- (Chi Squire test,  $X^2$  test, t- test)
5. Different methods of daa presentation with special reference to bioststical samples

### Practicals

1. Microbiological examination of canned foods, ice cream, egg by plate count, test for coliform (MPN) yeasts and molds
2. Production and estimation of citric acid
3. Production of fermented food products, curd, idli and cheddar cheese
4. Effect of ultra violet radiation on microorganisms present in food (fermented milk, and food products)
5. Estimation of fats present in the milk
6. Hansa test for detection of adulteration of cow milk with buffalo milk
7. Isolation of polychrophillic microflora from food
8. Demonstration of microbes present in curd and lassi
9. Test of sterility of food products (Pickles, and Bakery products)
10. Immobilization of yeast cells and demonstration of invertase activity
11. Isolation of microflora from fishery products
12. Organization of one study tour (Short/Long) and submitting tour report.

#### Distribution of Marks :

##### Semester III Industrial Microbiology Practicals

Major experiment (any one)	10
Minor experiment (Any two)	10
Viva-voce	10
Spotting	10

Laboratory Journal	05
Study tour report	05

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**Total 50**

#### List of the recommended books;

1. Fermentation technology, by Whittakar
2. Industrial Microbiology, by Casida (Wiley Eastern Ltd. Publication)
3. Industrial Microbiology by, A. H. Patel (MacMillan Publication)
4. Fundamentals of Dairy Microbiology by, J. B. Prajapati (Ekta publication)
5. Modern Food Microbiology by, James M. Joy (B. S. Publication)
6. Industrial microbiology by, B. M. Miller and W. Litsky)
7. Outline of Dairy Sacterio, Ogy by, S.U. Kumar
8. Industrial Microbiology by, Prescott and Dunn
9. Food Microbiology by Frezier
10. Industrial Microbiology by, Rose

### 21. BIOTECHNOLOGY(REGULAR / VOCATIONAL)Semester-III Biotechnology

The examination shall comprise of two theory papers, one in each semester and one practical in each Semester. Each theory paper will be of 3 hours duration and carry 80 marks. The internal assessment will carry 20 marks. The practical examination will be of at least 4 hours duration in one day and shall carry 50 marks.

The following syllabus are prescribed on the basis of six lectures per week and 6 practical periods per batch per week. Each theory paper has been divided into 6 units. There shall be one question in every unit with internal choice for each of 12 marks & one compulsory question covering all the syllabus of Semester-III (8 marks).

### 3SBIOTECHNOLOGY

Essential Mathematics, Biostatistics, Bioinformatics and  
Biophysical methods

#### Unit I : Essential Maths:

**Sets:** Definition, Subset. Union, intersection, Venn Diagrams, Complement of a Set, Universal Set. Use of Logarithms for simple problems (Without log tables). Binomial theorem (Without proof) – Simple Examples.

**Limits of a function:** Concept of limit, Limit of function at a point, Simple algebraic limits.

**Derivative/ Differentiation:** Derivative of simple algebraic functions. Derivatives of standard Trigonometric & Logarithmic functions (without proof). Addition rules, Subtraction rules, Product rule (Treatments only).

**Integration:** Integration as antidifferentiation, Problems involving simple polynomial functions.

**Unit II : Introduction to statistics:** Sampling:- Types of Sampling- Purposive sampling, Random sampling, Simple sampling & Stratified sampling.

Probability:- Random Experiment, Sample space, Event, Probability of an Event, Axioms of probability.

**Unit III : Measures of central Tendencies:** Mean, Calculation of Mean of ungrouped & grouped data. Mode & Median of ungrouped data. Measures of deviation, Mean deviation & Standard deviation (For Ungrouped Data), Test of significance, ANOVA.

**Unit IV : General Biophysical methods:** Acids and Bases, Ionization of strong acids and bases, pH and pOH, Buffers, pH changes in buffers, Buffer capacity, Blood buffers, Henderson – Hasselbalch Equation.

**Radioactivity** - Nucleus. Properties. Nuclear forces. Nuclear models (liquid drop and shell model). Radioactive nucleus. Nuclear radiations and their

properties - alpha, beta and gamma. Half life-physical and biological. Role of Radioactivity in Biology.

## **Unit V : Thermodynamics as applied to biological systems**

Laws of thermodynamics, Enthalpy. Entropy. Free energy. Gibb's free energy (G). Helmholtz free energy (A). Chemical potential. Half cell potential. Redox potential. General idea about structure and bioenergetics of mitochondria and chloroplast.

## **Unit VI : Bioinformatics- Introduction**

Historical overview and definition, goal, scope, bioinformatics applications, limitations, major databases in bioinformatics, Information retrieval from databases, tools for web search, Primary, secondary, composite databases and structural databases..

### **Practicals:**

1. Validation of Beer Lambert Law
  2. Determination of absorption maxima of protein.
  3. Determination of absorption maxima of DNA.
  4. Determination of action spectra of chlorophyll.
  5. Determination of least count for ocular micrometer.
  6. Determination of size of microscopic cells/ organisms using ocularmicrometer.
  7. Analyze the height of the plants inoculated with growth promoting microbes to determine mean height, standard deviation and standard error.
  8. Practical based on Chi-square and t- test.
  9. Demonstration of Hill's reaction.
  10. Retrieval of information from NCBI
  11. Retrieval of information from EBI
  12. Retrieval of structure file from PDB
  13. Preparation of buffers using pH meter
  14. Preparation of buffer using Henderson – Hasselbalch equation.
-

**Distribution of Marks for III<sup>rd</sup> Semester****Biotechnology practical examination**

1. Major experiment	-	12 Marks
2. Minor experiment	-	08 Marks
3. Viva-Voce	-	10 Marks
4. Spotting	-	10 Marks
5. Practical record	-	05 Marks
6. Study tour / Visit	-	05 Marks

**TOTAL 50 Marks****REFERENCEBOOKS:**

1. Fundamentals of Mathematical Statistics-S.C. Gupta and V.K.Kapoor. S. Chand & Co.
2. Discrete Mathematics - B.S. Verma, Vishwa Prakashan.
3. Statistics for Biologists- Campbell R.C. Cambridge University Press, Cambridge.
4. Practical Statistics for Experimental Biologists- Ward Law A.C.
5. Statistical Methods in Biology- Baily N.T.J, English University Press.
6. An Introduction to Biostatistics- P.S.S. Sunderrao & J. Richards, Prentice Hall Pvt. Ltd. India.
7. Biophysics - Cotrell (Eastern Economy Edition)
8. Clinical Biophysics –Principles and Techniques- P. Narayanan (Bhalani Pub.Mumbai)
9. Biophysics – Pattabhi and Gautham (Narosa Publishing House)
10. Instrumentation measurements and analysis – Nakara, Choudhari (Tata McGraw Hill)
11. Handbook of analytical instruments – R.S. Khandpur (Tata McGraw Hill)
12. Biophysical Chemistry- Upadhyay, Upadhyay and Nath – (Himalaya Pub. House, Delhi).
13. Methods in Biostatistics- B K Mahajan. Jaypee Brothers, New Delhi.
14. Basic Biostatistics and its application- A K Datta. New Central Book Agency (P) Ltd, Kolkata.
15. Elements of Biostatistics – S Prasad. Rastogi Publications, Meerut.
16. Biophysics- G R Chatwal. Himalaya Publishing House.
17. Biophysics – Mohan P Arora. Himalaya Publishing House.

18. Bioinformatics A Beginner's Guide WILEYINDIA PVT LTD
19. Bioinformatics Basics: Applications in Biological Science and Medicine, Second Edition. Robert R. Ruffolo. TAYLOR & FRANCIS GROUP
20. Biochemical Calculations. I H Segel. John Wiley & Sons

**Semester-  
IV  
Biotechnology**

The examination shall comprise of two theory papers, one in each semester and one practical in each Semester. Each theory paper will be of 3 hours duration and carry 80 marks. The internal assessment will carry 20 marks. The practical examination will be of at least 4 hours duration in one day and shall carry 50 marks.

The following syllabi are prescribed on the basis of six lectures per week and 6 practical periods per batch per week. Each theory paper has been divided into 6 units. There shall be one question in every unit with internal choice for each of 12 marks & one compulsory question covering all the syllabus of Semester-IV (8 marks).

**4 S BIOTECHNOLOGY  
GENETIC ENGINEERING AND MICROBIAL BIOTECHNOLOGY**

**Unit-I : Molecular basis of life:**

Structure of DNA.  
Replication of DNA in prokaryotes and eukaryotes. DNA damage and repair mechanisms.  
Homologous (Holiday model) and non-homologous (site-specific) recombination (transposons).  
Genetic code.

**Unit-II : Protein synthesis:**

Transcription and Translation process in prokaryotes and eukaryotes.  
RNA processing in eukaryotes.

Post- translational modification of proteins.  
Regulation of gene expression in prokaryotes (lac operon)and eukaryotes.

**Unit-III : Gene cloning:**

Isolation of genomic and plasmid  
DNA.DNA manipulating enzymes.

Cloning vectors:- Plasmids, bacteriophages, cosmids and phagemids.  
Southern blotting and colony hybridization.  
PCR.  
Gene library.

**Unit-IV : Microbial Biotechnology I- Medicine:**

Interferon.  
Insulin.  
Recombinant vaccines. Dextran.  
Amino acids.  
Pharmaceutically important recombinant products – (Growth hormone, erythropoietin)

**Unit-V : Microbial Biotechnology II- Industry:**

Batch and continuous fermentation.  
Types of bioreactors (CSTR, Fluidized bed reactor, UASB).  
Alcohol fermentation.  
Penicillin fermentation.  
Gluconic acid fermentation.  
Citric acid fermentation.  
Amylase fermentation.

**Unit-VI : Microbial Biotechnology III- Environment:**

Energy from Biomass (Biogas and Biodiesel)  
Microbial Pesticides and Biofertilizers.

Microbial Bioremediation.  
Bioleaching.  
Biodegradation of xenobiotic compounds. Water Treatment – Aerobic and Anaerobic

**Practicals.**

- 1) Agarose gel electrophoresis of nucleic acid.
- 2) Isolation of Genomic DNA.
- 3) To check purity of DNA
- 4) Plasmid isolation – Mini preparation.
- 5) DNA ligation
- 6) Competant cell preparation

- 7) Transformation.
- 8) Restriction enzyme and restriction digestion of plasmid DNA.

- 9) Laboratory scale production and estimation of ethyl alcohol.
- 10) Laboratory scale production and estimation of amylase.
- 11) Laboratory scale production and estimation of citric acid.
- 12) Isolation of *Azotobacter*.
- 13) Isolation of Phosphate solubilizing bacteria.
- 14) Determination of Chemical oxygen demand (COD).
- 15) Determination of Biological oxygen demand (BOD) .

### Distribution of marks for IV Semester

#### Biotechnology practical examination

1. Major experiment	-	12 Marks
2. Minor experiment	-	08 Marks
3. Viva-Voce	-	10 Marks
4. Spotting	-	10 Marks
5. Practical record	-	05 Marks
6. Study tour / Visit	-	05 Marks

**TOTAL 50 Marks**

#### Books Recommended For SEM-IV:-

1. Recombinant DNA:-James. D. Watson, John. Tooze, David.Kutz
2. Introduction to Genetic Engineering: - Nicholas
3. General Microbiology. Vol 1& II. : - Powar & Dagainawala
6. Molecular Biology of the Cell: - J. D. Watson, D. Bray
7. The DNA Story: - J. D. Watson
8. Genes: - Pramod Kumar
10. Genetic Engineering and its Applications -Joshi P.
11. Gene Transfer and Expression a Laboratory Manual: - MichaelKriegler
12. Concept in Biotechnology: - D. Balasubramaniam
13. Molecular Cloning.- A Laboratory Manual, J. Sambrook, E.F Fritsch and T. Maniatis, Cold Spring Harbor Laboratory Press,New York
14. Introduction to Practical Molecular Biology, P.D. Dabre, JohnWiley & Sons Ltd., New York, 1988
15. Molecular Biology LabFax, TA. Brown (Ed.), Bios Scientific Publishers Ltd., Oxford, 1991
16. Molecular Cell Biology(5<sup>th</sup> Edition) J. Darnell, H. Lodish and

17. D.Baltimore, Scientific American Books, Inc., USA, Gene VI (Xth Edition) Benjamin Lewin, Oxford University Press, U.K.

18. Molecular Biology and Biotechnology. A comprehensive desk reference, R.A. Meyers (Ed.) VCH Publishers, Inc., New York, 1995
19. Genomes, T.S. Brown
20. Environmental Biotechnology. S. V. S. Rana, Rastogi Publications Meerut.
21. Industrial Microbiology by A. H. Patel
22. Industrial Microbiology by Casida.
23. Biotechnology by U. Satyanarayana.

## 22.

### BIOINFORMAT

### ICS 3S

### Bioinformatics

#### (Fundamentals of Bioinformatics)

**Unit I :** Water as a biological solvent, Structure of water and polarity, Concept of osmolarity, ionization of water, weak acids and bases, Terminologies like, pH, Buffer solution, Molarity, Normality, Normality, equivalent weight and their function in cell.

**Unit II :** Carbohydrates, Definition and classification of carbohydrates, structure, occurrence, and biological importance of Monosaccharide, disaccharides, oligosaccharides, polysaccharides, and Mucopolysaccharides. Proteoglycans and glycoprotein.

**Unit III :** Lipids and fatty acids, Classification, nomenclature, structures and properties of saturated and unsaturated fatty acid, Simple and Compound lipids, Triglycerides, glycerophospholipids, Glycolipids, Isoprenoids, and Steroids, Biological functions of lipids.

**Unit IV :** Proteins, Introduction, Structure, Basic Building Blocks of Proteins, Protein structure, Primary, Secondary, tertiary and Quaternary structures. Denaturation and renaturation of proteins, Biological function of proteins.

**Unit V :** Enzymes, General characters and properties of

enzymes, Nomenclature of enzymes, Holoenzymes, apoenzymes, active sites of enzymes, isoenzymes, Mechanism of enzyme action, factors affecting rate of enzyme catalyzed reaction, Enzyme kinetics. Km value.



**Unit VI :** Metabolism, Definition, Bioenergetics, ATP, structure and biological role, EMP pathway, TCA cycle, Beta hydrolysis, Lipid Biosynthesis, Protein synthesis.

### Practicals : 3S Bioinformatics

#### Section I: Qualitative test and Biochemical Preparations

1. Qualitative analysis of Carbohydrates
2. Qualitative tests for proteins, lipids and amino acids
3. Preparation of buffers of different pH.
4. Measurement of pH of given sample by universal indicator solutions, pH strip and pH meter.

#### Section II: Quantitative analysis

1. Paper chromatography of amino acids.
2. Paper chromatography of Sugars .
3. TLC
4. Estimation of glucose by Benedict's method
5. Estimation of glycine
6. Saponification value of oils.
7. Estimation of proteins by Biuret method.

#### Distribution of Marks for Practical Examination:

**Time: 6 Hours**

**Marks 50**

- |                                      |    |
|--------------------------------------|----|
| 1. Section I (Practical experiment)  | 15 |
| 2. Section II (Practical Experiment) | 15 |
| 3. Viva Voce                         | 10 |
| 4. Practical Record                  | 10 |

### 4S Bioinformatics

#### (Fundamentals of Molecular Biology and immune System)

**Unit I :** Structure of DNA, forms of DNA-A, B, C, D and Z DNA. Secondary structure of RNA, Replication in

prokaryotes and Eukaryotes. Structural organization of Eukaryotic and Prokaryotic genomes. Organelle genome organization and Transposable genetic elements.

**Unit II :** Fundamentals of Structural, Comparative and Functional Genomics and its applications. Genome sequencing methods. Introduction to Genome analysis. Structural organization of Eukaryotic and Prokaryotic genes. Regulation of gene expression in Eukaryotes and Prokaryotes.

**Unit III :** Process of Translation in Eukaryotes and Prokaryotes: Translational factors, Initiation, Elongation and Termination. Regulation of translation in Eukaryotes and Prokaryotes. Structure of Eukaryotic and Prokaryotic Ribosomes.

**Unit IV :** Organs and cells of immune System and their function. Various types of Antibodies, their structure and function. Antigen Antibody Reaction. Antigen, Hapten.

**Unit V :** Humoral and Cell mediated immunity, MHC and immunity to infectious diseases, Vaccines, Lymphocytes trafficking, T- lymphocytes, B-lymphocytes, Macrophages, Dendritic cells, natural killers, Lymphokines, Activated killer cells, Eosinophiles, Neutrophils and mast Cells.

**Unit VI :** Molecular Basis of immunity: Theories of Antigen-Antibody reactions. T Lymphatic and B Lymphatic responses. Different Classes of immunoglobulins and their differentiation. Interferons and Interleukins and its applications.

### **Practicals : 4S**

#### **Bioinformatics Section I**

#### **: Molecular Biology**

1. Isolation of plant DNA by CETAB Method.
2. Isolation of organism DNA by Modified CETAB method.
3. Isolation of Chloroplast.
4. Isolation of Mitochondria.
5. Amplification of DNA by RAPD method.
6. Introduction to Instrumentations: Laminar Air Flow, PCR, Gel Documentation System, Hi-speed centrifuges, Bench top Centrifuges, UV-Spectrophotometer.

7. Separation of Proteins by using SDS-PAGE.

8. Preparation of different percent of Agarose Gel.
9. Isolation of RNA.
10. Quantification of RNA and DNA by UV-Spectrophotometer.

### Section II: Quantitative analysis

1. ELISA- test
2. Test for *Salmonella* strain by using Widal Kit.
3. VDRL- test.
4. Identification of Blood Groups.
5. Identification of RH factor.
6. To perform Antibiotic sensitivity test by Multiple disc method.

### Distribution of Marks for Practicl Examination:

Time: 6 Hours	Marks 50
SectionI (Practical experiment)	15
Section II (Practical Experiment )	15
Viva Voce	10
Practical Record	10

## 23.APICULTURE

### 3SAPICULTURE

#### Paper III (Entomology & Bee Pathology)

- Unit-I** : a) Bees, Insects – harmful & beneficial, man has hunter & beekeeper, bees relation to human culture.
- b) Insects & Classification- Classification of hymenoptera, position of bee in hymenoptera solitary & social bees, progressing evolution of social organization among related bees.
- Unit-II** : a) Genera of bees, honeybees, geographical distribution, nesting behavior, castes & division of labor, general organization of

Trigona.

- b) Apis species, Identification of *A. florea*, *A. dorsata*, *A. cerena*, & *A. mellifera*. Sub spicies, varieties & races. Comparative morphology of Apis species, & individual castes in Apis species.

- c) Head & Abdomen, wax glands, sting apparatus, scent gland.

- Unit–III :**
- Comparative anatomy, digestive system, circulatory system, respiratory system, nervous system, excretory system, reproductive system and sense organs.
  - Mating fertilization, metamorphosis in different castes, physiology of bees , digestion circulation, excretion, respiration & reproduction.

- Unit–IV :**
- Signification of Temperatures, humidity & ventilation of hive.
  - Bee behaviors, Orientation, communication, bee dances, conditioned reflexes Behavioral relation to individual castes egg laying , nursing, foraging , guarding seating, robbing & frightening.

**Unit- V : Bee pathology**

- General classification of bee diseases, diagnostic symptoms. Toxic effects and lethal effects of poisonous pollen, nectar, insecticides & chemicals
- Pathogenic infection – Viral, bacterial, fungal, protozoan & various diseases by endoparasites. & ectoparasites.

**Unit– VI : Bee pathology**

- Predator, enemies of bees- wasps, robber fly, and dragon fly, mites. spider, pseudo scorpion, bee louse, wasp moth, frogs, lizard, birds and monkey.
- General methods of diagnostic preventing, curative measures. Breeding methods for evaluating bee strains, apiary sanitation, control on introduction & migration of stock quarantine measures.

**BSc. II. Semester-III Lists of Practical.**

- Identification of species of Apis and Trigona with caste differentiation.
- Species of honey bees including Trigona
- Comparative external morphology of different parts of body,
  - parts of head, (Worker, drone, queen)

- Mounting of antenna, mandibles, compound eye, ocelli, labrum, proboscis
  - Structure of Thorax, division of thorax, wing structure, legs structure. Petiole, Structure of Abdomen.
  - Mounting of typical tergum, typical sternum, wax glands, wax mirrors, scent gland, male and female genitalia, mounting of sting.
4. Internal anatomy;
- Hypo pharynx with glands, salivary glands.
  - Digestive system adult detailed structure oesophagus, honey stomach typical movement by of honey stomach, ventriculus, and proctodaeum.
  - Circulatory system : Haemocoel and heart,
  - respiratory system, mounting tracheas, types of spiracles air sacs
  - reproductive system, male complete system. Structure of sperms mounting of sperm. Female complete system, queen ovaries, ova
  - Nervous system; entire system in adult, sense organs on antennae, .
- Methods of microscope diagnosis, structure of first spiracle.
  - Nosema symptoms, microscopic diagnosis structure of spores
  - Microscope examinations of EFB bacteria
  - Fungal disease Chalk brood stone brood
  - Viral disease of larva and adults sac brood
  - Bee pest and predators: birds, snakes, lizards frogs, spiders predator wasps ants robber flies, mantids, different type external pests-*Verora jacobsoni*, *Tropiaelaps clareae*, *Acarapis wooki*, and *Neocypholaelaps*.
  - Wasps nest identification of species control; wasps. Wasps. Wax moth life history P.D.B.*Bacillus thuragienis*.

**Field Visit :-** (One visit atleast within the state and One visit atleast outside the state.)

- Visit to Apiary
- Visit to leading institutions.

**Practical-III :**

The distribution of marks for practical examination shall be as follows:

1. Spotting.(1-10)	15
2. Major Dissection (Different organ systems)	12
3. Minor Dissection (Air sacs, heart, sense organs, sting, wax and scent gland)	08
4. Permanent stained mounting.	05
5. Viva-voce.	05
6. Practical Record	05

**TOTAL: 50**

**4S  
APICULTURE  
(BEECHEMIST  
RY)**

**Unit-I : Fundamentals of honey.**

Introduction to bee chemistry major chemical constituents of bees & bee products. Raw material - nectar, composition of nectar, conversion of nectar into honey, unripened (Immature) & ripened (Mature) honey.

**Unit-II : Properties and types of honey**

- a) Physico-chemical & Biochemical characteristics of honey, composition and variations in it due to different factors.
- b) Different types of honey - extra floral honey, apiary honey, unifloral, multifloral honey & extra floral honey, honey dew, squeezed honey.

**UNIT-III : Properties and quality standards of honey.**

- a) Natural properties of honey, hygroscopic & thixotropy, granulation, fermentation, antibacterial activity.
- b) Quality standards of honey, Specifications of honey as per Agmark / BIS / PFA. Factors affecting to the quality of honey, comparison with world standards.

**UNIT-IV: Processing of honey and bee wax.**

- a) Handling and processing of honey. Diversification of honey products - domestic & industrial

applications.

- b) Bees wax, secretion of wax, composition of wax, wax

from *A. florae*, *Apis cerana*, *A. dorsata* & *A. mellifera*. Excretion of bees wax, processing & bleaching of beeswax, quality of bee wax, BIS specifications, bee wax in industrial applications.

#### **UNIT-V : Bee pollen and bee venom.**

- a) Bee collected pollen, composition of bee pollen, industrial use of bee pollen, collection of pollen by pollen trap.
- b) Bee venom, principle of secretion of venom, composition of bee venom, collection of venom from bee colonies, preparation of bee venom, application of bee venom in medical field.

#### **Unit – VI : Royal jelly and propolis.**

- a) Royal jelly - origin of royal jelly, composition of royal jelly, royal jelly in industrial products, collections of royal jelly, preservation of royal jelly.
- b) Propolis - properties & uses of propolis.

#### **BSc, II. Semester-IV. List of Practical.IV**

1. Collection of nectar.
2. Nectar concentration by sugar refractrometer
3. Concentration from sealed and unsealed comb of different species.
4. Use of honey testing kit.
5. Analysis of honey as specification of Agmark/BIS and practical with honey testing kit.
6. To distinguish apiary and squeezed honey, capital density, pollen counts.
7. Analysis of bee wax,
  - a. Melting point. b. saponification value, c. acid value
  - d. Ester value, e. Iodine value, f. Ester/Ash % total volatiles
  - % Aroma, colour.
8. Demonstration of honey processing unit.
9. Demonstration of bee wax extraction Unit.
10. To determine Composition of bee pollens.
11. Collection of pollen by pollen traps.

12. To determine Composition of Royal Jelly
13. Collection and preservation of Royal Jelly.

**Field Visit :-** (One visit atleast within the state and One visit atleast outside the state.)

- i) Visit to Apiary
- ii) Visit to leading institutions.

### Practical-III :

The distribution of marks for practical examination shall be as follows:

1. Spotting.(1-05)	40
2. Physico-chemical analysis of honey.	10
3. Analysis of bee Wax.	15
4. Comments on honey bee products. (Any one)	05
5. Viva-voce	05
6. Practical Record	05
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<b>TOTAL</b>	<b>50</b>
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### List of Reference Books for the subject Apiculture(Semester III & IV) :-

1. First Lesson in Beekeeping : Dadant C.D. Malilton, Illinois.
2. Honey A Comprehensive survey pub-Heinemann(London) & International Bee Research Association England.
3. Value added products for Beekeeping Food & Agriculture - Organisation United Nation Bulletin No.124.
4. Studies in Chemistry of Indian Honeys & Bee Waxes. Thesis for M.Sc. degree submitted to Botany Uni. - Phadke R.E.
5. Investigation of Indian Honey bee Product -
6. Beekeeping in Integrated Mountain Development - Economics & Scientific perspective Publication.
7. Beekeeping- Teach yourself Books,By-Vernon F.(1984)
8. The Chemistry and Technology of Waxes, Reinhold publication Corpn. N.Y.
9. A.B.C.&X.Y.Z of Bee Culture 39 edition - A.Y.Root & Co. America.
10. The hive & the Honey Bee- 1975, 4<sup>th</sup> edition Dadant Publication, America.
11. Bees their vision, chemical senses & language-1950, Cornel University Press- By Fon firsh, & Karl.
12. Honey bee Biology 1982- By Free Johnson & Central Association

of Bee Keepers England.

13. The Social Behaviour of the Bees, 1974 : By Missioner C.D.
14. Beekeeping in India, 1962,82, Sardar singh, ICAR, New Delhi.
15. Beekeeping by E.F.Phillips. Agrobios (India) Publication.
16. Handbook of Beekeeping by Dharamsingh, Devendra Pratap Singh, Agrobios.
17. Technology & Value addition and Honey – Dr.D.M.Wankhale, K.D.Kamble, C.B.R.T.I., KVIC, Pune.
18. Extracted Honey – specification (Second Rev.) - I S 4941` ; 1994 BIS New Delhi.
19. Technology & Honey Bull.- R.Bornecke & Gonnet.
20. ABC & XYZ of Bee Culture (40<sup>th</sup> Edition) 1982, R.A.Morme and K.Flattum, A.I.Root & Co., 623, W. Liberty St. Medina, Dhid, 44336, USA.
21. Apiculture, 1987 (Translated from French in English by R.K.Kauls 1994), P.Jean-Prost, Oxford and IBH Publication, New Delhi.
22. Bee Genetica and Breeding 1986, T.E.Reinderer, Academic Press Inc., London.
23. Bees and Bee Keeping Science, Prentice & World Resources, 1990 – Eva Crane, Heinemann Newnes, Oxford, UK.
24. Bees and Mankind 1982, J.B.Free, George Allen & Unwin (Pub.), Limited London, UK.
25. Biogeography and Taxonomy of Honeybees 1985, F.Ruttmar, Springer-Verlag, Berlin, Jermamy.
26. Bee Biology of the Honey Bee, 87, M.Winston, Harvard University Press, Cambridge, England.
27. (The) Dance Language and Orientation of Bee 1967, K.Von Frisch, Harvard University Press, Cambridge, England.
28. Ecology and Neutral History of Tropical Bees 1989, D.W.Roubik, Cambridge University Press, Cambridge, England.
29. (The) Hive and the Honey Bee 1992 (Revised Edition), J.Graham, Dadint & Sons Inc., Hamilton, Illingis 62341, USA.
30. Honey Bee Ecology – A study of adaptation in social life 1985, T.D.Seeley, Princeton University Press, Princeton, NJOBS 40, USA.
31. Honey Bee Pathology 1991 (Second Edition), L.Bailey & Branda Ball, Academic Press, London.
32. (The) Illustrated Encyclopaedia of Beekeeping 1985, R.J.Morse

- and T.Hooper, Alphabet and Image Ltd., Shareborne, Dorset, UK.
33. Insect pollination of crops (Second Edition) 1993, J.B.Free, Academic Press, London.
34. Neurobiology and Behaviour of Honey, 1985, R.Menzal & A.Mercer, Springer-Verlag, Berlin, Germany.
35. Phonomenon of Bee, 1987, J.B.Free, Chapman and Hall, London.
36. The Social Behaviour of the Bees, A Comparative Study 1974, C.D.Mathener, Harvard University Press, Cambridge, England.

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#### 24. ENVIRONMENTAL STUDIES

Total Marks : 100

##### PART-A

##### SHORTANSWER PATTERN

25 Marks

1. **The Multidisciplinary nature of environmental studies**
  - . Definition, scope and importance.
  - . Need for public awareness. (2 lecture hours)
2. **Social Issues and the Environment**
  - . From Unsustainable to Sustainable development
  - . Urban problems related to energy
  - . Water conservation, rain water harvesting, watershed management
  - . Resettlement and rehabilitation of people; its problems and concerns.  
Case studies.
  - . Environmental ethics : Issues and possible solutions.
  - . Climate change, global warming, acid rain, ozone layerdepletion, nuclear accidents and holocaust. Case studies.
  - . Wasteland reclamation.
  - . Consumerism and waste products.
  - . Environment Protection Act.
  - . Air (Prevention and Control of Pollution) Act.

- . Water (Prevention and Control of Pollution) Act.
- . Wildlife Protection Act.



- . Forest Conservation Act.
- . Issues involved in enforcement of environmental legislation.
- . Public awareness. (7 lecture hours)

### 3. Human Population and the Environment

- . Population growth, variation among nations.
- . Population explosion - Family Welfare Programme.
- . Environment and human health.
- . Human Rights.
- . Value Education.
- . HIV/AIDS.
- . Women and Child Welfare.
- . Role of Information Technology in Environment and human health.
- . Case Studies. (6 lecture hours)

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#### PART-B

ESSAY TYPE WITH INBUILT CHOICE

50 Marks

### 4. Natural resources :

- . **Renewable and non-renewable resources:**
  - . Natural resources and associated problems.
  - Forest resources : Use and over exploitation, deforestation, case studies. Timber extraction, mining, dams and their effects on forests and tribal people.
  - Water resources : Use and over-utilization of surface and ground water, floods, drought, conflicts over water, dams-benefits and problems.
  - Mineral resources : Use and exploitation,

- environmental effects of extracting and using mineral resources, case studies.
- Food resources : World food problems, changes caused by agriculture and overgrazing, effects of modern agriculture, fertilizer - pesticide problems, water logging, salinity, case studies.

- Energy resources : Growing energy needs, renewable and non renewable energy sources, use of alternate energy sources, Case studies.
- Land resources : Land as a resource, land degradation, man induced landslides, soil erosion and desertification.
- . Role of an individual in conservation of natural resources.
- . Equitable use of resources for sustainable lifestyles. (8 lecture hours)

## 5. Ecosystems

- . Concept of an ecosystem.
- . Structure and function of an ecosystem.
- . Producers, consumers and decomposers.
- . Energy flow in the ecosystem.
- . Ecological succession.
- . Food chains, food webs and ecological pyramids.
- . Introduction, types, characteristic features, structure and function of the following ecosystem :-
  - Forest ecosystem
  - Grassland ecosystem
  - Desert ecosystem
  - Aquatic ecosystems (ponds, streams, lakes, rivers, oceans, estuaries) (6 lecture hours)

## 6. Biodiversity and its conservation

- . Introduction - Definition : genetic, species and ecosystem diversity.
- . Biogeographical classification of India.
- . Value of biodiversity : consumptive use, productive use, social, ethical, aesthetic and option values.
- . Biodiversity at global, National and local levels.
- . India as a mega-diversity nation.
- . Hot-spots of biodiversity.
- . Threats to biodiversity : habitat loss, poaching of wildlife, man-wildlife conflicts.

- . Endangered and endemic species of India.
- . Conservation of biodiversity : In-situ and Ex-situ conservation of biodiversity. (8 lecture hours)

## 7. Environmental Pollution

- . **Definition**
- . Causes, effects and control measures of :-
  - Air pollution
  - Water pollution
  - Soil pollution
  - Marine pollution
  - Noise pollution
  - Thermal pollution
  - Nuclear hazards
- . Solid Waste Management : Causes, effects and control measures of
- . Role of an individual in prevention of pollution.
- . Pollution case studies.
- . Disaster management : floods, earthquake, cyclone and landslides. (8 lecture hours)

## PART-C

### ESSAY ON FIELDWORK

**25 Marks**

#### 8. Field work

Visit to a local area to document environmental assets - / forest / grass land / hill / mountain

Visit to a local polluted site - Urban / Rural / Industrial / Agricultural

Study of common plants, insects, birds.

Study of simple ecosystems - pond, river, hill

(5 lecture hours)

(Notes : i) Contents of the syllabus mentioned under paras 1 to 8 shall be for teaching for the examination

- ii) Contents of the syllabys mentioned under paras 1 to4 shall be for teaching to the Semester commencingfirst, and
- iii) Contents of the syllabys mentioned under paras 5 to8 shall be for teaching to the Semester commencinglater.

**LIST OF REFERENCES:-**

- 1) Agarwal, K.C., 2001, Environmental Biology, Nidi Publ. Ltd.,Bikaner.
- 2) Bharucha Erach, The Biodiversity of India, Mapin Publishing Pvt.Ltd., Ahmedabad - 380 013, India, Email : [mapin@icenet.net](mailto:mapin@icenet.net) (R)
- 3) Brunner R.C., 1989, Hazardous Waste Incineration, McGraw HillInc. 480p.
- 4) Clark R.S., Marine Pollution, Clanderson Press Oxford (TB)
- 5) Cunningham, W.P.Cooper, T.H.Gorhani, E & Hepworth, M.T., 2001,Environmental Encyclopedia, Jaico Publ. House, Mumbai, 1196p
- 6) De A.K., Environmental Chemistry, Wiley Eastern Ltd.
- 7) Down to Earth, Certre for Science and Environment (R)
- 8) Gleick, H.P. 1993, Water in Crisis, Pacific Institute for Studies inDev., Environment & Security. Stockholm Env. Institute, Oxford Univ. Press. 473p.
- 9) Hawkins R.E., Encyclopedia of Indian Natural History, BombayNatural Histroy Society, Mumbai (R)
- 10) Heywood, V.H. & Watson, R.T. 1995, Global Biodiversity Assessment, Cambridge Univ. Press 1140p
- 11) Jadhav, H & Bhosale, V.M. 1995, Environmental Protection andLaws, Himalaya Pub. House, Delhi. 284 p.
- 12) Mckinney, M.L. & Schoch, R.M. 1996, Environmental ScienceSystems & Solutions, Web Enhanced Edition. 639 p.
- 13) Mhaskar A.K., Matter Hazardous, Techno-Science Publications (TB)
- 14) Miller T.G.. Jr., Environmental Science, Wadsworth PublishingCo. (TB)
- 15) Odum, E.P., 1971, Fundamentals of Ecology, W.B.Saunders Co.,

U.S.A., 574p.

- 16) Rao M.N. & Datta A.K., 1987, Waste Water Treatment, Oxford & IBH Publ. Co. Pvt. Ltd. 345 p.
- 17) Sharma B.K., 2001, Environmental Chemistry, Goel Publ. House, Meerut.
- 18) Survey of the Environment, The Hindu (M)
- 19) Townsend C., Harper J., and Michael Begon, Essentials of Ecology, Blackwell Science (TB)
- 20) Dr. Deshpande A.P., Dr. Chudiwale A.D., Dr. Joshi P.P. & Dr. Lad A.B. : Environmental Studies, Pimpalpure & Company Pub., Nagpur.
- 21) b-É. É'á±É PÉÉWÉÉ : É'ÉÉÉ'ÉWÉÉÉÉ'É, É'ÉÉÉÉÉÉ +xó: ÉÉÉÉÉÉ (É'±É'É'É, xÉÉÉÉÉ).
- 22) Trivedi R.K., Handbook of Environmental Laws, Rules, Guidelines, Compliances and Standards, Vol. I and II, Enviro Media (R)
- 23) Trivedi R.K. and P.K. Goel, Introduction to Air Pollution, Techno-Science Publications (TB)
- 24) Wagner K.D., 1998, Environmental Management, W.B.SaundersCo., Philadelphia, USA 499p.  
(M) Magazine  
(R) Reference  
(TB) Textbook
- 25) Environmental Studies : R.Rajgopalan, Oxford Uni. Press, New Delhi, 2005
- 26) Environmental Chemistry and Pollution Control, Dasganu Prakashan, Nagpur : Dr.N.W.Ingole, Dr. D.M.Dharmadhikari, Dr.S.S.Patil.

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## SANT GADGE BABA AMRAVATI UNIVERSITY GAZETTE



Official Publication of Sant Gadge Baba Amravati University

PART – TWO

Thursday, the 15<sup>th</sup> June, 2017

### NOTIFICATION

No. 40/2017

Date : 15 June, 2017

**Subject :** Implementation of Syllabi of Various Courses / Subjects as per Semester and Credit Grade System in the Faculty of Humanites from the session 2017-2018 and Onwards.

It is notified for general information of all concerned that, the authorities of the University has accepted of Semester & Credit Grade System syllabi of various Courses/ Subjects of B.A. Part-I Semester-I & Semester – II mentioned in column No.2 and which is to be implemented stagewise from the session 2017-2018 and onwards, with appendices as shown in column No.3 of the following table.

**TABLE**

Sr.No.	Course / Subjects	Appendices of the New Syllabi
1	2	3.

### B.A.Part-I Semester – I & II

1. English  
The Syllabi prescribed for the subject Compulsory English, English Literature, Functional English & Supplementary English which is appended herewith as **Appendix-A**
2. Marathi  
The Syllabi prescribed for the subject Compulsory Marathi , Marathi Literature, which is appended herewith as **Appendix-B**
3. Hindi  
The Syllabi prescribed for the subject Compulsory Hindi, Hindi Literature, & Prayojanmulak Hindi which is appended herewith as **Appendix-C**

4. Sanskrit The Syllabi prescribed for the subject Compulsory Sanskrit & Sanskrit Literature, which is appended herewith as **Appendix-D**
5. Urdu The Syllabi prescribed for the subject Compulsory Urdu & Urdu Literature, which is appended herewith as **Appendix-E**
6. Persian Literature The Syllabi prescribed for the subject Persian Literature which is appended herewith as **Appendix-F**
7. Pali & Prakrit The Syllabi prescribed for the subject Compulsory Pali & Prakrit & Pali Literature which is appended herewith as **Appendix-G**
8. Music The Syllabi prescribed for the subject Indian Music which is appended herewith as **Appendix-H**

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Sd/-

Registrar

Sant Gadge Baba Amravati University

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**SANT GADGE BABA AMRAVATI UNIVERSITY GAZETTE - 2017 - PART TWO -76**

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translocation of elements from soil to plants, translocation of elements within the plant. Factors affecting salt absorption and translocation.

**Unit V** : Biochemistry of plant diseases and biochemical basis of resistance to plant diseases and defensive mechanisms.

**M. Sc. II -  
Biochemistry  
Semester - IV  
Practical - VII  
(Plant Biochemistry)**

- 1) To study water imbibition of line and dead seeds.
- 2) To study kinds of germination
- 3) Assay of amylase and change in sugar content in germinating seeds.
- 4) Estimations of Ascorbic acid in germinating seeds.
- 5) Demonstration of presence of ascorbic acid in vegetable by dye method.
- 6) Isolation of chloroplast from Spinach Leaves.
- 7) Estimation of chlorophyll -a and -b from isolated chloroplast.
- 8) Separation of green plant pigments by column chromatography.

- 9) Demonstration of presence of pectin in guava by jelly formation.
- 10) Determination of Lignin (Klason's method)
- 11) Estimation of tannin in given sample.
- 12) Effect of inhibitor on trypsin activity
- 13) Isolation of plant DNA

**Distribution of Marks in University  
Practical Examination (for Sem I to IV)**

1.	Long experiment	-	15 marks
2.	Short experiment	-	10 Marks
3.	Viva-voce examination	-	05 marks
4.	Spotting	-	05 marks
5.	Practical Record book	-	05 marks
6.	Internal Assessment	-	10 marks
<b>Total</b>			<b>- 50 marks</b>

**Project work-VIII  
Examination of  
Project work:**

1. The examination should be held at the centers of practical examination.
2. There shall be panel of examiners including Head of the department and the supervisor of the student.
3. There should be at least 2 to3 external examiners for a batch of up to 10 students or 3 to5 external examiners for a batch of more than 10 students.
4. The students should submit the project report within 20 days after the last/ final theory paper in university examination.
5. The date of the viva-voce examination on project work should be within the 30 days after the completion of the theory examination.

**Distribution of marks in project work  
examination:**

- |    |                             |   |          |
|----|-----------------------------|---|----------|
| 1. | Evaluation of project       | - | 20 marks |
| 2. | 20 marks (by and examiners) |   |          |
| 3. | Internal assessment         | - | 10       |

marksTotal - 50

marks

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**List of Book recommended for M.Sc. Biochemistry Semester-I to IV**

1. TextBook of Biochemistry by West & Tood.
2. Principles of Biochemistry by Lehninger
3. Principles of Biochemistry by White Handler & Smith.

4. Textbook of Biochemistry & Human Physiology by G.P.Talwar.
5. Biochemistry by Stryer.
6. Out lines of Biochemistry by Conn & Stumpf.
7. Biophysical Chemistry-by Upadhyay & Nath,Himalaya publ
8. Fundamentals of Biochemistry by ILJain,S Chand.
9. Animal Physiology by Arora M.P.,Himalaya Publication
- 10.. Practical Cytology, Genetics & Biostatistics by Goswami H:K.
11. Advances in Biotechnology by Kumar N.C.
12. Animal Nutrition and Feeding Practices by S.K.Ranjhan, Atlantic pub.
13. Biotechnology: A new Industrial Revolution by Steven prentis, Atlantic Publication.
14. The Story of Iodine Deficiency An International Challange in Nutnition Basil S. Hedzel, Atlantic Pub!.
15. Nitrition & Preventive helth care by Mary Alic *CaLiendo* Atlantic Publ.
16. The, Vegetarian Alternative A guide to helpful & human Diet Vick Sussma Atlantic Publ.
17. Genetics by P.S.Verma & V.K.Agrawal, S.Chand & Co: .
18. Cell Biology, Genetic, evolution & Ecology by P.S.Verma & V.K.Agrawal, S.Chand & Co.
19. Elementary Biochemistry by J.LJain, S.Chand & Co.,
20. *Plant Physjology & Biochemistry* by Verma S.K.*Chand & Co.,*
21. Advances in Chromatography (In two volumes)by Giddings, S.Chand & Company.
22. Instrumental Methods of Analysis by Willard Merritt Dear CBS, Publication.
23. The chemical Foundations of Molecular Biology by Steiner, S.Chand & Company.
24. Animal Physiology & Biochemistry IInd Ed.1994 by R.A.Agrawal Anil Shrivas faw & Kaushal kumar S.Chand .
25. Animal Physiology 6th ed. 1994 by P.S.Verma, V.K.Agrawal & P.S.Tyagi S.Chand & Co. .
26. Biotechnology & other alternative Technologies for Utilization of Biomass/Agricultural Waste by Chakraverti. Oxiford & IBH-Pub:
27. Genetic Engineering & Biotechnology by Chopra Nasim.
28. Gene IV by Levin.
29. Biotechnology by Keshav Terham.
30. Biotechnology in Agriculture by Chopra (Oxford & IBH Pub.)
31. Genetic Engineering & Biotechnology by Chopra/Nasim (Oxford & IBH pub.)
32. Textbook of Animal Physiology IInd Ed. by Nagabhu Sharam/ (Oxford & IBHPub.)
33. Biotechnology by OECD (Oxford & IBH )
34. Biotechnology & Patent Protection by OECD, Oxford & IBH.
35. Advances in Cell & Chromosomes Research by Shрма & Shрма (Ed.) (Oxford & IBH publishings)
36. Cell physiology by Swa.mi (Oxford & IBH Publishings)
37. Bioactive compounds from Marine Organisms by Thompson Et al (Oxford & IBH Publishings)
38. Text book of Biochemistry by West/Todd (Oxford & IBH Pub.)
39. Biotechnology Business Possibilities and prospects by Malgavkar (Oxford & IBH publishing)
40. Biomass for Energy by OECD (Oxford & IBH Publ.)
41. A Hand book of Modem Physiology (c) by Pal/(Oxford & IBH Publishings)
42. Handbook of Clinical Genetics (C) by Talukdar/Sharms, Oxford & IBH Publishings)
43. Applied Nutrition (3/E) by Rajalkshmi (Oxford & IBH Pub.)
44. Naomal and Therapeutic Nutrition (16/E) By Robinson/Proudfit (Oxford & IBH Publishings)
45. Stereo chemistry of organic compounds (1994) by E L Eliel & SHW Awley, Inter Science Pub. 30 Wiley and Sons. Inc.
46. Organic Chemistry (6th Ed. 2000) by R.T. Morrison & R.N.Boyd, Prentice Hall of India New Delhi.
47. Organic Chemistry Vol. 1 Fundamentai Principles (6th Ed. 1985) by I.L.Finar, ELBS, Vol.2 Stereo Chemistry and the Chemistry of Natural Products. (5th ed. 1985) by I.L.Fina, BLBS.
48. Physical Biochemistry by Kansal Edward Van Ho1de (1971 ) Prentice Hall Inc., New Jersey.
49. Physical Biochemistry 2nd ed. (1982) by David Friefelder, W.H.Freeman-and Co.NY. .
50. Principles and Techniques of Practical Biochemistry (4th ed 1999) by K.Wilson and J.Walker (eds.) Cambridge Univ. Press.
51. Molecular Biology of the Cells (3rd Edn. 1994) by Alberts et al., Garland Publications Inc.NY and London.
52. Ge11Bioiogy (1993) by E.S.Sedava, Jones and Barlett Publishers Boston, London. .
53. Cell and Molecular Biology (8th Ed. 2001) by E D P de Robertis & E M F de Robertis (Jr.) Lippincott Williams & Wilkins, Philadelphia.
54. Principles of Cell Biology (1988) by Klein Smith and M.Kish, Harper-Cellins Pub.Inc.New Delhi. .



55. Text Book of Medical Physiology (10th Ed. 2001) by A.C.Guyton & J.E.Hall, Harcourt Asia.
56. Biochemistry (4th edn. 1992) by Lubert Stryer WH Freeman & Co., NY
57. Handbook of Photosynthesis (ed) Mohammad Pe Sarakle, Marcel Dekkar, Inc. NY, Basel, Hong Kong 1997.
58. Introduction to Plant Biochemistry (1983) T W Goodwin and E I Mercer, Pergaman Press, Oxford, NY, Toronto: Sydney, Paris, Frankfurt.
59. Seed Physiology of development and germination (2nd ed. 1994) J, D Bewley and M Black Plenum Press NY.
60. Biochemistry of Energy utilization in plants D T Dennis Blackie, Glasgow and London 1987.
61. Plant Biochemistry by P M Dey and J B Harborne. Harcourt Asia PTE Ltd., Singapore. . . .
62. The Chemical Kinetics of Enzyme Action by K J Laidier and P S Bunting, Oxford University Press, London.
63. Enzyme Structure and Mechanism (1977) by Alan Fersht, Reading, USA.

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Sr.No.Paper Nos.	Page
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1. Special Note	1
2. Ordinance No. 4 of 2008	3

### M.Sc. Part-I Semester I

1 I(Biomolecules)	1
2 II (Analytical Techniques)	1
3 III (Advance Enzymology)	2
4 IV (Bio-Energetics and Biological oxidation)	3

### M.Sc. Part-I Semester-II :

5 V (Clinical Biochemistry)	4
6 VI (Endocrinology and Neurochemistry)	5
7 VII (Cell Biology)	6
8 VIII (Bioinformatics, Biostatistics and Research Methodology)	6

### M.Sc. Part-II Semester-III :

9 IX (Basic Immunology)	8
10 X (Applied Immunology)	9
11 XI (Fermentation Technology)	9
12 XII (Recombinant DNA Technology)	10

### M.Sc. Part-II Semester-IV :

13 XIII (Physiology)	12
14 XIV (Advanced Molecular Biology)	13
15 XV (Plant Biochemistry)	15
16 XVI (Plant Nutrition and Reproduction)	15

- 1) Restriction Digestion of DNA
- 2) DNA Ligation
- 3) DNA Molecular size Determination
- 4) DNA Fingerprinting
- 5) Southern hybridization
- 6) Restriction Mapping
- 7) In vitro Transcription
- 8) Southern Blotting
- 9) Northern Blotting
- 10) Plasmid preparation
- 11) Genomic DNA isolation.
- 12) Gene Cloning
- 13) Bacterial Gene expression.
- 14) Bacterial Transformation
- 15) Bacterial Conjugation
- 16) Bacterial Transduction
- 17) Whole Blood DNA extraction.
- 18) Educational tour and submission of report.

### Project work (Marks 50)

#### Distribution of marks in University

#### Practical Examination:

1. Long Experiments (At least two)	-	15 marks.
2. Short Experiments	-	10 marks.
3. Viva-voce examination	-	05 marks
4. Spotting	-	05 marks
5. Practical record book	-	05 marks
6. Internal Assessment	-	10 marks

**Total - 50 marks**

#### Distribution of marks in Project work Examination:

1. Valuation project	-	40 marks
1. Internal Assessment	-	10 marks

**Total - 50 marks**

Supervisor of the Studentaminers including Head of the departmentand the

2. There should be at least 2 to 3 external examiners for a batch of up to 10Students or 3 to 5 external examiners for a bach of more than 10 Students.
3. The Students should submit the project reporty within 20 days afterthe last/final theory paper in University examination.
4. The date of Viva-voce examination on project work should be withinthe 30 days after the completion of theory examination

### **Distribution of marks in Project work examination:**

- |   |    |
|---|----|
| 1. Evaluation of Project  | 20 |
| 2. Viva--voce (Jointely by internal and<br>marksexternal examiners) | 20 |
| 3. Internal   | 10 |

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**Total : 50 marks**

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### **Books recommended for M.Sc. Part-I & Part-II (Microbiology)**

1. Biophysical Chemistry - Upadhyay & Nath (Himalaya Pub.)
2. Practical Biochemistry - Plummer (TMH Pub.)
3. Principal of Biochemistry - Lehninger (CBS Pub.)
4. Practical Biochemistry - Jayraman (Wiley Estern Pub.)
5. Physical Biochemistry - Morrison (Oxford)
6. Enzyme - Dixon &. Webb
7. Fundamentals of Enzymology - Lewis (Oxford)
8. Bacterial metabolism - A.H. Rose
9. Biochemistry - West & Toad
10. Out line of Biochemistry - Corn & Stump. (Wiley Eastern Pub.)
11. Soil Microbiology - Alexander (Wiley Eastern Pub.)
12. Genes VIII - Lewin (Oxford)
13. Element of Biotechnology - P.K. Gupta. (Rastogi Pub.)
14. Fundamentals of Biotechnology - Purohit & Mathur (Agro Bot. Pub.)
15. Essentials of molecular biology - Freifelder D. (Narosa Pub.)
16. A textbook of biotechnology - Duby (S. Chand Pub.)
17. Molecular Biology - Freifelder D. (Narosa Pub.)
18. Microbial Genetics - Freifelder D. (Narosa Pub.)

22 Kurian and Sebastian. Prawns and Prawn Fisheries of India. Hindustan Publ. Co., 1976.

23. Lagler, K. F Studies in fresh water fishery biology 1950
24. Lagler, K. F., Bardach J.E., Miller R.R. and May Passino, D.R. Ichthyology, John Wiley, 2003.
25. Nilsson, S. & Holmgren, S., Fish Physiology Recent Advances, Croom Helm, London, 1986.
26. Norman, J. R. and Greenwood P. H. A History of Fishes, Third Ed., Ernest Benn Limited, London. 1975.
27. Norris, D. O., Vertebrate Endocrinology (2nd ed.), Academic Press, 1997.
28. Proceedings of International Symposium on Reproductive Physiology of fishes. 1982, 1987, 1991, 1995, 1999 (68) Piska R. S., Fisheries and Aquaculture, Lahari Publications Hyderabad
29. Ribelin, W. E. & Migaki, G., The Pathology of Fishes, The Univ. of Wisconsin Press, 1975.

Rick Parker, Aquaculture Science, 2nd Edition, Delmar Thomson

## Learning

30. Rounsfell, G.A. and Everhart, W. H., Fishery Science: It's Methods and Applications, John Wiley & Sons, Indian Reprint International Books and Periodicals Supply Service, New Delhi 1985.
31. Santhanam, R. Fisheries Science, Daya Publishing House, 1990.
32. Singh, B. R. Advances in Fish Research, Vol. I and II Narendra Publishing House, Delhi 1993 and 1997.
33. Srivastava, C.B.L. A Textbook of Fishery Science and Indian Fisheries, Kitab Mahal. 1985
34. The Wealth of India, Raw Materials Vol. IV, Fish and Fisheries, CSIR, 1962.

## M. SC. IIZOOLOGY

### SEMESTER-IV

#### Project Work:

The subject of the project will be given to a student independently on any topic belonging to Life sciences. The examinee shall be required to produce three typed copies of project signed by teacher in-charge and certified by the department as bonafide work of him/her. Oral presentation is necessary to explain details there of the project. Therefore, he/she is required to prepare transparencies for O.H.P. or slides for slide projector, or power point program for L. C. D. projector if available. The *viva voce* on the project shall be the part of interaction among the examiner and the student presenting his/her project. Valuation and marks will be submitted to the university.

#### Distribution of marks –

1.	Project submission	80
2	Viva)	20

**Total : 100 marks**

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9. Methods of testing for petroleum and petroleum products. IS 1448-1960 Part I to Part IV. Published by ISI New Delhi 1967
10. IP Stands for Petroleum and products Published Applied Service Publisher Ltd. London, 33<sup>rd</sup> Edition 1974.
11. American Stds. For testing Materials, New York 1967.
12. Textbook of Inorganic Chemistry by A. I. Vogel.
13. Instrumental Methods of Analysis by Willard, Merit and Dean
14. Industrial Chemicals, Faith et. al. Wiley Interscience New York
15. Textbook Of Practical Organic Chemistry by I. C. Voley.
16. Industrial Organic Chemistry by J. K. Stille
17. Unit Operations by Kale

18. Reagents for Organic Synthesis Fisher and Fisher.
19. Technique of Organic Chemistry Vol I, Part I- IV A. Weishberger.

### Semester IV

#### Analytical Chemistry Practicals (Special)

**Total Hours: 90 hrs. (9 Hours per week)**

**Marks: 100**

- 1) Solvent extraction of Al/Mg or Mg/UO<sub>2</sub> using 8- hydroxy quinoline complex and determination by spectrophotometry.
- 2) Separation and estimation of copper and cobalt on cellulose Column.
- 3) Analysis of pyrosolite with respect to I) iron II) Manganese
- 4) Assay of sulphur drugs
- 5) Analysis of vit. C in juice and squashes
- 6) Determination of saponin value and iodine value of oil.
- 7) Determination of p- nitrophenol by colorimetry.
- 8) Determination of iron in syndets by colorimetric method.
- 9) Determination of Phenol by Conductometry.
- 10) Potentiometric determination of thiourea.
- 11) Estimation of calcium/sodium in the sample of dairy whitener by flame photometry.
- 12) Analysis of pigments with respect to Zn and Cr.
- 13) To determine the amount of each copper and bismuth or copper and iron (III) from the given mixture at 745 nm by spectrophotometric titration using solution of
- 14) EDTA identification of sulphur drug in tablets and ointments by TLC.
- 15) Fertilizer analysis for N, P, K
- 16) Analysis of iodized table salt for its iodine content.
- 17) Estimation of the purity of given azo dye colorometrically.
- 18) Chemical analysis of chilly and turmeric powder.
- 19) Simultaneous estimation of Cl and I by potentiometric method.

- 20) Colorimetric determination of simple ions (phosphate, sulphate, nitrate/nitrite, toxic heavy metals).
- 21) Analysis of soap and detergent.
- 22) Determination of alcohol from beverages spectrophotometrically using dichromate.
- 23) Determination of amount of Zinc from the given sample solution by Nephelometric/Turbidimetric titration using standard solution of Ba (NO<sub>3</sub>)<sub>2</sub> or Pb (NO<sub>3</sub>)<sub>2</sub>
- 24) Analysis of Pharmaceutical mixtures
- 25) Simultaneous determination of Vitamic C and Vitamin E
- 26) Analysis of some common pesticides insecticides, plastics and detergents
- 27) To determine the amount of each para nitro-phenol and meta nitro-phenol from the given mixture by spectrophotometric titration using standard solution of NaOH (max-280 nm)
- 28) Estimation of sodium benzoate/sodium metabisulphite. boric acid and salicylic acid in food
- 29) ) Analysis of chrome steel alloy for chromium and nickel content
- 30) Agricultural analysis of soil sample, animal feeds, soil micronutrients, milk powder for Ca, Fe and P content.
- 31) Any other relevant expt. may be added

The Practical examination will be based on the syllabus of Analytical Chemistry (Special Papers).

**Time: 6-8 hours (one day examination)**

**Marks:**

**100**

I) Exercise -1	- 40 Marks
II) Exercise-2	- 40 Marks
III) Record	- 10 Marks
IV) Viva- Voce	- 10 Marks

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**Total -100 Marks**

**M.Sc. (Chemistry) Semester-IV**

**Practical-VIII - Project Work**

**The Students will develop utilities such as analytical**

spectra, simulation programmes that will supplement laboratory exercises in their subject of specialization. For this, variety of small research project designed by the teacher based on the interest of the student and capabilities should be worked out.

Time : 9 Hrs. Per Week

Marks :

The project will be evaluated by external and internal examiners.

**Study Tour:** Educational / Industrial tour is compulsory for M.Sc.

**Chemistry.**

(i) Semesters I / II : Visit to local industry.

(ii) Semester III / IV : Education tour to visit the industry / Research Laboratory.

## List of equipments/apparatus required for the M.Sc. Chemistry Semester-I to IV

### Practicals.

1. Conductivity meter	03 nos./batch
2. pH meter	03 nos./batch
3. Potentiometer	03nos./batch
4. Polariometer	02 nos./batch
5. Centrifuge machine	02 nos./batch
6. Vaccum Pump	01 no./batch
7. Hot air oven	01 no./batch
8. Blower hot & cold	03 nos./batch
9. Stop watch	10 nos./batch
10. Weight box con.100 gm.	10 nos./batch
11. Analytical double pan balance	10 nos./batch
12. One pan electrical balance	10 nos./batch
13. Tripple beam balance	02 nos./batch
14. Melting point apparatus	02 nos./batch
15. Spectro photometer	02 nos./batch
16. Water still	01 no./lab
17. Colorimeter	02 nos./batch
18. Thermostate	01 no./batch
19. Electrodes platinum	03 nos./batch
Silver	03 nos./batch
Glass	03 nos./batch
Reference	03 nos./batch
20. Heating mentle	02 nos./batch
21. Glass double distillation unit	01 no./lab
22. Flamed Photometer	01 no./batch
23. LCR meter	01 no./lab

24. Polarpraph with recorder	01 no./lab
25. U.V.visible spectrophotometer	1 no./lab
26. Standard cell	02 nos./batch
27. Muffle furnace	01 no./lab
28. D.C.Voltmeter	01 no./lab
29. Infrared lamp	05 nos./lab

30. Refrigerator	01 no./lab	nos./batch(for Nitrogen element estimation)	
31. Magnetic stirrer 2 ml, 5 ml.	02 nos./batch	3. Distillation unit	04 nos./batch
32. Dimmer state	01 no./lab	4. Separating funnel	10 no./batch
33. Abbe's refractometer	01 no./batch		
34. Sodium lamp for polarimeter	02 nos./batch		
35. T.L.C. Kit	01 no./lab		
36. Calorimeter	01 no./lab		
37. Bomb Calorimeter	02 nos./batch		
38. BOD analyser	01 no./lab		
39. Water analysis kit	01 no./lab		
40. Computer-386/486	01 no./lab		
41. U.V.Lamp 02 no./lab			
42. Ice making machine	01 no./lab		
43. LCR bridge	01 no./lab		
44. HPLC	01 no./lab		
45. Deioniser	01 no./lab		
46. Ion exchange column's	04 no./lab		
47. Turbidity meter	01 no./lab		
48. Optical densitometer	01 no./lab		
49. Orsat apparatus (gas analysis)	01 no./lab		
50. Interferometer (ultrasound)	01 no./batch		
51. Youy's balance	01 no./lab		
52. Hydraulic press	01 no./lab		
53. Shaking machine	01 no./lab		
54. G.M.Counter	01 no./lab		
55. Electrophorasis apparatus	01 no./lab		
56. Karl-Fisher Titration apparatus	01 no./lab		
57. Power supply (regulator)	01 no./batch		
58. Regulated furnace	01 no./lab		
59. Thermocouple	01 no./lab		
60. Vaccum oven	01 no./lab		
61. Top pan balance	01		
no./labetc.,			

### List of glasswares (main) for M.Sc. Chemistry Semester-I to IV Practicals

1. Soxhlet set	02 nos./batch
2. Kjeldahl's apparatus set	02



5.	250ml	10 nos./batch
	500ml	10 nos./batch
6.	Quick fit stand joints b-14, b-19, b24	
7.	China dishes	10 nos./batch
8.	Dessicators	10 nos./batch
9.	Thiel's tube for melting point	05 nos./batch
10.	Quick fit water condensers b-19, b-24	10 nos./batch
11.	Quick fit flasks, Capacity 50 ml, 100 ml, 250ml, 500ml, 1000ml.	10 nos./batch

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**8. M.Sc.Semester-I****INDEX**

M.Sc. (Physics) Prospectus No.2015124

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<b>Sr</b>	<b>Subject</b>	<b>S U B J E C T</b>	
		<b>P A G E</b>	

<b>No.</b>	<b>Code</b>		<b>NO.</b>
1.	-	Special Note	1
2.	-	Ordinance No.4 of 2008	3
3.	-	Direction No.14 of 2009	
4.	-	Direction No.26 of 2010	12
5.	-	Direction No.27 of 2010	35
6.	-	Direction No.39 of 2011	38
7.	-	Direction No.25 of 2012	40

3 Phy 4 (iv) Photonics-I

3 Phy 5 Lab on elective  
(Specialization)

--3 Phy 6 Review +Seminar Report  
Evaluation(Survey)

## 11. M.Sc.Semester-IV

4 Phy 1 Nuclear & Particle Physics 24

4 Phy 2 OPAMP theory and applications 26

4 Phy 3 (i) Micro-processor Programming 27

1Phy1 Mathematical Physics 3

1Phy2 Classical Mechanics 4

1Phy3 Quantum Mechanics-I 5

1Phy4 Computational Methods and Programming 6

1Phy5 LABORATORYCOURSE- 1 7

1Phy6 LABORATORYCOURSE- 2 8

## 9. M.Sc.Semester-II

2 Phy1 Electrodynamics-I 8

2 Phy2 Quantum Mechanics-II 9

2 Phy3 Solid State Physics 10

2Phy 4 (i) Net work Theorems and Solid State Devices 11

2Phy 4 (ii) Lasers & Laser Applications 12

2Phy5 LABORATORYCOURSE- 1 13

2 Phy 6 LABORATORYCOURSE- 2 14

## 10. M.Sc.Semester-III

3 Phy 1 Electrodynamics -II (Radiation & Plasma Physics) 15

3 Phy 2 Statistical Mechanics 16

3 Phy 3 Atomic & Molecular Physics 17

and Interfacing

4 Phy 3 (ii) Condense Matter Physics-II 28

4 Phy 3 (iii) Digital Communication 29

4 Phy 3 (iv) Photonics-II

4 Phy 4 (i) Advance Microprocessors 30

and Microcontrollers

4 Phy 4 (ii) Nano-science and Nanotechnology 32

4 Phy 5 Lab on elective (Specialization) 38

3 Phy4 ( i ) Digital Techniques	18
3 Phy4 ( ii ) Condensed matter Physics-I	20
3 Phy4 ( iii ) Analogue Communication	21

## SYLLABUS PRESCRIBED FOR M.SC. SEM-I TO IV PHYSICS

M.Sc. (Physics) 4-Semester course contents

(Restructured syllabi finalised by Sub-Committee of BOS (Physics))

CODE	TYPE	TITLE OF THE PAPER/LABORATORY	Remarks
1PHY-1	C	Mathematical Physics	Compulsory
1PHY-2	C	Classical Mechanics	Compulsory
1PHY-3	C	Quantum Mechanics-I	Compulsory
1PHY-4	C	Computational Methods and Programming	Compulsory
1PHY-5	C	General Lab	Compulsory
1PHY-6	C	Computer Lab	Compulsory
2PHY-1	C	Electrodynamics-I	Compulsory
2PHY-2	C	Quantum Mechanics-II	Compulsory
2PHY-3	C	Solid State Physics	Compulsory
2PHY-4	E/GIC	i.Net work Theorems and Solid State Devices ii. Lasers & Laser Applications Elective Interdisciplinary	
2PHY-5	C	Lab on Solid State Physics	Compulsory
2PHY-6	C	Lab on Electronics	Compulsory
CODE	TYPE	TITLE OF THE PAPER/LABORATORY	Remarks
3PHY-1	C	Electrodynamics -II (Radiation & Plasma Physics)	Compulsory
3PHY-2	C	Statistical Mechanics	Compulsory
2. ES	→	Elective Specialization to be selected by the Institution. If a student selects 3PHY-4(i) at the 3 <sup>rd</sup> Semester then 4PHY-5 & 4PHY-5 will be on the elective specializations.	

- 3PHY-6 at the third semester is related with Review +Seminar Report Evaluation (Survey).
- 4PHY-6 is related with Experimental Project +Seminar Report Evaluation
- The topic for 3PHY-6 must be related with 4PHY-6.
- The experimental Projects in 4PHY-6 may be based on research area.
- The student is required to submit three copies in each case i.e. 3PHY-6 and 4PHY-6 at the time of examination.
- The performances in 3PHY-6 and 4PHY-6 will be evaluated by an external and an internalexaminers appointed by the S.G.B.Amravati University, Amravati.

The topic of the Project which is to be completed by every student during fourth semester under 4PHY-6 is to be decided at the beginning of third semester. Accordingly the students are expected to do literature survey, define the problem of the project work and prepare a report including scope, limitation and objectives and deliver the seminar.

### The distributions of Lab activity marks :

Lab Activity codes	60% weightage	20% weightage	20% weightage
1PHY-5,	Performance of the student	Viva-Voce	Record and
1PHY-6,	at the time of examination	performance in	the Lab
2PHY-5,	including report.		
	assignments	2PHY-6,	
3PHY			
5 and			
4PHY			
-5			
3PHY-6	Performance in the seminar	Viva-	
	Voce	Seminar report at the	
		time of examination	
4PHY-6	Outcome of the Project and	Viva-Voce	
	Project report		

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<b>1. Semester I</b>		
1. MGI -101 Principles of Remote Sensing		2
2. MGI -102 Introduction to GIS		3
3. MGI -103 Geodesy and GPS		4
4. MGI -104 Introduction to IT		5
5. MGI -105 Remote Sensing Practical		6

6. MGI -106 GIS Practical

6

**8. Semester II**

- |   |    |
|---|----|
| 1. MGI -201 Principles of Cartography       | 6  |
| 2. MGI -202 Digital Image Processing        | 7  |
| 3. MGI -203 Photogrammetry                  | 8  |
| 4. MGI -204 Spatial Modeling & Analysis     | 9  |
| 5. MGI -205 Digital Image Processing Lab    | 10 |
| 6. MGI -206 Spatial Modeling & Analysis Lab | 11 |

**9. Semester III**

- |  |    |
|--|----|
| 1. MGI -301 Research Methodology   | 11 |
| 2. MGI -302 GIS Application Development                                    | 12 |
| 3. MGI -303 Geoinformatics Applications in<br>Natural Resources Management | 13 |
| 4. MGI -304 Geostatistics  | 14 |
| 5. MGI -305 Geostatistics Lab.   | 15 |
| 6. MGI -305 GIS Applications in Natural Resource<br>Management Lab         | 15 |

**10. Semester IV**

- |   |    |
|---|----|
| 1. MGI - 401 Database Management System                                     | 15 |
| 2. MGI - 303 Web Mapping and Web GIS  | 16 |
| 3. MGI - 403 Geoinformatics Applications<br>in Agriculture                  | 17 |
| 4. MGI - 404 Geoinformatics Applications in<br>Water Resources Management . | 18 |
| 5. MGI - 405 GIS Applications to agriculture and<br>Water Resources (Lab)   | 19 |
| 6. MGI - 405 Project (Lab)  | 19 |
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# SANT GADGE BABA AMRAVATI UNIVERSITY, AMRAVATI

Syllabi prescribed for Master of Science in Geoinformatics

## Semester-I to IV

### Semester I

1. MGI -101 Principles of Remote Sensing
2. MGI -102 Introduction to GIS
3. MGI -103 Geodesy and GPS
4. MGI -104 Introduction to IT
5. MGI -105 Remote Sensing Practical
6. MGI -106 GIS Practical

### Semester II

1. MGI -201 Principles of Cartography
2. MGI -202 Digital Image Processing
3. MGI -203 Photogrammetry
4. MGI -204 Spatial Modeling & Analysis
5. MGI -205 Digital Image Processing Lab
6. MGI -206 Spatial Modeling & Analysis Lab

### Semester III

1. MGI -301 Research Methodology
2. MGI -302 GIS Application Development

### 3. MGI -303 Geoinformatics Applications in Natural Resources Management

4. MGI -304 Geostatistics
5. MGI -305 Geostatistics Lab.
6. MGI -305 GIS Applications in Natural Resource Management Lab

### Semester IV

1. MGI - 401 Database Management System
2. MGI - 303 Web Mapping and Web GIS

### 3. MGI - 403 Geoinformatics Applications in Agriculture

4. MGI - 404 Geoinformatics Applications in Water Resources Management .
5. MGI - 405 GIS Applications to agriculture and Water Resources (Lab)
6. MGI - 405 Project (Lab)

**Syllabus prescribed for M.Sc.  
Geoinformatics (Semester-I)  
101- Principles of Remote  
Sensing**

**Unit 1** : Fundamentals: Definition – Scope –Energy sources – Electro Magnetic Radiation – energy interaction in the atmosphere – atmospheric windows – energy interaction with earth surface features – spectral reflectance patterns for different regions of EMR- Platforms – data capture types and systems –Sensors- Resolution: spatial, spectral, radiometric and temporal resolution.

**Unit 2** : History of Aerial Photography, principles of photography, Types of ‘Photographs, Elements of Photograph, Aerial Cameras, Stereoscopic Viewing.

**Unit 3** : Satellite programs in India - Data Products – orbit system – sensor characteristics, Data Products: Types – visual and digital - standard – special products – referencing system – annotation – image interpretation elements.

**Unit 4** : Thermal Remote Sensing: thermal infrared radiation – thermal properties of materials – emissivity of materials – Thermal IR detection and imaging – characteristics of TIR images- applications.

**Unit 5** : Remote Sensing applications – Soil – Land use\Land cover – Watershed management - Disaster management – Urban Planning

**Text Books**

1. Lillis and T.M. , R.W.Kiefer and Chipman (2004) 5th edition. Remotesensing and image interpretation, John Wiley & Sons, New York.
2. Campbell B.,(2007) Fourth Edition, Introduction to Remote Sensing, The Guildford Press

**References**

1. Hayes L., [1991] Introduction to Remote Sensing, Taylor and Francis Publication, London.
2. Henderson, F. M., and Anthony J. Lewis, 1998, Manual of Remote Sensing, Volume 2, Principles and Application of Imaging Radar, 3rd Edition, John Wiley and Sons Inc, Canada, USA.
3. Sabins F.F Jr.(1987) Remote Sensing: Principles and Interpretation, W.H.Freeman & Co., New York.
4. Curran P.J (1985) Principles of Remote Sensing, Longman, Essex.



## 102- Introduction to GIS

**Unit 1 :** Definition - maps and spatial information - components of GIS, maps and spatial data - thematic characteristics of spatial data - other sources of spatial data: census, survey data, air photos, satellite images, field data.

**Unit 2 :** Spatial and attributes data Spatial entities - Raster and Vector spatial data structures - comparison of Vector and Raster Methods - Acquisition of spatial data for terrain modeling  
- Raster and Vector approach to digital terrain modeling - modeling network - layered approach and object database management system - linking spatial and attribute data.

**Unit 3 :** Data Input and Editing: Integrated GIS database - Encoding methods of data input: keyboard, manual digitizing scanning and automatic digitizing methods, electronic data transfer  
- data editing: methods of developing and correcting errors in attributes and spatial data.

**Unit 4 :** Data Analyzing Operation in GIS: Terminologies - Measurements of lengths, perimeter and area in GIS - queries - reclassification - buffering and neighborhood functions - integrated data - Raster and Vector overlay method: point-in-polygon, line-in-polygon and polygon-on-polygon - problems of Raster and Vector overlays - spatial interpolation - GIS for surface analysis - network analysis.

**Unit 5 :** Models of spatial processes: - conceptual models - models of physical and environmental processes - problems related to using GIS to model spatial processes. Maps as output - alternative cartographic outputs - non-cartographic outputs maps as decision tools.

### Text Books

1. Heywood's, Comenius's and S. Carver (2006) An Introduction to Geographical Information Systems, Dorling Kindersley (India) Pvt. Ltd.

2. Burroughs PA 2000 PA McDonnell [2000] Principles of Geographical Information systems, London: Oxford University Press.

### References

1. Lo.C.P., Yeung. K.W. Albert (2002) Concepts and Techniques of Geographic Information Systems, Prentice-Hall of India Pvt Ltd, New Delhi

2. Longley, P.A., Goodchild, M.F., Maguire, D.J. and Rhind, D.W. (2005) Geographic Information Systems and Science. Chichester: Wiley. 2nd edition
3. Burgh P.A (1986) Principles of geographical Information System for Land Resources Assessment, Clarendon Press, Oxford.

### 103- Geodesy and GPS

- Unit 1** : Definition and scope of Geodesy, Earth, Geoid, and Ellipsoid of rotation, Reference surfaces and coordinate systems in Geodesy, Indian Geodetic System and Everest Spheroid, World Geodetic System 84(WGS 84).
- Unit 2** : Geometry of Ellipsoid of rotation, Normal sections, Principal radii of curvature, Geodetic coordinates and Natural coordinates, Classification of control survey, 1st and 2nd order horizontal control by triangulation, Trilateration, surfaces and plumb lines, Fundamental equation of Physical Geodesy.
- Unit 3** : Fundamentals of GPS: Introduction, Space segment, User segment and Control segment, Observation principle and signal structure, Intentional limitation of system accuracy, Accuracy of GPS measurement. Point positioning and relative positioning, GPS Observations and Data Processing: Code and carrier phase observables, Linear combinations and derived observables.
- Unit 4** : GPS Receivers: Receiver Concepts and main receiver components, Examples of GPS receivers, Classical receivers, Examples of currently available geodetic receivers, Navigational receivers.
- Unit 5** : Planning and Realization of GPS Observations: Methods of surveying with GPS, Static, and Kinematic positioning, Navigation with GPS, Differential GPS. DGPS Surveys- application of DGPS surveys and the associated limitations.

#### Text Books

1. Torge, Wolfgang. 1991 Geodesy, 2nd Edition, New York: deGruyter.

2. B. Hofmann-Wellenhof and H. Moritz, Physical Geodesy, Springer-Verlag Wien, 2005.

#### References

1. P. Misra and P. Enge. 2001, Global Positioning System Signals, Measurements, and Performance. Lincoln, Massachusetts: Ganga-Jamuna Press.

2. Kaplan, Understanding GPS: principles and applications, 1996, 1 ed. Norwood, MA 02062, USA: Artech House, Inc.
3. Gopi Satheesh, Sathikumar.R., Madhu N., 2007, Advanced Surveying, Total Station, GIS and Remote Sensing, Dorling Kindersley (India) Pvt. Ltd.

104-

## Introduction to IT

**Unit 1** : Introduction to Computer System: Hardware and Software

- Hardware Components of a Computer - Processor - Mainmemory - Secondary Memory - Input Devices
- Output devices - Storage and Backup Devices –

**Unit 2** : Software Component - Software/Program - Operating System - Application Software/Program - Software for e-Governance

**Unit 3** : Operating System: OS Functions - OS Services - Types of OS – Windows - Unix/Linux - Solaris - Real Time OS –

**Unit 4** : Programming: Assemblers – Compilers – Interpreters - Machine Code - Assembly Language - High Level Languages - Systematic Programming - Object-Oriented Programming

**Unit 5** : Computer Network: Communication Between Computers – LAN – WAN –INTERNET - World Wide Web - Repeater - Hub - Switch - Router - Gateway - Communication Protocols

### Text Books

1. John L. Hennesy, David A. Patterson Computer Organization and Design: The Hardware / Software Interface (Third Edition), Morgan Kaufmann, 2004
2. Harold Abelson and Gerald Jay Sussman, with Julie Sussman, Structure and Interpretation of Computer Programs, MIT Press, 2nd ed., 1996

### References

1. Doublas E. Comer, Internetworking with TCP/IP Vol.1: Principles, Protocols, and Architecture (4th Edition) Prentice Hall, 4th Edition.
2. Pressman R.S, Software Engineering: A Practitioner’s Approach (6<sup>th</sup> Edition), McGraw Hill, 2005
3. Gary Nutt, Operating Systems: A Modern Perspective, Pearson Education Asia 2nd Edition 2000.

### 105- Remote Sensing Lab

1. Familiarization with prism stereoscopes
2. Marginal Information of aerial photograph
3. Orientation of stereo model and marking principle point, fiducial axes and flight line.
4. Computing photo scale using known objects
5. Visual Interpretation of Satellite images-Keys of Interpretation
6. Familiarizing various satellite image formats
7. Loading Digital images in Remote Sensing software
8. Familiarizing Digital Satellite Images-Spectral Reflectance values, Resolution
9. Interpretation of Thermal images and Radar Images.

border information. Designing and layouts of the maps.

**Unit II :** Types of map- Small scale, medium scale and large scales maps. Choropleth map, Socioeconomic map, Water resources map, Geologic map, Forest map, Agriculture map, Water resource map, Water quality map, Soil survey map, Map for hot spots and Maps published the Survey of India.

106-

### GIS Lab

1. Georeferencing scanned map
2. Creating layers; point, polyline and polygon
3. Managing Projection & Datum's
4. Managing attribute table
5. Managing Dimension; area and length
6. Symbolizing layers
9. Converting XY Data to GIS format
10. Designing Cartographic Output

## Syllabus Prescribed for M.Sc. Geoinformatics (Semester-II) 201- Fundamentals of Cartography

**Unit I :** History of cartography (Ancient Period to Recent period), Terms and definition, Map projection, and references, spheroids, Map numbering system, Base map and Thematic maps, Map legend symbols and

**Unit III :** Scales and their functions and map projections. Graphics scale, Plain scales, Diagonal scale. Classification of projections, Choice of projections, Orthographic projections, Projections Lambert. Mercator projection, Lambert cylindrical projections, Polyconic projections, Global projections, Conic projections, Definition, methods of representing scale.

**Unit IV :** Map design, Symbolization and colors of patterns, Color gradients, Color type correlation, Point, line and polygon patterns map, Design concept layout of topographical maps, Basic elements of placement in maps. Map and legend and its importance in large layout map point line area.

**Unit V :** Thematic mapping- Cadastral maps, Topographical maps, Agricultural maps, Population maps, Cultural maps, Structural and statistical graphs related to data, Agricultural data, Pollution, Cultural and Cadastral data. Types of Graphs- Application of graphs for Geographical data.

### Text Books

1. Michael Scott, Morgan, Programming Language Pragmatics. Kaufmann, 2000.
2. Daniel P. Friedman, Mitchell Wand, Christopher T. Haynes Essentials of Programming Languages. MIT Press, 2nd Edn. 2001

### References:

1. Peter Van-Roy, Seif Haridi, Concepts, techniques, and models of computer programming, MIT Press, 2004
2. Matthias Felleisen, How to design programs: an introduction to programming and computing, MIT Press, 2001
3. Friedman, Wand and Haynes, Essentials of Programming Languages. Prentice-Hall International (PHI), 1998.

## 202- Digital Image Processing

**Unit 1 :** Principles: Data encoding and decoding - digital image formats - band sequential and band interleaved -

characteristic features. software - raster and vector files

**Unit 2 :** Image Rectification and Restoration: geometric correction, radiometric correction -image enhancement: contrast manipulation - graylevel threshold, level slicing, and contrast stretching.

**Unit 3** : Histogram equalization – Image subtraction – Image averaging – Spatial filtering: Smoothing, sharpening filters  
 – Laplacian filters – Frequency domain filters : Smoothing  
 – Sharpening filters – Homomorphic filtering.  
 Principal components.

**Unit 4** : Vegetation components - intensity - hue - saturation colour space transformation. Pattern Resolution: concepts - linear and non-linear discriminate function.

**Unit 5** : Image Classification: Supervised classification - classification stage - minimum distance to Means classifier  
 - parallelepiped classifier - Gauss maximum likelihood classifier - training stage - Unsupervised classification - output stage - post classification smoothing.

### Text Books

1. Lillisand T.M. , R.W.Kiefer and Chipman (2004) 5th edition. Remotesensing and image interpretation, John Wiley & Sons, New York.
2. American Society of Photogrammetry, (1983). Manual of RemoteSensing, (2nd edition), ASP, Falls Church, Virginia

### References

1. Ekstrom, M. P. 1984, Digital image processing techniques. New York, Academic Press.
2. Harris, R. 1987, Satellite Remote Sensing - An Introduction. London, Routledge.
3. Moffit, H.F., and Edward, M.M., (1980). Photogrammetry, Harper and Row Publishers, New York.

## 203- Photogrammetry

**Unit 1** : Flight Planning: Flight map – end lap and side lap – scale

– flight altitude - base height ratio – ground coverage and stereoscopic model – flight line spacing.

**Unit 2** : Photo Mosaic : Number of photos and film roll – exposure time and interval – drift angles - seasons and weather conditions – Mosaics – Ground Control point – Mosaic types and characteristics.

**Unit 3** : Stereoscopic Plotting Procedures and Instruments : Direct optical projection plotters projection system, viewing system, measuring and tracing system - orientation of

0  
photography – stereo plotters with mechanical or optical –mechanical projection.

**Unit 4 :** Instruments using the Zeus Parallelogram, instruments with optical – Mechanical projections – Automated Stereo plotting Instruments: electronic image correlation and automatic stereo plotters, analytical plotters.

**Unit 5 :** Orthophotography : Meaning, need, procedure, characteristics, uses and problems – Digital Photogrammetry.

### Text Books

1. Kraus K<sub>nl</sub> 2007: Photogrammetry:geometry from images and laser scans, 2<sup>nd</sup> edition, Walter de Gruyter, Germany
2. Mikhail M, Bethel S, McGlone C.(2001), Introduction to Modern Photogrammetry, John Wiley and Sons, Inc.

### References

1. Moffit H.F. And Edward, M.M, 1980 : Photogrammetry, 3rd Edition, Harper And Row Publishers, New York.
2. Burside, C.D., 1985 : Mapping From Aerial Photographs, Collins Publishers.
3. Kasser M, Egels Y (2002) Digital Photogrammetry, Taylor & Francis.

## 204- Spatial Modeling & Analysis

**Unit 1 :** Modeling Spatial Problems : Introduction - need for spatial models – conceptual model for solving spatial problems -steps involved. Types of spatial models – descriptive and process models – types of process models – creating conceptual models

**Unit 2 :** Raster Modelling : Understanding raster data set - composition of raster dataset coordinate space and raster data set – discrete and continuous data – resolution – raster encoding – representing features in raster data set –assigning attributes.

**Unit 3 :** Spatial Analysis : Understanding spatial analysis - operators and functions – local, focal, zonal, global and application functions – surface analysis: slope,

1  
hill shade, contour and hydrologic analysis – mapping distance:shortest path – mapping density – cell statistics – neighborhood statistics – reclassification.

**Unit 4 :** Creating Surface models: Introduction – creating raster surface from points – interpolating a raster surface –creating TIN surface from vector data – building TIN – creating a TIN from a raster – creating a raster from a TIN.

**Unit 5 :** Analyzing Surfaces: Understanding the shape of a surface – calculating slope, mapping contours - deriving contourlines from a surface – calculating area and volume.

### **Text Books**

1. Heywood.L, Comelius.S and S. Carver (2006) An Introduction to Geographical Information Systems, Dorling Kinderseley (India) Pvt. Ltd.
2. Heywood, Cornellius and Carver, 2001, 2 nd Indian Reprint. A n Introduction to Geographical Information Systems Parsian Education (Singapore ) Pte. Ltd., Indian Branch, Delhi – 110 092, India.

### **References**

1. Tsung Chang – Kang, 2002, Introduction to Geographic Information Systems, Tata McGraw -Hill Publishing Company Limited, New Delhi.
2. Zeiler Michael, 2002, Modeling Our World, The ESRI Guide to Geodatabase Design, Environmental Systems Research Institute, Inc., Red Lands, California. USA- 92373 -8100.
3. Mitchell, A., , 1999, The ESRI Guide to GIS Analysis Volume 1: Geographical Patterns and Relationships, Environmental Systems Research Institute, Inc., Red Lands, California. USA 92373 –8100

### **205- Digital Image Processing Lab**

1. Geometric Correction
2. Radiometric correction
3. Histogram construction for digital data
4. Outputs of linear and non-linear stretch.
5. Filtered outputs
6. Ratio images
7. Change detection analysis

8. Image classification based on digital values
9. Unsupervised classification
10. Supervised classification



## 206- Spatial Modeling & Analysis Lab

1. Spatial and tabular query
2. Overlay analysis
3. Extract analysis
4. Proximity analysis
5. Spatial Interpolation: IDW and Kriging
6. Spatial Autocorrelation
7. Network analysis
8. Generating TIN
9. Generating DEM
10. 3D and Volume analysis .

### Syllabus prescribed for M.Sc. Geoinformatics (Semester-III)

#### 301- Research Methodology

- Unit 1** : Research Problem: Meaning of research problem- Sources of research problem-Criteria / Characteristics of a good research problem-Errors in selecting a research problem- Methods of Research: Qualitative research and Quantitative research.
- Unit 2** : Developing a Research Proposal: Format of research proposal-Individual research proposal-Institutional proposal-Hypothesis: Meaning-Types of hypothesis.
- Unit 3** : Sampling: Sampling and Population, Techniques sampling selection, Characteristics of a good sample, Sampling errors and how to reduce them.
- Unit 4** : Tools and Techniques of Data Collection: Checklist, Data schedule, Observation, Opinionative, Interview, Sociometric techniques, Questionnaire, Rating scales, Interview schedules.
- Unit 5** : Research Report: Format of the Research Report, Style of

writing the report, References and Bibliography - Evaluation of Research: Criteria of evaluation.

#### Text Books

1. Research Methodology . Methods & Techniques : Kothari, C.R.
2. Tests, Measurements and Research Methods in Behavioural Sciences . Singh, A.K.

## References

1. The Craft of Research, 2nd Edition (Chicago Guides to Writing, Editing and Publishing). Wayne C. Booth, Joseph M. Williams, Gregory G. Colomb.
2. Wayne Goddard, Stuart Melville, Research Methodology: An Introduction 2nd Edn, Juta Juta Academic , Lansdowne, 2004
3. John W. Creswell, Research design: Qualitative, Quantitative, and Mixed Method Approaches, 2nd Edn, SAGE, 2003

## 302- GIS Application Development

**Unit 1 :** Customization of GIS: Overview-programming for GIS applications - the expansion of GIS through customization and related capabilities - Automation of redundant processes - Data development/update automation - user tool development -

**Unit 2 :** Programming concepts: object-oriented concepts of applications component programming concepts - logic model - organizational understanding to logic modeling  
,Research logic model elements - Develop simple, sample logic model

**Unit 3 :** Java Review: Write, debug and repair java code for GIS-  
Integration of code in GIS environment.

**Unit 4 :** Introduction to Arc Objects: Introduction to Arc GIS family of products-Programming Arc GIS using Arc Objects- understanding Component Object Model (COM)

**Unit 5 :** Components of Arc Object-Understanding Object Model Diagrams-Fundamental Object Model Diagram components-Object Model Diagram symbols- different types of class relationships-working with events- Accessing and Rendering Data-Querying and selecting data-working with geometry-creating and editing data

## Text Books

1. Jo Wood, 2002. Java programming for spatial sciences, CRC Press.
2. Robert Burke, Andrew Arana, Thad Tilton, 2003. Getting to Know About ArcObjects: Ingram Publisher Services.

## References

1. Stuart Dabbs Holloway(2002)Component Development for the Java platform: Addison-Wesley
2. Michael Zeiler, 2001. Exploring ArcObjects: ESRI

### 303- Geoinformatics

#### Applications in Natural Resources Management

- Unit 1** : Natural Resource Evaluation: Need – objectives – sources of data – limitations – need for evaluation in development planning
- Unit 2** : Land Evaluation: Objectives – principles – procedures – approaches – land use requirements and land quality parameters – layer creation – matching – classification – case studies.
- Unit 3** : Wastelands: Types – identification – management – eroded lands – types – layer creation – case studies.
- Unit 4** : Water Resources: Surface water: precipitation – space time analysis – overland flow – storage – groundwater: potential – quality – layer creation – overlay analysis – integrated watershed development – case studies.
- Unit 5** : Natural Vegetation: Forests – classification (NRSA) – grasslands – layer creation overlay – management – case studies.

#### Text Books

1. Fischer, M., H.J. Scholten, and D. Unwin, 1996. Spatial Analytical Perspectives on GIS, Taylor & Francis, London, UK.
2. Michael F. Goodchild, Louis T. Steyaert, Bradley O. Parks, 1996. GIS and Environmental Modeling: Progress and Research Issues. Fort Collins, CO 80525: GIS World Inc.

304-

## Geostatistics

- Unit 1** : Fundamental concepts -Histogram – univariate and bivariate, estimation of basic statistical parameters, viz., mean, standard deviation, variance, correlation, covariance. Introduction to probability theory. Kinds of probability – classical or a priori probability,
- Unit 2** : Random variables, Distribution functions and expectation: Introduction and summary, Cumulative distribution function, Density function, Expectations and moments.
- Unit 3** : Estimation theory: Introduction and summary, methods of finding estimators, properties of point estimators, unbiased estimation, Sampling and sampling distribution, sample mean, sampling from normal distribution.
- Unit 4** : Testing of hypothesis: Introduction and summary, simple hypothesis testing, composite hypothesis, tests of hypotheses – sampling from normal distribution, chi-square tests, tests of hypotheses and confidence intervals, sequential test of hypotheses.
- Unit 5** : Geostatistics – introduction, The variogram – calculation, interpretation, Variances, covariances, Krige's volume- variance relationship. Extension variances and estimation variances – simple calculations in one and two dimensions. Optimal estimation – introduction to kriging, Linear, Non-linear and Multivariate Geostatistics

#### References

1. Ripple, William J. (ed.). 1994. The GIS Applications Book: Examples in Natural Resources: A Compendium, American Society for Photogrammetry and Remote Sensing, Bethesda, Maryland.
2. Young, Haines, David Green, and Steven Cousins (eds.), 1994. Landscape Ecology and GIS, Taylor & Francis, Bristol, P.A.
3. Fotheringham, S., and P. Rogerson, Ed. 1995. Spatial Analysis and

## **Text Books**

1. Noel Cressie, 1991. Statistics for Spatial Data, John Wiley & Sons
2. Isaaks, E. H. and R. M. Srivastava. 1989. An Introduction to Applied Geostatistics. Oxford Univ. Press, New York, Oxford

## **References**

1. Yang, X. S., 2009, Introductory Mathematics for Earth Scientists, Dunedin Academic Press
2. Volk, W, 1980, Applied Statistics for Engineers, Krieger Publishing Company, Huntington, New York
3. Wackernagel, H. 2003. Multivariate geostatistics, Third edition, Springer-Verlag, Berlin

### 305 - Geostatistics (Lab)

Frequency distributions, Cumulative frequency distributions and Frequency Curves, Mean, Median and Mode, Range, Variance and Standard Deviation. Linear Correlation and Regression, Non-

Linear Regression - Multiple Correlation And Multiple Regression, Factor and Factor analysis. Statistical Inference: Testing of Hypothesis Parametric. Generation of PC1, PC2 and PC3 (Using Statistical Software).

### 306 - Natural Resources and Management (Lab)

Interpretation of Satellite Images for Natural Resource Assessment of Soil, Water and Land. Preparation of theme based map layers and integration, classification using standard colour and symbol codes. Generation of Natural resource maps for sustainable management.

## Syllabus prescribed for M.Sc.

### Geoinformatics (Semester-IV)

#### 401- Database Management System

**Unit 1 :** Introduction to Database Management Systems: Data, Information, Database, Transaction and its desired properties, File Server Model, Client Server Model, Advantages of using DBMS over conventional methods, DBMS Features, Components of DBMS, Data Abstraction, Data Independence.

**Unit 2 :** Data Modeling: Logical and Physical Data Models, E-R Modeling, Record Based Models, Relational Model An overview, Relational Concepts, Tables, Keys, Constraints, Data Integrity and Constraints, Integrity Rules, Normalization

**Unit 3 :** Introduction to SQL: Introduction to SQL, SQL

concepts of next generation databases, XML, Data Warehouses Data Mining

### Text Books

Features, SQL Operators, SQL Datatypes, SQL Parsing, Types of SQL Commands, Querying Data from the database, Correlated Sub-queries, Joins, Hierarchical Queries, PL/SQL Introduction

**Unit 4 :** Distributed Databases: Structure and design, Distributed query processing, Recovery, Commit protocols, Concurrency controls, Deadlock handling, Shadow paging

**Unit 5 :** Emerging trends Object Oriented databases, Object oriented queries Active databases Deductive databases

1. Abraham Silberschatz; Henry F Korth, Database System Concepts, McGraw Hill Publication, 2002
2. Won Kim, Introduction to Object-Oriented Databases, MIT Press, 1990

## References

1. Stefano Ceri; Giuseppe Pelagatti, Distributed Databases: Principles and Systems, Universities Press, 2000
2. Jan L Harrington, Object Oriented Database Design Clearly Explained, Harcourt, 2000
3. Elmasri, Ramez; Navathe, Shamkant B, Fundamentals of Database Systems, Pearson, 2000 .

## 402- Web Mapping and Web GIS

**Unit 1 :** Introduction: Internet, web and Internet. Fundamentals of computer networking – network environment – network communication models – protocols – TCP/IP.

**Unit 2 :** Web mapping – static and interactive web mapping, collaborative web mapping. Web Mapping Services- OpenLayers-Google maps-yahoo maps and Microsoft mapservices, Mashups, GeoRSS

**Unit 3 :** Distributed geographic information services – principle – components – logic and data components.

**Unit 4 :** Open Geospatial Consortium- Web Map Servers- WMS-, interoperable systems and non-interoperable systems- Web Feature Servers- Metadata standard, XML, Geographic Markup Language -

**Unit 5 :** Client/server computing– client/server system partition – layered architecture – advantages and disadvantages of client and server side architecture. Distributed component framework – Web GIS

Implementation: Web Map servers and Data servers, Configuration, layering, design of interfaces, Quality of Service and Security Issues in the Development of Web GIS - Performance, Security, Scalability

## Text Books

1. Korte, G. B., (2001) The GIS book: 5th Edition, Onward press, Australia. Cartwright, W., M.P. Peterson, G. Gartner (Eds) Multimedia Cartography, Berlin: Springer.
2. Kraak, M., and A. Brown (2001) Web Cartography: Development and Prospects, London: Taylor and Francis.

## References

1. Kraak, M. and F. Ormeling (2003) Cartography: Visualization of Geospatial Data, Delhi: Pearson Education.
2. Ron Lake, David S. Burggraf, Milan Trinic, Laurie Rae, 2004, Geography mark-up language (GML) John Wiley & Sons Ltd.

## 403- Geoinformatics Applications in Agriculture

**Unit 1 :** Crops: Introduction - Agriculture Ecosystems, Yield parameters, spectral properties of crops, identification of crops and acreage estimation, vegetation indices, production forecasting through digital analysis, monitoring and condition assessment - case studies .

**Unit 2 :** Soils: introduction - Soil survey methods, soil classification, Land evaluation, Saline, alkaline soils, soil mapping, soil identification and mapping of problem soils, sedimentation and erosion, soil conservation - case studies.

**Unit 3 :** Field-scale applications of RS and GIS: soil moisture content assessment, crop phenologic stage identification, crop biomass and yield production estimation, crop disease, weed and insect infestation detection and monitoring, farm mapping, cropping system analysis, agro-ecological zoning.

**Unit 4 :** Retrieval of agrometeorological parameters from satellites, floods and droughts assessment and monitoring, water and wind induced soil erosion assessment and monitoring

**Unit 5 :** Precision Agriculture: Definition and rationale: agronomy, environment, economics, Tools: variable rate technology (VRT), GPS, GIS, Yield monitoring and mapping, Developing prescriptive maps for VRT management, Applications

## Text Books

1. Pierce J. Francis and Clay David, 2007, GIS Applications in Agriculture, Taylor & Francis Group

2. Steven, M.D. and Clark, J.A., Butterworths, 1990, Application of Remote Sensing in Agriculture, London.

## References

1. Ripple, William J. (ed.). 1994. The GIS Applications Book: Examples in Natural Resources: A Compendium, American Society for Photogrammetry and Remote Sensing, Bethesda, Maryland.
2. Young, Haines, David Green, and Steven Cousins (eds.), 1994. Landscape Ecology and GIS, Taylor & Francis, Bristol, P.A.
3. William Ripple, 1986, Geographic Information Systems for Resource Management, ACSM.

## 404- Geoinformatics Applications in Water Resources Management

**Unit 1 :** Introduction: Hydrologic cycle, components of hydrologic cycle - processing and parameterization in hydrology; Water resource scenario in India, Hydrological modeling. GIS applications in water resources development and management.

**Unit 2 :** Spectral properties of water. Floods types; causes and mitigation measures, flooding potential zonation mapping, flood hazard assessment, flood risk analysis using RS and GIS, RS and GIS in Cyclone mapping and mitigation, digital surface modeling and flood hazard simulation.

**Unit 3 :** Groundwater, hydro geomorphology, Ground water potential assessment, groundwater prospect zones mapping, ground water modeling, ground water information system, planning and management of ground water. Groundwater quality mapping. Ground and surface water interactions

**Unit 4 :** Irrigation management: Mapping and monitoring of catchments and command areas, land irrigability, soil irrigability mapping, irrigation canal alignment,

crop norm violation, agriculture water demand estimation for different crops, tank information system, wet land mapping, siltation mapping, optimum usage planning and management of irrigation water.

**Unit 5 :** Watershed management: Watershed- Drainage and water body mapping, morphometric analysis, classification, delineation and coding of watersheds, reservoir



sedimentation -  
watershed  
development  
planning,  
watershed  
prioritization,  
Watershed  
Information  
System;  
mapping  
drought-prone  
areas.

## Text Books

1. John G Lyon, 2003, GIS for Water Resources and Watershed Management, CRC Press LLC
2. K.Kovar & H.P. Nachtnebel, 1996, Application of Geographic Information Systems in Hydrology and Water Resources Management, International Association of Hydrological Sciences

## References

1. Lynn E.Johnson [2002] Geographic Information Systems in WaterResources Engineering, CRC Press LLC
2. Jain S.K and Singh V.P., 2003, Developments In Water Science – Water Resources Systems Planning and Management, Antony Rowe Ltd
3. U.M.Shamsi, 2002, Water, Waste water and Storm Water Systems, American Society of Civil Engineers.

Spectro-radiometric  
Survey of agriculture  
crops. Determination  
of crop acreage from  
satellite images and  
image processing.  
Spectral signatures  
from spectro  
radiometer for water  
bodies. Analysis of  
Satellite Images for  
Drainage and  
WaterShed  
demarcation. Mapping  
Lithologically and  
Structurally Controlled  
delineation of Aquifer  
Systems. Preparation of  
theme based layers and  
integration for

assessing agricultural and groundwater potential of the area.406- Project (Lab)

Students may carry out their internship project in an industry or any reputed academic/research institutes. The internship project aims at giving the student an opportunity to participate and work in a substantive project activity. Typically, the project helps the student to learn about work culture, business processes, technologies, marketing strategies, etc. Under the institute project, the student takes up a research topic or participates in an Institute project under the guidance of a faculty or project coordinator.

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## NOTIFICATION

No. : 69/2018

Date : 5<sup>th</sup> July, 2018

### **Subject : Implementation of Syllabi of Master of Arts (Psychology) (Semester-I to IV) as per Semester and Credit Grade System in the Faculty of Humanities from the Session 2018-2019 and onwards.**

It is notified for general information of all concerned that the authorities of the University has accepted the Syllabus of Master of Arts (Psychology) (Semester-I to IV) as per Semester and Credit Grade System as mentioned in Column No. 2 which are to be implemented from the session 2018-2019 and onwards with appendices which are attached herewith as shown in column No. 3 of the following table.

TABLE

Sr.No.	Course / Subjects	Appendices of the New Syllabi
1.	2.	3.
	<b>A) Faculty of Humanities :</b>	
1.	M.A. (Psychology) (Sem-I & II)	The Syllabi prescribed for M.A. (Psychology) (Semester-I & II)( <b>Revised</b> )which is appended herewith as <b>Appendix 'A'</b>

2.	M.A. (Psychology (Semester-III & Semester-IV))	The Syllabi prescribed for M.A.(Psychology)(Semester-III & IV) which is appended herewith as <b>Appendix 'B'</b>
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Sd/-

(Dr. A.P. Deshmukh)  
Registrar

Sant Gadge Baba Amravati University

## Appendix-A

### S SEMESTER SYSTEM SYLLABUS FOR PSYCHOLOGY

#### M. A.

#### SEMESTER I to IV

**With effect from 2017-**

**2018&2018-2019**

#### General Instruction

- The examination in MA Psychology for each Semester will have 4 Theory Papers. Each Theory Paper will have Maximum 80 Marks External and 20 Marks for Internal Assessment, Practical Paper will have Maximum 100 Marks. Minimum Marks for Passing in each Paper will be 40%.
- There will be 4 Theory Periods for each Paper and 4 Periods for Practical in a week, per batch of 10 students. Total 20 Clock Hours has teaching per batch in a week.
- Student will be allowed to appear in the Practical examination with duly certified and completed practical record book signed by the teacher and Head of the Department.
- For M.A. Semester-I & II, the Practical Syllabi consists only Section A of 100 Marks.
- For M.A. Semester-III, the Practical Syllabi consist of the following Two Sections :

**Section-A :** Psychological Testing - 70 Marks  
**Section-B :** Case Study & Report Presentation - 30 Marks

- For M.A. Semester-IV, the Practical Syllabi consist of the following Two Sections :

**Section-A :** Psychological Testing - 70 Marks  
**Section-B :** Dissertation & Viva-Voce - 30 Marks

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**M.A. Psychology, Semester-I**

Paper	Title of the paper	Marks	Duration of examination	Internal Assessment Marks	Total Marks
<b>A) Theory :</b>					
I	Cognitive Psychology	80	3 Hrs	20	100
II	Research Methodology and Statistics I	80	3 Hrs	20	100
III	Biopsychology I	80	3 Hrs	20	100
IV	Personality Psychology	80	3 Hrs	20	100
<b>B) Practical :</b>					
V	Practical	100	--	--	100
<b>Total Marks A + B</b>		<b>420</b>		<b>80</b>	<b>500</b>

**M.A. Psychology, Semester-II**

Paper	Title of the paper	Marks	Duration of examination	Internal Assessment Marks	Total Marks
<b>A) Theory :</b>					
I	Cognitive Process	80	3 Hrs	20	100
II	Research Methodology and Statistics II	80	3 Hrs	20	100
III	Biopsychology II	80	3 Hrs	20	100
IV	Personality Theories	80	3 Hrs	20	100
<b>B) Practical :</b>					
V	Practical	100		--	100
<b>Total marks A + B</b>		<b>420</b>		<b>80</b>	<b>500</b>

**M.A. Psychology, Semester-III**

Paper No	Title of the Paper	Marks	Duration of Examination	Internal Assessment Marks	Total
<b>A Theory</b>					
I	Health Psychology	80	3 Hrs	20	100
II	Abnormal Psychology I	80	3 Hrs	20	100
III	Clinical Psychology	80	3 Hrs	20	100
IV	Counseling Psychology	80	3 Hrs	20	100
<b>B Practical</b>					
V	Practical (PR5)	100		--	100
<b>Total Marks A+ B</b>		<b>420</b>		<b>80</b>	<b>500</b>

**M.A. Psychology, Semester-IV**

Paper No	Title of the Paper	Marks	Duration of Examination	Internal Assessment Marks	Total
<b>A Theory</b>					
I	Stress, Coping and Health	80	3 Hrs	20	100
II	Abnormal Psychology II	80	3 Hrs	20	100
III	Clinical Assessment	80	3 Hrs	20	100
IV	Psychotherapies	80	3 Hrs	20	100
<b>B Practical</b>					
V	Practical (PR5)	100		--	100
<b>Total Marks A+ B</b>		<b>420</b>		<b>80</b>	<b>500</b>

Number of questions to be set in each paper will be Four

- 1) One Multiple Choice Question with ten sub questions will be set from all units.
- 2) Two long answer questions and two short answer questions to be set on four units.
- 3) For every question, long answer type or short answer type, there will be an alternate choice. However, there shall be no internal choice in the question.
- 4) In each short answer type question there will be two to four sub questions with no internal choice.
- 5) There will not be a question like ‘write short notes on’

**Practical :**

- 1] One practical examination in each semester of 100 Marks and three hours duration.
- 2] Practical examination in I to IV Semester will be conducted by Internal and External Examiners appointed by the University.

**Distribution of Marks for I& II Semester (Practical Examination)**

1] Record Book	20	
2] Conduct of Experiment	25	
3] Report of Experiment	25	
4] Viva-Voce	30	
		-----
Total	100	

**Distribution of Marks for III& IV Semester (Practical Examination) Semester-III**

**Part-A (70 Marks)**

1] Record Book	--	15 Marks
2] Conduct of Experiment	--	15 Marks
3] Report of Experiment	--	15 Marks
4] Viva-Voce	--	25 Marks

**Part-B**

**Case Study : (30 Marks)**

a) Report Presentation

Total -- 100 Marks

**Semester-IV**

**Part-A (70 Marks)**

1] Record Book	--	15 Marks
2] Conduct of Experiment	--	15 Marks
3] Report of Experiment	--	15 Marks
4] Viva-Voce	--	25 Marks

**Internal Assessment :**

1. Each Paper will have Internal Assessment of 20 Marks.
2. Head of the Department will Monitor Internal Assessment of the Student on the basis of Evaluation Report from the concerned Teacher / Teachers, under the Supervision of the Principle of the College and will be done at the end of each Semester.
3. Distribution of 20 Marks of Internal Assessment for Theory :

i) Seminar& Presentation - 20 Marks

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## CERTIFICATE

### DEPARTMENT OF PSYCHOLOGY

Name of the College..... - .....

This is to certify that this practical record is original work done by Mr./Ms./Smt.....

..... Class..... Semester..... during the academic year.....

He/she has submitted/not submitted the Seminar as prescribed by S.G.B. Amravati University, Amravati.

Signature of the Teacher

Signature of the Head of the Department

Signature of the External Examiner

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### **Syllabi of M.A.Part-I**

**M.A. Psychology  
Semester-I**

### **Paper-I**

Marks – Theory : 80

Int.Ass. : 20

### **Objectives:**

### **Cognitive Psychology**

1. To develop insight into one's own and others' behaviour and underlying mental processes.
2. To enrich students' understanding of major concepts, theoretical perspectives, and empirical findings in cognitive psychology

### **UNIT-I INTRODUCTION TO COGNITIVE PSYCHOLOGY**

- A) Origin and Brief History of Cognitive Psychology
  - i) Current status of cognitive psychology
  - ii) Modern cognitive psychology
- B) Isms in Cognitive Psychology
- C) Methods of Cognitive Psychology
- D) Paradigms of Cognitive Psychology
  - i) Information Processing approach,
  - ii) Ecological approach

### **UNIT II: ATTENTION AND PERCEPTION**

- A) Attention:
  - i) Divided attention
  - ii) Selective attention
- B) Theories of Attention
  - i) Filter theory
  - ii) Attenuation theory
  - iii) Late selection theory

- C) Theories of Perception
  - i) Gestalt
  - ii) Bottom up
  - iii) Top down
  - iv) Feature analysis
  - v) Subliminal perception
  - vi) extra sensory perception
  - vii) signal detection theory

### **UNIT III: LANGUAGE**

- A) Language Learning
  - i) Stages of language development
  - ii) Apes and language
- B) Understanding Spoken Language:
  - i) Speech perception
  - ii) Constituent structure
  - iii) Transformation grammar
  - iv) Factor Affecting comprehensive
- C) Reading
  - i) Theories of word recognition
  - ii) Reading and working memory
- D) Speaking
  - i) Selecting the content of speech
  - ii) Speech errors
  - iii) Gesture
  - iv) The social context of speech
- E) Writing
  - i) Comparing speaking and writing
  - ii) Cognitive task involved in writing

### **UNIT IV: PROBLEM SOLVING AND CREATIVITY**

- A) **Define Problem**
  - i) Stages of problem solving
  - ii) Types of problem
  - iii) Problem solving approach
  - iv) Algorithms
  - v) Heuristic
  - vi) Means ends analysis
  - vii) Computer simulation and analogy.
- B) **Creativity**
  - i) Define creativity
  - ii) Measuring creativity
  - iii) Attitude and Cognitive dissonance
  - iv) Attribution theory.

### **SOURCE BOOKS :**

1. Matlin, M. (1994). Cognition. Prism India Books.
2. Solso, R.L. (2004). Cognitive Psychology (6th ed). Delhi: Pearson Education.
3. Stenberg, R. J. (2007). Cognitive Psychology. Australia: Thompson Wadsowrth
4. Galloti, K.M.(2004). Cognitive Psychology In and Out of Laboratory. USA: Thomson Wadesworth.
5. Kellogg, R. T. (2007). Fundamentals of Cognitive Psychology. N. D. Sage Publications. Wade, C. and Tavris, C. (2007). Psychology. Pearson Education.

### **REFERENCE BOOKS :**

1. Best, J. B. (1999). Cognitive Psychology. USA: Wadsworth Publishing Co.
2. Gunther, R. K. (1998). Human Cognition. New Jersey: Prentice-Hall.
3. Kalpan, S. & Kalpan, R. (1982) Cognition & Environment. N.Y.: Praeger Publishers.
4. Flavell, J. H. (1985). Cognitive Development. (2nd ed). N.J.: Prentice-Hall.
5. Reed, S. K. (1998). Cognition: Theory and Application (3rd ed). California Books/Cole Pub. Company.
6. Borude, R.R. Bodhanik Manasashastra. Chhaya Prakashan.
7. Cohen, G. (1983). Psychology of Cognition (2nd ed). London: Academic Press.
8. Desai, B. & Abhyankar, S.C. (2007). Prayogik Manasashastra and Sanshodhan Paddhati. Pune: Narendra Prakashan.

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M.A. Psychology  
Semester-I  
Paper-II

**Research Methodology and  
Statistics –I**

Marks – Theory : 80  
Int.Ass. : 20

**Objective  
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- re of psychological research, Types of research, Stages of psychological research, Ethical issues in psychological research,  
B) Research problem: Meaning and nature, Types and sources  
C) Review of literature: Purpose and sources

**UNIT-II HYPOTHESIS, VARIABLES AND RESEARCH METHODS**

- A) Hypothesis: Meaning and nature, Characteristics, types, sources and uses  
B) Variable: Meaning, Types, Important consideration in selection of variables, Methods of manipulating independent variables, Techniques to control extraneous variables  
C) Experimental Research: Meaning and characteristics, Types of experimental research- Laboratory experiment and field experiment  
D) Non experimental research: Meaning and characteristics, Types of non-experimental research-Field study, Survey Research, Ex post facto research, case study.

**UNIT-III PARAMETRIC AND NON-PARAMETRIC STATISTICS**

- A) Meaning and nature of parametric statistics, meaning of t-ratio, t-ratio with independent means, t-ratio with correlated means, t-ratio with matched group.  
B) Meaning and nature of non-parametric statistics, Chi square, Assumption of chi-square, Chi-square based on hypothesis of equal probability and normal distribution, Mann-Whitney U-test, median test.

**UNIT-IV CORRELATION**

- A) Meaning and nature of correlation, Types of correlation, Methods of correlation- Rank difference, Product moment, Biserial, Point biserial, Tetrachoric, and Phi Coefficient.  
B) Level of significant, Type I and Type II error, One tailed and two tailed test.

**References :**

- 1) Broota, K. D. (2002) , Experimental Design in Behavioural Research, New Age International (P)Limited Publishers.
- 2) Minium, E.D., King B.M. & Bear G. (1993) , Statistical Reasoning in Psychology and Education(3<sup>rd</sup> Edition) , Wiley Student Edition.
- 3) Guilford , J. P. &Fruchter , B. (1978) , Fundamental Statistics in Psychology and Education ( 6<sup>th</sup>Edition) , McGraw-Hill International Editions.
- 4) Gottsdanker , R. (1978) , Experimenting in Psychology , Prentice Hall
- 5) Kerlinger , F. N. (1973) , Foundation of Behavioural Research (2<sup>nd</sup> Edition) . N. Y. ,Magraw Hill.
- 6) Singh , A. K. , (2012) , Tests, Measurements and Research Methods in Behavioural Sciences, (6<sup>th</sup>Edition) , BharatiBhawan Publishers and Distributors.
- 7) Mangal , S. K. (2007) , Statistics in Psychology and Education ( 2<sup>nd</sup> Edition) , Prentice Hall of India Private Limited , New Delhi
- 8) Kothari, C. R. , (2014) , Research Methodology : Methods and Techniques (4<sup>th</sup> Edition) , NewAge International Publishers

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**UNIT-I  
INTRODU  
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**M.A.Psychology**  
**Semester-I**  
**Paper-III**

**BIOPSYCHOLO  
GY-I**

Marks – Theory : 80  
Int.Ass. : 20

**Objectives :**

- 1) To introduce the students to the new emerging field of Psychology i.e. Biopsychology.
- 2) To make students understand the term Biopsychology.
- 3) To outline the students about methods of study used for Biopsychology.
- 4) To discuss the ethical constraints of research into Biopsychology.
- 5) To discuss the structure and functions of the nervous system.
- 6) To understand sensory system and discuss its role in perception.
- 7) To discuss the role of Endocrine system in Biopsychology.
- 8) To understand mechanism of Sleep and disorders related to it.
- 9) To discuss neurological disorders.

**UNIT-I Introduction to Biopsychology**

- A) Biopsychology :Definition, Origins of the field of biopsychology, other disciplines related to Biopsychology, Divisions of Biopsychology.
- B) Origins of dichotomous thinking, Problems with thinking about the Biology of Behaviour in terms of Traditional Dichotomies, Origins of evolutionary theory, Evolution and Behaviour, Course of Human Evolution, Thinking about Human Evolution, Evolution of the Human Brain.
- C) Fundamental Genetics : Mendelian Genetics, Chromosomes, Genetic code and gene expression, Human Genome Project, Growth of Epigenetic, Interaction of Genetic Factors and Experience, Phenylketonuria : A single gene metabolic disorder, Development of Birdsong, Genetics of Human Psychological Differences, Twin Studies of Epigenetic Effects and Effects of Experience on Heritability.

**UNIT-II Methods and Strategies of Research**

- A) Experimental Ablation : Evaluating the Behavioural Effects of Brain Damage, Producing Brain Lesions, Stereotaxic Surgery, Histological Methods, Tracing Neural Connections, Studying the Structure of the Living Human Brain.
- B) Recording and Stimulating Neural Activity : Recording Neural Activity, Recording the Brain's Metabolic and Synaptic Activity, Stimulating Neural Activity.
- C) Neurochemical Methods : Finding Neurons that Produce Particular Neurochemicals , Localizing Particular Receptors, Measuring Chemicals Secreted in the Brain.
- D) Genetic Methods: Twin Studies, Adoption Studies, Genomic Studies, Targeted Mutations, Antisense Oligonucleotides.

**UNIT-III: Sensory System**

- A) Visual System : Perception, The Eye : Lens, Retina, Pupil, Functions of the retinal cells, Colour Vision- Trichromatic theory , Opponent process theory, Influences on perception at eye level : at the retina, Monocular influences, Binocular influences. Visual Pathway and Perception.
- B) Auditory System : Auditory Perception, Anatomy of the Ear, Auditory pathways in the Brain, Properties of Sound, Analysis and perception of sound.
- C) Other Sensory System : Olfactory system, Taste, Somatosenses – Cutaneous senses, Threshold of sensation, Spatial resolution, Kinesthesia, ascending pathway and the somatosensory cortex.

**UNITIV: The Nervous System and Behaviour**

- A) Introduction , Cell Structure and the Communication Network –Sensory neuron, Connector neuron, Motor neuron. Work of neurons and axons, electrochemical process of nervous transmission, The Synapse, Neural networks- cell assemblies.

- B) The Central Nervous System : The Brain, Structure of the Brain, Areas of the Brain – the cortex, the four lobes of the cortex, Motor and Somatosensory areas, Functions of the two hemispheres, Subcortical structure – the brainstem, the reticular formation, the thalamus, the hypothalamus, the limbic system, the amygdala, corpus callosum, the cerebellum, the spinal cord.
- C) Neurochemicals : Neurotransmitters – Acetylcholine, the monoamines, Dopamine's, Serotonin, Norepinephrine, Amino acid transmitters, Glutamic acid , GABA, Glycine, peptides, Endorphins and enkephalins, Neruomodulators – Pheromones.
- D) Effect of Psychoactive Drugs on CNS: Minor tranquillizers, Neuroleptics, Stimulants, Antidepressants, other antidepressant- Opiates, other psychoactive drugs.
- E) Autonomic Nervous System : The Sympathetic division and Parasympathetic division.

**Reference books :**

1. Biopsychology – Physiological Psychology by Sheila Hayward.
2. Biopsychology – By John . P. J. Pinel and Steven .J. Barnes., Global edition-Pearson.
3. Physiology of Behaviour by Neil .R. Carlson.
4. Biological Psychology- An Introduction to Behavioural, Cognitive and Clinical Neuroscience. By – S. Marc Breedlove and Neil .V. Watson.
5. Biological Psychology by James .W. Kalat.
6. Current Issues in Developmental Psychology – A Biological Perspective. By A. F. Kalverboer and M. L. Genta.
7. Foundations of Biopsychology – by Andrew Wickens.
8. The Biopsychology of Mood and Arousal – by Robert .E. Thayer

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**Semester I  
Paper IV**

**Personality  
Psychology**

Marks – Theory : 80  
Int.Ass. : 20

**Unit I: Personality  
Psychology**

The concept of personality: nature, Definition and heterogeneity.

Theory of personality: Characteristics, major components, evaluation of personality theory, important issues in personality theory.

## Unit II: Personality Assessment

Methods used in personality study: case history method, Correlational method, clinical method and Experimental method.

Assessment of personality: major techniques of Assessment of personality.

Personality development: heredity and environment.

## Unit III : Psychoanalytic and Neo Psychoanalytic Theories

S. Freud, C. Jung, A. Adler

E. Erikson, H. Sullivan, Mahler's object relation theory.

## Unit IV: Trait and Type Approach

G. Allport, R. Cattell, H. Eysenck

Type A and Type B, McCrea and P Costa's Five factor Model.

## Books Recommended

1. Barabara, E (2006). Personality Theories (7<sup>th</sup>ed). New York: Houghton mifflin Company
2. Boeree, C. G. (2006) Personality Theories [<http://www.ship.edu/%7Ecgboree/perscontents.html>]
3. Burger J.M. (2000): Personality 5<sup>th</sup> edition, Wadsworth Thomson Learning, USA.
4. Ewen R. B. (2003) An introduction to theories of personality. 3rd edn. Lawrence Erlbaum Associates Inc. Hillsdale, New Jersey, London
5. Hall, C. s. & Linzey, G. (1991) Theories of Personality, 3rd edn.. John Wiley & Sons, Inc.U.S.A.
6. Pandey, J. (ed.) (2001) Personality and Health Psychology In Psychology in India Revisited. Developments in the discipline, sage Publication India Pvt Ltd. New Delhi. India.
7. Pervin, L (2003). The Science of Personality. 2nd edn. Oxford University Press. New York
8. Samuel W (1981): Personality Mc Graw Hill International Book Company.
9. Schultz D.P. & Schultz S.F. (2001) Theories of Personality 7<sup>th</sup> edition Wadsworth Thomson Learning, USA.

## M.A. Psychology Semester-I Paper V Practicals

Total Marks : 100

This Paper consists of Eight Laboratory Experiments. Each student shall complete Eight Experiments and Submit Record Book containing Report of Experiments.

### A. Practical (Any Eight)

100 Marks

- 1 Depth Perception
- 2 Size Constancy
- 3 Filled Unfilled Time Perception
- 4 Reaction Time
- 5 Problem Solving
- 6 Concept Formation
- 7 Cognitive Distortion
- 8 Judgment Time
- 9 Weber's Law
- 10 Retinal Colour Zone
- 11 Size Weight Illusion
- 12 Phi Phenomenon

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### Cognitive Processes

Marks – Theory : 80

Int.Ass. : 20

### Objectives

M.A.Psychol

ogy

Semester –

II Paper –I

1. To develop insight into one's own and others' behaviour and underlying mental Processes.
2. To enrich students' understanding of major concepts, theoretical perspectives, and Empirical findings in cognitive psychology.

### **Unit I: MEMORY**

- A) Basic Model of Memory
  - i) Short term Memory
  - ii) Long Term Memory
- B) Forgetting
  - i) Forgetting in STM
  - ii) Forgetting in LTM
- C) Memory as reconstruction:
  - i) Eyewitness testimony
  - ii) Flash bulb memory
  - iii) Autobiographical memory
  - iv) Improving memory: mnemonics

### **Unit II: MODELS OF MEMORY**

- A) Atkinson –shiffrin model
- B) Tulving model
- C) Level of processing approach
- D) Parallel distributed processing approach

### **Unit III: COGNITIVE DEVELOPMENT**

- A: Cognitive development
  - i) Developmental psychology
  - ii) Assimilation and Accumulation-Piaget
  - iii) Mind in Society- Vyogotsky

**B: Neurocognitive development**

- i) Early neural development
- ii) Environment and neural development
- iii) Cognitive development: Intelligence and ability
- iv) Development of information acquisition skills
- v) Higher order cognition in children, prototype formation among children

**UNIT IV: DECISION MAKING**

**A: Making Decision**

- i) Basic Concept of probability
- ii) Cognitive illusions in decision making
- iii) Framing effects
- iv) Illusory correlation
- v) Hindsight bias
- vi) Overconfidence

**B: Utility Models Of Decision making**

- i) Expected utility theory,
- ii) Multiattribute utility theory
- iii) Image theory
- iv) Improving decision making

**Source Books :**

1. Matlin, M. (1994). Cognition. Prism India Books
2. Solso, R.L. (2004). Cognitive Psychology (6th ed). Delhi: Pearson Education.
3. Stenberg, R. J. (2007). Cognitive Psychology. Australia: Thompson Wadsworth.
4. Galloti, K.M.(2004). Cognitive Psychology In and Out of Laboratory. USA: Thomson Wadsworth.
5. Kellogg, R. T. (2007). Fundamentals of Cognitive Psychology. N. D. Sage Publications.
- Wade, C. and Tavris, C. (2007). Psychology. Pearson Education.

**Reference Books :**

1. Best, J. B. (1999). Cognitive Psychology. USA: Wadsworth Publishing Co.
2. Gunther, R. K. (1998). Human Cognition. New Jersey: Prentice-Hall.
3. Kalpan, S. & Kalpan, R. (1982) Cognition & Environment. N.Y.: Praeger Publishers.
4. Flavell, J. H. (1985). Cognitive Development. (2nd ed). N.J.: Prentice-Hall.
5. Reed, S. K. (1998). Cognition: Theory and Application (3rd ed). California Books/Cole Pub. Company.
6. Borude, R.R. Bodhanik Manasashastra. Chhaya Prakashan.
7. Cohen, G. (1983). Psychology of Cognition (2nd ed). London: Academic Press.
8. Desai, B. & Abhyankar, S.C. (2007). Prayogik Manasashastra and Sanshodhan Paddhati. Pune: Narendra Prakashan.

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**M.A. Psychology Semester-II**

**Paper-II**

**Research Methodology and Statistics-II**

Marks – Theory : 80  
Int.Ass. : 20

**Objectives-**

1. To acquaint the student in psychological research method
2. To develop computation skill in students and enable them to analyze data for project and dissertation

**UNIT-I SAMPLING AND DATA COLLECTION**

- A) Meaning of Population and Sample, Characteristics of sampling, Probability sampling-Simple random sampling, Stratified sampling, cluster sampling. Non-Probability sampling-Quota sampling, Accidental sampling, Purposive sampling, systematic sampling, Snowball sampling, Saturation sampling and Dense sampling. Sampling error.
- B) Tools of data collection- Observation, Questionnaire, Schedule, Interview and Rating scale

**UNIT-II:  
RESEARCH  
DESIGN**

- A) Research design: Meaning, Purpose and criteria
- B) Between group design: Two randomized group design, More than two randomized group design, Randomized block design, Factorial design
- C) Within group design: Repeated measures design, Single factor repeated

res design.

- D) Quasi experimental design: Time series design, Equivalent time samples design, Non-equivalent control group design, Counter balanced design, Separate sample pre-test post-test design.

### UNIT-III: NORMAL PROBABILITY CURVE

- A) Meaning of NPC, Area under NPC, Characteristics of NPC, Application of NPC, Skewness and Kurtosis  
B) Standard Score: z Score, T-score, Percentile

### UNIT-IV: ANALYSIS OF VARIANCE

- A) Meaning of ANOVA, Assumptions of ANOVA, One way ANOVA.  
B) Post hoc comparison- DMRT, Tuckey and Protected t-test.  
C) Research report writing (APA)

#### References :

- 1) Broota, K. D. (2002) , Experimental Design in Behavioural Research, New Age International (P)Limited Publishers.
- 2) Minium, E.D., King B.M. & Bear G. (1993) , Statistical Reasoning in Psychology and Education(3<sup>rd</sup> Edition) , Wiley Student Edition.
- 3) Guilford , J. P. &Fruchter , B. (1978) , Fundamental Statistics in Psychology and Education ( 6<sup>th</sup>Edition) , McGraw-Hill International Editions.
- 4) Gottsdanker , R. (1978) , Experimenting in Psychology , Prentice Hall
- 5) Kerlinger , F. N. (1973) , Foundation of Behavioural Research (2<sup>nd</sup> Edition) . N. Y. ,Magraw Hill.
- 6) Singh , A. K. , (2012) , Tests, Measurements and Research Methods in Behavioural Sciences, (6<sup>th</sup>Edition) , BharatiBhawan Publishers and Distributors.
- 7) Mangal , S. K. (2007) , Statistics in Psychology and Education ( 2<sup>nd</sup> Edition) , Prentice Hall of India Private Limited , New Delhi
- 8) Kothari, C. R. , (2014) , Research Methodology : Methods and Techniques (4<sup>th</sup> Edition) , NewAge International Publishers

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**M.A. Psychology**  
**SEMESTER -**  
**II Paper-III**  
**BIOPSYCHOLOGY**  
-II

Marks – Theory : 80  
Int.Ass. : 20

#### Objectives :

- 1) To introduce the students to the new emerging field of Psychology i.e. Biopsychology.
- 2) To make students understand the term Biopsychology.
- 3) To outline the students about methods of study used for Biopsychology.
- 4) To discuss the ethical constraints of research into Biopsychology.
- 5) To discuss the structure and functions of the nervous system.
- 6) To understand sensory system and discuss its role in perception.
- 7) To discuss the role of Endocrine system in Biopsychology

## UNIT-I: THE ENDOCRINE SYSTEM

- A) The Pituitary Gland : Anterior Pituitary Hormone and Posterior Pituitary Hormone.
- B) Other Glands in the Human Endocrine System : The Adrenal Glands, The Pancreas, The Gonads , The Thyroid Gland, The Pineal Gland.
- C) Interactional Effects with Behaviour : Reaction to environmental stimuli, Reaction to internal changes, the menstrual cycle and its effect on behavior.

## UNIT-II MOTIVATION AND EMOTION

- A) (i) Homeostatic Motivation: Mechanism of Eating , Eating disorder- Obesity, Anorexia nervosa- social cause, cultural cause, emotional cause, treatment. Bulimia nervosa.  
(ii) Non-homeostatic Motivation – curiosity and exploration, Arousal theory, Sexual behaviour, self stimulation of brain, addiction and its consequences.
- B) Emotion : Emotions as response patterns – Fear- Research with Laboratory animals and humans, Anger, Aggression, and impulse control. Hormonal control of Aggressive Behaviour.
- C) Communication of Emotions : Facial expression of emotions : innate responses, Neural basis of the communication of emotions : Recognition, Neural Basis of the communication of Emotions : Expression.
- D) Feelings of Emotions : The James Lange Theory, Feedback from Emotional expression.

## UNIT-III: SLEEP AND BIOLOGICAL RHYTHMS

- A) A Physiological and Behavioural description of Sleep- Stages of Sleep, Mental Activity During Sleep. Disorders of Sleep- Insomnia, Narcolepsy, REM Sleep Behaviour Disorder, Problems Associated with Slow-Wave Sleep, Functions of Slow-Wave Sleep, Functions of REM Sleep, Sleep and Learning.
- B) Physiological Mechanisms of Sleep and Walking : Chemical Control of Sleep, Neural Control of Arousal, Neural Control of Slow-wave Sleep, Neural Control of REM Sleep.
- C) Biological Clocks – Circadian Rhythms and Zeitgerbers, TheSuprachiasmatic Nucleus, Control of Seasonal Rhythms: The Pineal Gland and Melatonin, Changes in Circadian Rhythm: Shift Work and Jet Lag.

## UNIT-IV NEUROLOGICAL DISORDERS

- A) Tumors – Seizure Disorders, Cerebrovascular Accidents, Traumatic Brain Injury. Disorders of development : Toxic Chemicals, Inherited metabolic disorders, Down Syndrome.
- B) Degenerative Disorders : Transmissible Spongiform Encephalopathies, Parkinson’s Disease, Huntington’s Disease, Alzheimer’s Disease, Amyotrophic Lateral Sclerosis, Multiple Sclerosis, Korsakoff’s Syndrome.
- C) Disorders caused by Infectious diseases.

### Reference books :

1. Biopsychology – Physiological Psychology by Sheila Hayward.
2. Biopsychology – By John . P. J. Pinel and Steven .J. Barnes., Global edition-Pearson.
3. Physiology of Behaviour by Neil .R. Carlson.
4. Biological Psychology- An Introduction to Behavioural, Cognitive and Clinical Neuroscience.  
a. By – S. Marc Breedlove and Neil .V. Watson.
5. Biological Psychology by James .W. Kalat.
6. Current Issues in Developmental Psychology – A Biological Perspective. By A. F. Kalverboerand M. L. Genta.
7. Foundations of Biopsychology – by Andrew Wickens.
8. The Biopsychology of Mood and Arousal – by Robert .E. Thayer

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**M.A. Psychology Semester-II Paper-IV**  
Personality Theories

Marks – Theory : 80  
Int.Ass. : 20

**UNIT I: BEHAVIOURAL AND SOCIAL APPROACH**

Behavioural view of the person  
Pavlov, B. F. Skinner  
A. Bandura, J. Rotter, Dollard and Miller

**UNIT II: COGNITIVE BEHAVIOURAL APPROACH**

G. Kelly, Michell, A. Ellis, A. Beck

**UNIT III: HUMANISTIC AND EXISTENTIAL APPROACH**

C. Rogers, A. Maslow  
R. May, V. Frankl

**UNIT IV: THE INDIAN APPROACHES TO PERSONALITY**

Guna theory-Srimabdhagvadgeeta  
View point of Shri. Aurobindo  
GautamBudha- Abhidhama

**Books Recommended :**

1. Barabara, E (2006). Personality Theories (7<sup>th</sup>ed). New York: Houghton mifflin Company
2. Boeree, C. G. (2006) Personality Theories [<http://www.ship.edu/%7Ecgboree/perscontents.html>]
3. Hall, C. s. & Linzey, G. (1991) Theories of Personality, 3rd edn.. John Wiley & Sons, Inc.U.S.A.
4. Nithyanandan, V. (2008) Buddhist and western psychology comparative study. Global vision publishing house.
5. Pandey, J. (ed.) (2001) Personality and Health Psychology In Psychology in India Revisited. Developments in the discipline, sage Publication India Pvt ltd. New Delhi. India.
6. Pervin, L (2003). The Science of Personality. 2nd edn. Oxford University Press. New York
7. Samuel W (1981): Personality Mc Graw Hill International Book Company.
8. Schultz D.P. & Schultz S.F. (2001) Theories of Personality 7<sup>th</sup> edition Wadsworth Thomson Learning, USA.
9. Sri Aurobindo, The synthesis of Yoga (1970 - 73) Sri Aurobindo Birth Centenary Library, Sri Aurobindo Ashram Press, Pondicherry, India
10. Tilak B. G. (1986) GeetaRahasya or Karma Yoga Rahasya, B. s. Sukhtankar (Eng. Tra.) 6<sup>th</sup>ednGeeta printers, Pune, India

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**M.A. Psychology Semester-II Paper-V**  
Practicals

Marks – Theory : 100

This Paper consists of Eight Laboratory Experiment. Each student shall complete Eight Experiments and submit Record Book containing Report of Experiment

**Practical (Any Eight )100 Marks**

- 1 Motivational Conflict
- 2 Paired Associate Learning
- 3 Ziegarnik Effect
- 4 Human Maze Learning
- 5 Normal Probability Curve
- 6 Conflict Resolution
- 7 AstheticColour Preference
- 8 Fatigue
- 9 Intelligence
- 10 Creativity
- 11 Emotional Intelligence
- 12 Personality
- 13 Aptitude
- 14 Attitude

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**M.A. Psychology Semester III**

**Paper-I  
Health Psychology**

Marks – Theory : 80

Int.Ass. : 20

**Objectives:**

1. To acquaint the students with the nature and significance of the emerging area of health psychology within a life-span perspective.
2. To highlight the importance of social and psychological processes in the experience of health and illness.
3. To focus on the behavioural risk factors vis-a-vis disease prevention and health promotion.

**UNIT I: INTRODUCTION TO HEALTH PSYCHOLOGY**

- A) Definition
  - i) Goals of Health Psychology
  - ii) History of Disease Care
    - a. Ancient Indian System
    - b. Ancient Chinese Medicine
  - iii) Medical Practices in Ancient Greece and Rome
- B) Pathway to Modern Medical Inquiry
  - i) The infectivity of Biomedical Model of Health
  - ii) Psychoanalytical View
  - iii) Psychosomatic Medicine
  - iv) Behavioural Medicine
  - v) Bio-Psychosocial Model of Health
- C) Pathway to Modern Medical Inquiry
  - i) The Infectivity of Biomedical Model of Health
  - ii) Psychoanalytical View
  - iii) Psychosomatic Medicine
  - iv) Behavioural Medicine
  - v) Bio-Medical Model of Health
- D) Emergence of Health Psychology
  - i) Illness Patterns Today
  - ii) Rising Costs of Health Care
  - iii) New Age Technology
  - iv) Increase in Health Care Concerns
  - v) Change in Medical Perspective

**UNIT II: PHYSIOLOGY OF HEALTH**

- A) The Nervous System
  - i) Central Nervous System (CNS)
    - a. Forebrain
    - b. The Mid Brain
    - c. The Hind Brain
    - d. The Spinal Cord
  - ii) The Peripheral Nervous System
    - a. Disorders of Nervous System
- B) The Endocrine System
  - i) Adrenal Glands
  - ii) Other Endocrine Glands
  - iii) Disorders
- C) The Cardiovascular System
  - i) The Heart
  - ii) Blood
  - iii) Plasma
  - iv) Blood Cells
- D) The Digestive System and Related Disorders
- E) The Respiratory System and Related Disorders
- F) Genetic Process and Health
- G) Immune System and Related Disorders

### UNIT III: HEALTH AND BEHAVIOUR

- A) Lifestyle, Risk Factors and Health,
- B) Health Behaviour
- C) Theories of Health Behaviour
- D) Motivational Models
  - i) Health Belief Model
  - ii) Protection Motivation Theory
  - iii) Planned Behaviour or Reasoned Action Theory
  - iv) Learning Theory
    - a. Classical Conditioning
    - b. Operant Conditioning
    - c. Modelling
- E) Behavioural Enactment Models
  - i) Implementation Intention
  - ii) Goal Theory
  - iii) Multi-stage Models of Health Behaviour
  - iv) Transtheoretical Model
  - v) Precaution Adoption Process Model (PAPM)
  - vi) Health Action Process Approach (HAPA)

### UNIT IV: HEALTH COMPROMISING BEHAVIOUR

- A) Substance Abuse and Dependence
  - i) Tobacco
    - a. Cessation of Smoking
  - ii) Alcohol
    - a. Effects of Alcohol Consumption
    - b. Dealing with Alcoholism
  - iii) Drug Abuse
    - a. Effects of Drug Addiction
    - b. Dealing with Drug Addiction
  - iv) Non-Substance Abuse-Technology Addiction
    - a. The Prevalence of Technology Addiction and Cause for Concern
    - b. Proneness to Technology Addiction
    - c. Assessment of Technology Addiction

### Reference Books-

1. Manika Gosh (2015). Health Psychology-concepts in Health and Well-Being. Pearson Publication Delhi.
2. Madhukar K. Tajne (2017). Health Psychology-Basic Issues and Process. Ishika Publication House, Delhi, Jaipur.
1. Aboud, F.E. (1998). Health Psychology in Global Perspectives. Thousand Oaks, CA: Sage.

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## M.A. Psychology Semester III

### Paper-II

#### Abnormal Psychology-I

Marks – Theory : 80  
Int.Ass. : 20

**Objectives:** The paper aims at providing an overview of the concept of abnormality and to help students to acquire the knowledge about the causes, symptoms and treatments of various types of psychological disorders. This will sensitize them to information on abnormal psychology and dispel myths regarding it.

### UNIT I: INTRODUCTION TO ABNORMAL PSYCHOLOGY

- A) Abnormal Behaviour and Society
  - i) Defining Abnormal Behaviour
  - ii) Relating Abnormal Behaviour
  - iii) Explaining Abnormal Behaviour
  - iv) Treating Abnormal Behaviour
- B) Classification and Assessment
  - i) Classification of Abnormal Behaviour based on DSM 5 and ICD 11 (Major categories)
  - ii) Assessment

## **UNIT II: Causal Factors and Viewpoint of Abnormal Behaviour**

- A) Causes and Risk Factors for Abnormal Behaviour
  - i) Necessary, Sufficient and Contributory Causes
  - ii) Feedback and Bidirectionality in Abnormal Behaviour
  - iii) Diathesis-Stress Model
- B) Viewpoints for Understanding the Causes of Abnormal Behaviour
  - i) The Biological Viewpoint and Biological Casual Factors
  - ii) The Psychodynamic Perspectives
  - iii) The Cognitive Behavioural Perspective
  - iv) The Humanistic-Existential Perspective
  - v) The Socio-cultural Viewpoint and Socio-cultural Causal Factors

## **UNIT III: ANXIETY DISORDERS AND OBSESSIVE-COMPULSIVE DISORDER**

- A) Anxiety Disorder Syndromes
  - i) Panic Disorder
  - ii) Generalized Anxiety Disorder
  - iii) Phobia
  - iv) Obsessive-Compulsive Disorder
  - v) Posttraumatic Stress Disorder
- B) Interpreting and Treating Anxiety Disorder
  - i) The Psychodynamic Perspective
  - ii) The Behavioural Perspective
  - iii) The Cognitive Perspective
  - iv) The Biological Perspective

## **UNIT IV: SOMATOFORM AND DISSOCIATIVE DISORDERS**

- A) Somatoform disorder
  - i) Somatization Disorder
  - ii) Hypochondriasis Disorder
  - iii) Pain Disorder
  - iv) Conversion Disorder
  - v) Causal Factors in Somatoform Disorder
  - vi) Treatment and outcomes in Somatoform Disorder
- B) Dissociative Disorder
  - i) Dissociative Amnesia and Fugue
  - ii) Dissociative Identity Disorder
  - iii) Depersonalization Disorder
  - iv) Causal factors in Dissociative Disorder
  - v) Treatment and Outcomes in Dissociative Disorder

### **Reference books:**

1. Butcher J.N., Hooley J.M., Mineka S & Dwivedi, C.B., (2018). Abnormal psychology. 16th Edn. Pearson publication New Delhi.
2. Oltmanns. T.F., (2016). Abnormal psychology, 8th Edn. Pearson Publication, New Delhi.
3. Sarason I.G., & Sarason, B.R., (2010). Abnormal Psychology: The problem of Maladaptive Behaviour, 11th Edn. PHI Learning Pvt. Lmt New Delhi.
4. Alloy, L.B., Riskind, J.H., & Manos, M.J. (2006). Abnormal psychology: Current perspectives (9th ed.). Delhi: Tata McGraw-Hill.
5. American Psychiatric Association: "Diagnostic and Statistical Manual of Mental Disorders", DSM-5 (5th Edn)
6. Barlow, D.H. & Durand, V.M. (1999). Abnormal psychology (2nd ed.). Pacific Grove: Books/Cole.
7. Carson, R.C., Butcher, J.N., Mineka, S., & Hooley, J.M. (2007). Abnormal Psychology, 13th Edn. Pearson Education, India.
8. Davison, G.C. Neal, J.M. & Kring, A.M. (2004). Abnormal psychology. (9th ed.). New York: Wiley. Comer, R.J. (2007). Abnormal psychology (6th ed.). New York: Worth Publishers.
9. Sue, D., Sue D. W. & Sue S. (2006) "Abnormal Behavior" (8th Edn) Houghton Mifflin Company.

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Paper-III  
**CLINICAL  
PSYCHOLOGY**

Marks – Theory : 80  
Int.Ass. : 20

**Objectives:**

1. Develop a basic understanding about assessment and interventions in the context of clinical psychology.
2. Demonstrate familiarity with scientific, ethical, legal, and practice-oriented issues in the field
3. Demonstrate the Methods of assessment and intervention in clinical psychological practice within the contemporary healthcare environment

**UNIT I : INTRODUCTION AND FOUNDATION OF CLINICAL PSYCHOLOGY**

- A) Definition and Characteristics of Clinical Psychology
  - i) Definition
  - ii) Characteristics of Clinical Psychology
    - i) Emphasis on Science
    - ii) Emphasis on Individual
    - iii) Emphasis on helping
  
- B) Activities and Work setting of Clinical Psychologist
  - i) Research
  - ii) Teaching
  - iii) Psychotherapy
  - iv) Consultation
  - v) Administration
  
- C) Distinguishing Clinical Psychology from Related Profession
  - i) Psychiatry
  - ii) Counseling Psychology
  - iii) School Psychology
  - iv) Social Work
  - v) Other Related Profession

**UNIT II: HISTORY AND RECENT DEVELOPMENTS**

- A) Ancient Roots
- B) Eighteen and Nineteenth Centuries
- C) The Birth of a Discipline : 1890-1910
- D) Childhood: World War I through World War II
- E) Adolescence : Post WWII and the Development of an Identity
- F) Adulthood: Milestones and Growing Pains

**UNIT III: MODELS IN CLINICAL PSYCHOLOGY**

- A) The Role of Theoretical Models
- B) Psychoanalysis
- C) Biological Model
- D) Interpersonal Model
- E) Humanism
- F) The Behavioural Model
- G) Cognitive Model

**UNIT IV: SPECIALIZATION IN CLINICAL  
PSYCHOLOGY: FORENSIC PSYCHOLOGY**

- A) Definition
- B) Psychology and Law
- C) Expert Witnesses
- D) Psychology and Criminal Law
- E) Civil Commitment
- F) Child Abuse and Neglect
- G) Training and Certification in Forensic Psychology

## Readings:

1. Hecker, J.E., & Thorpe, G.L. (2005). Introduction to clinical psychology: Science, practice, and ethics (Low Price Edition). Delhi: Pearson Education.
2. Pomerantz, A.M. (2008). Clinical Psychology: Science, practice, and culture. Sage Publications: New Delhi
3. Trull, T.J., & Phares, E.J. (2001). Clinical psychology: Concepts, methods, and profession (6th ed.). Belmont, CA: Wadsworth/Thomson Learning
4. Holt, R.R. (ed.). (1984). Diagnostic psychological testing. Revised edition. New York: International Universities Press.
5. Kaplan, R.M., Saccuzzo, D.P. (2001). Psychological testing: Principles, applications, and issues (5th ed.). New Delhi: Asian Books Pvt. Ltd.
6. Koocher, G.P., Norcross, J.C., & Hill III, S.S. (eds.). (1998). Psychologists' desk reference. Oxford: Oxford University Press.
7. Marks, D.F., & Yardley, L. (eds.). (2004). Research methods for clinical and health psychology. New Delhi: Sage.
8. Osborne, R.E., Lafuze, J., & Perkins, D.C. (2000). Case analysis for abnormal psychology: Learning to look beyond the symptoms. Philadelphia: Psychology Press.

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**M.A. Psychology  
Semester III**

**Paper-IV  
COUNSELING  
PSYCHOLOGY**

Marks – Theory : 80  
Int.Ass. : 20

## Objectives:

1. Understand the nature and process of counseling
2. Acquire the listening and communication skill for counseling.
3. Understand the personal and professional aspects of counseling

## **UNIT I: INTRODUCTION TO COUNSELING**

- A) Definition and Goals of Counseling
- B) Training, Job Setting and Activities of Counselor
- C) Stages of the Counseling process
- D) Characteristics of Counselor
- E) Written Communication and Counseling
- i) Aims and objectives of record keeping
- ii) File composition

## **UNIT II: BUILDING THE COUNSELING RELATIONSHIPS, AND IN DEPTH EXPLORATION**

- A) Communication and Building the Counseling Relationship
- B) The Core Conditions of Counseling
- C) Counselor's Actions that Impede Communication
- D) In Depth Exploration
  - i) Goals and methods
  - ii) Advanced empathy
  - iii) Immediacy
  - iv) Confrontation
  - v) Interpretation
  - vi) Role playing

## **UNIT III : ETHICS, COMMITMENT TO ACTION AND TERMINATION**

- A) Ethics in Counseling
  - i) Codes of Professional Ethics
  - ii) Ethical Principals
  - iii) Ethical Theory
  - iv) The Relationship between Ethics and the Law
  - v) Common Ethical Violation by Mental Health Professionals
- B) The Process of Goal Setting

## **UNIT IV: COUNSELLING STRATEGIES AND TECHNIQUES**

- A) Assessment and Diagnosis in Counseling
- B) A Frame of Reference for Understanding Assessment and Diagnosis
- C) Components of Effective Assessment
- D) Tools for Effective Diagnosis
- E) Placement of Assessment in The Counseling Process: Risk and Opportunities
- F) Intake Interviews
- G) Mistakes Counselors Make in the Assessment Process

### **Reference:**

1. Welfel, E. R. and Patterson L.E. (2005), The counseling Process: A Multitheoretical integrative Approach' CENGAGE Learning India private Ltd. New Delhi.
2. Tajne. M.K., (2017). Handbook of Counseling, ABD publishers, New Delhi
3. Gladding, S.T. (2012), Counseling: A Comprehensive Profession, 7<sup>th</sup>Edn. Pearson publication, New Delhi.
4. Gibson, R.L. & Mitchell, M.H. (2006), Introduction to Counselling and Guidance, Printice Hall of India Private Ltd., New Delhi.
5. Nelson R. & Jones (2008), Basic Counselling Skills: A Helper's Manual. Sage Publication, India private Ltd. New Delhi.

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## **M.A. Psychology Semester III**

**Paper-V  
Practicals**

### **A) Any Eight of Following**

1. Clinical Analysis Questionnaire
2. Neuroticism Scale Questionnaire
3. Eight State Questionnaire
4. Clinical Case Study Form
5. PGI Quality of Life
6. PGI Health Questionnaire

**70 Marks**

7. Spiritual Intelligence Scale
8. Sentence Completion Test
9. Maudsley Personality Inventory
10. Reaction to Frustration
11. Sinha's Comprehensive Anxiety Scale
12. Mental Health Inventory
13. Rorschach Ink Blot Test
14. Social Phobia Scale

## **B) Case Study**

**30 Marks**

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**M.A. Psychology  
Semester IV**

### **Paper-I**

**STRESS, COPING AND HEALTH**

Marks – Theory : 80

Int.Ass. : 20

### **Objectives:**

1. To impart an introduction to the concept, forms/types and sources of stress phenomenon within a life-span perspective;
2. To discuss in brief the nature, consequences, and management of emotional vital signs of health/well-being;
3. To provide evidence about the correlates/consequences of stress; and evaluate the role of moderating variables in stress-health/well-being linkage;

### **UNIT I: STRESS AND HEALTH**

- A) Understanding Stress
  - i) Common Sense Understanding of Stress
  - ii) Early Research in Stress
  - iii) Definition of Stress-Its Nature and Meaning

- B) Theories of Stress
  - i) Fight or Flight Response
  - ii) General Adaptation Syndrome
  - iii) Cognitive Appraisal Theory
  - iv) Person-Environment Fit Theory
  - v) Psychodynamic Theory
  - vi) Nuclear Conflict Theory
  - vii) Genetic Constitutional Theory
  - viii) Diathesis-Stress Model
  - ix) Holistic Health Theory
- C) Role of Physiology in Stress
  - i) Nervous System
  - ii) The Brain: Its Role in Stress
  - iii) The Autonomic Nervous System
  - iv) Endocrine System and Its Role in Stress
  - v) The Cardiovascular System
- D) Sources of Stress
  - i) Daily Hassle
  - ii) Stressful Life Events
  - iii) Academic Stress
  - iv) Family and Relationship
  - v) Occupational Stress
  - vi) Social Stressors
- E) After-effects of Stress
  - i) Effects of Early Stressful Life Experiences

## **UNIT II: MODERATOR AND EFFECTS OF STRESS**

- A) Personality and Stress
  - i) Type A Behaviour Pattern and Health
  - ii) Type A Behaviour Pattern and Stress
  - iii) Health and Type A Behaviour
  - iv) Type C Personality and Stress
  - v) Locus of Control
  - vi) Hypersensitivity Personality
  - vii) Cancer-Prone Personality
  - viii) Depression-Prone Personality
  - ix) Attribute Style
- B) Psycho-Physiological Consequences of Stress
  - i) The Cardiovascular Disorders
  - ii) Allergies
  - iii) The Digestive System Disorders
  - iv) Stress and Ageing
  - v) Stress and Cancer
  - vi) Stress and Acquired Immune Deficiency Syndrome (AIDS)
  - vii) Other Indirect Effects of Stress

## **UNIT III: COPING WITH STRESS**

- A) Meaning and Definition of Coping
  - i) Styles of Coping
  - ii) Goals of Coping
- B) Measurement of Stress
  - i) Measurement in Laboratory
  - ii) Physiological Measure
  - iii) Major Life Events
  - iv) Daily Hassles
  - v) Perceived Stress
- C) Individual Differences in Coping with Stress
  - i) Personality
  - ii) Psychological Hardiness
  - iii) Tolerance for Stimulation
  - iv) Attributional Style
  - v) Learned Helplessness
  - vi) Sense of Coherence
  - vii) Gender and Coping



- D) Stress Management: Basic Techniques of Stress Management
  - i) Medical Approach
  - ii) Behavioural Approaches to Stress Management
  - iii) Relaxation
  - iv) Bio-feedback
  - v) Meditation
  - vi) Transcendental Meditation (TM)
  - vii) Mindfulness
  - viii) Hypnosis
  - ix) Cognitive Approaches to Stress Management
  - x) Systematic Desensitization
  - xi) Cognitive Restructuring
  - xii) Rational-emotive Therapy (RET)
- E) Self-development Approach
  - i) Assertiveness
  - ii) Time Management
  - iii) Learning to be Happy

#### **UNIT IV: HEALTH PROMOTION AND PREVENTION OF ILLNESS**

- A) Health Promotion
    - i) Methods Used in Health Promotion
    - ii) Dissemination of Information
    - iii) Behaviour Change Methods
    - iv) Incentives
    - v) Social Engineering
  - B) Levels of Preventive Health Behaviour
    - i) Primary Prevention
    - ii) Secondary Prevention
    - iii) Tertiary Prevention
  - C) Health Enhancement Through Primary Prevention
    - i) Immunization
    - ii) Safety Measures
    - iii) Diet and Nutrition
      - a. What is Nutrition?
      - b. Effects of Malnutrition
      - c. Obesity
      - d. Factors linked to Obesity
      - e. Weigh Management
    - iv) Exercise
      - a. Benefits of Exercise
      - b. Types of Exercise
      - c. The Exercise Regimen
    - v) Sleep
      - a. Sleep Cycle
      - b. Health Implication of Sleep
    - vi) Personal Hygiene
      - a. HIV Infection and AIDS
    - vii) Genetic Screening
      - a. Advantages and Disadvantages of Genetic Screening
- b.

#### **Reference Books-**

1. Manika Gosh (2015). Health Psychology-concepts in Health and Well-Being. Pearson Publication Delhi.
2. Madhukar K. Tajne (2017). Health Psychology-Basic Issues and Process. Ishika Publication House, Delhi, Jaipur.
3. Aboud, F.E. (1998). Health Psychology in Global Perspectives. Thousand Oaks, CA: Sage.

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**Paper-II**  
**Abnormal**  
**Psychology II**

Marks – Theory : 80  
Int.Ass. : 20

**Objectives:**

The paper aims at providing an overview of the concept of abnormality and to help students to acquire the knowledge about the causes, symptoms and treatments of various types of psychological disorders. This will sensitize them to information on abnormal psychology and dispel myths regarding it.

**UNIT I : MOOD DISORDERS AND SUICIDE**

- A) Unipolar Mood Disorder
  - i) Depression that are not Mood Disorders
  - ii) Mild to Moderate Depressive Disorders
  - iii) Major Depressive Disorders
  - iv) Causal Factors in Unipolar Mood disorders
- B) Bipolar Mood Disorder
  - i) Cyclothymia
  - ii) Bipolar Disorders
  - iii) Schizoaffective Disorder
  - iv) Causal factors in Biopolar Disorder
- C) Treatment and Outcomes
- D) Suicide

**UNIT II: PERSONALITY DISORDERS**

- A) Clinical Features of Personality Disorders
- B) Categories of Personality Disorders
- C) Causal factors in Personality Disorders
- D) Treatment and Outcomes
- E) Antisocial Personality and Psychopathy

**UNIT III: SUBSTANCE RELATED AND OTHER ADDICTIVE DISORDERS**

- A) Alcohol Abuse and Dependence
- B) Drug Abuse and Dependence
- C) Other Addictive Disorders: Hyperobesity and Pathological Gambling
- D) The Genetics of Alcoholism.

**UNIT IV: THE SCHIZOPHRENIA AND DELUSIONAL DISORDER**

- A) The Schizophrenia
- B) The Clinical Picture in Schizophrenia
- C) Classic Subtype of Schizophrenia
- D) Causal Factors in Schizophrenia
- E) Treatment and Outcomes
- F) Delusional Disorder (Paranoia)

**Reference Books:**

1. Butcher J.N., Hooley J.M., Mineka S & Dwivedi, C.B., (2018). Abnormal psychology. 16th Edn. Pearson publication New Delhi.
2. Oltmanns. T.F., (2016). Abnormal psychology, 8<sup>th</sup>Edn. Pearson Publication, New Delhi.
3. Sarason I.G., & Sarason, B.R., (2010). Abnormal Psychology: The problem of Maladaptive Behaviour, 11<sup>th</sup>Edn. PHI Learning Pvt.Lmt New Delhi.
4. Alloy, L.B., Riskind, J.H., & Manos, M.J. (2006). Abnormal psychology: Current perspectives (9th ed.). Delhi: Tata McGraw-Hill.
5. American Psychiatric Association: “Diagnostic and Statistical Manual of Mental Disorders”, DSM-5 (5<sup>th</sup> Edi)
6. Barlow, D.H. & Durand, V.M. (1999). Abnormal psychology (2nd ed.). Pacific Grove: Books/Cole.
7. Carson, R.C., Butcher, J.N., Mineka, S., & Hooley, J.M. (2007). Abnormal Psychology, 13th Edn. Pearson Education, India.
8. Davison, G.C. Neal, J.M. & Kring, A.M. (2004). Abnormal psychology. (9<sup>th</sup>ed.). New York: Wiley. Comer, R.J. (2007). Abnormal psychology (6th ed.). New York: Worth Publishers.
9. Sue, D., Sue D. W. & Sue S. (2006) “Abnormal Behavior” (8<sup>th</sup> Edi) Houghton Mifflin Company

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## M. A. Psychology Semester IV

### Paper-III CLINICAL ASSESSMENT

Marks –

1. The student will have a basic understanding of and be able to critique the major contemporary models of psychotherapy.
2. The student will have practiced the basic techniques of the various psychotherapeutic models.
3. The student will appreciate the multifaceted and complex nature of psychological issues and their treatment.
4. The student will continue to develop his/her own theory and approach to counseling and psychotherapy.
5. The student will be aware of current research in the field.
6. The student will be stimulated to further study, thought, and awareness of standards on issues related to the field.

#### UNIT I: INTRODUCTION TO PSYCHOTHERAPIES

- A) Nature and Definition of Psychotherapies
- B) Goals or Purposes of Psychotherapy
- C) Types of Psychotherapy
- D) Modes of Psychotherapy
- E) Nature of Therapeutic Variables
- F) Course of Psychotherapy

#### UNIT II: PSYCHODYNAMIC PSYCHOTHERAPY

- A) Psychoanalysis
- B) Psychoanalytic Theory since Freud
  - i) Carl Jung's Analytical Psychotherapy
  - ii) Alfred Adler's Individual Psychotherapy
  - iii) The Neo-Freudians
  - iv) The Ego Psychologists
  - v) The Object Relations Theorists
  - vi) Brief Psychodynamic Theory
  - vii) Interpersonal Psychotherapy

#### UNIT III: BEHAVIOUR THERAPY

- A) Basic assumptions & various forms of behavior therapies
- B) Systematic Desensitization & Flooding, Implosive Therapy, Aversive Therapy
- C) Bio-Feedback Technique
- D) Assertiveness Training

#### UNIT IV: COGNITIVE, HUMANISTIC AND EXISTENTIAL THERAPIES

- A) Cognitive Therapies:
  - i) Rational Emotive Behaviour Therapy
  - ii) Beck's Cognitive Therapy
- B) Roger's Client Centered Therapy
- C) Gestalt Therapy
- D) Logo Therapy & Reality Therapy
- E) Lazarus Multimodal Therapy
- F) Transactional Analysis

### Reference Books:

- 1 Capuzzi, D., & Gross, D.R. (2016). Counseling and Psychotherapy: theories and interventions 6<sup>th</sup>Edn. Pearson Education: India.
- 2 Corey, G. (2013). Theory and practice of counseling and psychotherapy 9<sup>th</sup>Edn. Cengage Learning New Delhi
- 3 Tajne. M.K., (2017). Handbook of Counseling, ABD publishers, New Delhi
- 4 Seligman, L., & Reichenberg, L., (2014). Theories of counseling and psychotherapy: Systems, Strategies and skills, PHI Learning private limited Delhi.
- 5 Woolfe, R. & Dryden, W (1996). Handbook of counseling psychology. New Delhi: Sage.
- 6 Stewart, I. (2000). Transactional analysis counseling in action. London: Sage.
- 7 Watts, A. W. (1973). Psychotherapy: East and West. London: Penguin books.

- 8 Rama, S. & Ballentine, R. & Ajaya, S. (1976). Yoga and psychotherapy. Hinsdale, PA: Himalayan International Inst.
- 9 Ajaya, S. (1989). Psychotherapy: East and West. Hinsdale, Penn.: Himalayan International Inst.
- 10 Veereshwar, P. (2002). Indian systems of psychotherapy. Delhi: Kalpaz publications

## **M.A. Psychoogy Semester IV**

### **Paper-V Practicals**

#### **A) Test Administration (Any Eight )70 Marks**

- 1) Medico Psychological Questionnaire
- 2) Assertiveness Inventory
- 3) Beck's Depression Inventory
- 4) Dysfunction Analysis Questionnaire
- 5) Defense Mechanism Inventory
- 6) Bhatia Battery of intelligence
- 7) Type A /B Behavioral Pattern Scale
- 8) Comprehensive Scale of Tension
- 9) TAT
- 10) Dysfunction Analysis Questionnaire
- 11) Emotional Stability
- 12) Cognitive Style
- 13) Deprivation Scale
- 14) Martial Adjustment Scale

#### **B) Dissertation**

**30 Marks**

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## FORENSIC SCIENCE

Draft Syllabus of B.Sc. Part-I (Semester- I & II)

IS Forensic Science (Basics of Forensic Science)

(Effective from session 2015-16)

The examination in Forensic Science of First semester shall comprise of one theory paper, internal assessment and practical examination. Theory paper will be of 3 Hrs. duration and carry 80 marks. The internal assessment will carry 20 marks. The practical examination will be of 6 to 8 hours duration and carry 50 marks.

The following syllabus is prescribed on the basis of six lectures per week and 6 practical periods per batch per week. Each theory paper has been divided into 6 units. There shall be one question in every unit with internal choice for each of 12 marks & one compulsory question covering all the syllabus of Semester-I (8 marks).

B.Sc. Part-I (Semester- I)

IS Forensic Science (Basics of Forensic Science)

Total Lectures: 84

Marks: 80

Note: Figures to the right hand side indicate number of lectures.

### Unit I : Developmental Growth of Forensic Science

14L

Introduction to Forensic science - nature, need and function. Laws and Principles, basics of Forensic Science, (Historical development) and scope of Forensic Science in India. Forensic Scientists, Investigating officers and their assigned role and duties. Global perspective in the field of forensic science: history, development, education and training. Organizational setup of forensic science lab and other national & international agencies. Ethical issues in Forensic Science.

### Unit II :

14L

#### A) Forensic Science Laboratories and Facilities

[5L]

Growth of Forensic Science Laboratories in India - Central and State level Laboratories. Services and functionalities provided by various FSLs. Various divisions in the FSL.

#### B) Recognition of Bloodstain Patterns

[9L]

History of Bloodstain Pattern interpretation, properties of human blood, target surface considerations, Size, Shape and Directionality of bloodstains, Spattered blood, other Bloodstain Patterns, interpretation of Bloodstain on clothing and footwear, Documentation and Photography for Bloodstain Pattern Analysis.

### Unit III : Crime and Crime Scene management

14L

Criminals, criminal behavior, Crime Scene survey, physical evidence, collection preservation types and importance of criminal investigation. Components of Crime Scene Management - Information management, manpower, technology & logistics management, role of crime scene managers and first responding officers. Crime Scene Reconstruction: defining crime scene reconstruction, nature & stages of crime scene reconstruction.

**Unit IV : Impressions and Prints**

14L

- Finger prints: Nature, Location, collection and evaluation, taking control samples, Forensic Significance.
- Footprints: Importance, Gait Pattern, Casting of footprints in Different medium, Taking Control samples.
- Tire Marks/prints and Skid marks, taking control samples, Forensic Significance.
- Lip Prints: Nature, Location, collection and evaluation, taking control samples, Forensic Significance.
- Bite Marks: Nature, Location, collection and evaluation, taking control samples, Forensic Significance.
- Ear Prints: Nature, Location, collection and evaluation, taking control samples, Forensic Significance.

**UNIT: V Forensic Documents**

14L

Various types of forensic documents: genuine and forged documents, classification of forensic documents: Specimen writings, admitted writings, Handling, preservation and marking of documents, natural variation and disguise in writing, Principle of Handwriting Identification, general and individual characteristics, Basic Tools needed for forensic documents examination and their use. Functions of a Forensic Document Examiner.

**Unit VI: Forensic Medicine**

14L

Global Medical Jurisprudence, Legal Procedure in India, Documentary evidence: Medical certificates, medical reports, dying declaration. Determination of time since death, including by histopathological methods. Medico legal investigation of sexual offences, including examination of victims and suspects. Medico legal aspects of death: causes of death such as asphyxia, electrocution, thermal trauma, heat burns, starvation, natural death, sudden death, death by accident. Medico legal aspects of wounds: medical and legal definition of wounds, types of mechanical and regional injuries, aging of wounds.

**Semester- I**

**15 Forensic Science (Basics of Forensic Science)**

**Total Laboratory sessions: 21**

**Marks: 50**

1. Collection and Handling of Petroleum samples.
2. Collection and Handling of murder case samples.
3. Collection and Handling of fire crime scene samples.
4. Sketching and Photography of various type of crime scene.
5. Document and Fingerprint Photography.
6. To take Plain and Rolled inked fingerprints and to identify the patterns.
7. To develop Latent fingerprints with Powder method.
8. Lifting of Fingerprints.
9. Detection of forgeries including traced and stimulated forgery and built up documents.
10. Examination of security features of Currency Notes and Indian Passports.
11. Report writing and interpretation.

## SEM - II

### Forensic Science

#### 2S Forensic Science (Forensic Chemistry)

Total Lectures: 84

Marks: 80

Note: Figures to the right hand side indicate number of lectures.

#### Unit I

14L

##### A) Qualitative-Quantative Analysis

[5L]

Organic - inorganic products - Chemical, oils, petroleum products, cement.

##### B) Forensic Chemistry

[5L]

Screening, sampling-methods type (collection), statistical method, different standard methods, Inorganic analysis, Micro-chemical method.

##### C) Miscellaneous

[4L]

Characteristics/examination/act/organic-inorganic products-Gold, silver, tobacco, tea, sugar, salts, fertilizers, dyes, drugs, paints, fats, various acts (legal aspects). *milk, coffee*

#### Unit II: Separation and detection technique

14L

Gas chromatography: Theoretical principles, instrumentations and technique, columns, stationary phases, detectors, Forensic applications. HPLC: Review of theory, Instrumentation, Technique, column, detectors, LC-MS, Forensic applications. *Atomic Absorption Spectroscopy*- Introduction, Basic principles, Instrumentation and Techniques, Forensic applications. Flame spectrometry- Principle, Instrumentation and working, Forensic applications. ~~X~~ Inductive Coupled Plasma Spectroscopy - Principles and Instrumentation, Forensic applications. Thermal methods-TGA, DTA, DSC.

#### Unit III: Forensic Toxicology

14L

Introduction and concept of forensic toxicological examination and its significance. Poisons: (Plant Poison, Animal Poison, Metallic Poison) classification of poisons, types of poisoning, collection and preservation of toxicological exhibits in fatal and survival cases, signs and symptoms of poisoning, mode of action and its effect on vital functions, medico-legal and post-mortem examination report/finding studies, ~~X~~ specific analysis plan/approach to toxicological examination of poisoning samples, excretion of poisons, detection of poisons on the basis of their metabolic studies, interpretation of analytical data and forming of opinion.

#### Unit IV: Narcotic Drug and Psychotropic Substances

14L

Analysis of Narcotic Drugs and Psychotropic Substances, Drug effects, drug Hazards, Tolerance and dependence of drugs, Problems of drug addiction, Identification of drug addict, Drug addicts and crimes, Classification of Narcotics and other drugs, Analytical techniques for identification of drugs. Types of Pharma drugs, Steroids, Forensic Pharmacological studies, Ingestion of drugs, absorption, distribution, metabolism, pathways of drug metabolism, drug metabolism and drug toxicity, excretion of drugs.

#### Unit V: Study of Analysis of Beverages

14L

Introduction, Definition of alcohol and illicit liquor, Alcoholic and non-alcoholic beverages and their composition, Proof spirit, absorption, de-toxication and excretions of alcohol, problems in alcohol cases and difficulties in diagnosis, Alcohol and prohibition, Consequences of drunken driving. Analytical techniques in the analysis of alcohol and other articles. Case study.

*Intentionally scarce  
rite*

14L

UNIT VI: Miscellaneous

Arson: chemistry of fire, investigation and evaluation of clue material, analysis of arson exhibits by instrumental methods: Management of Arson cases. Food adulteration: Introduction. Prevention of food adulteration. Analytical techniques for analysis of exhibits involved in food and other material cases. Relevant provision of: 1. Prevention of Food Adulteration Act 1954 (Definition, Power of Food Inspector, Offences and Penalties). 2. Narcotic Drugs & Psychotropic Substances Act 1985 (Definition, Licit Opium Cultivation, Minimum and Commercial Quantity in Narcotic Drugs, Offences and Penalties). 3. Prevention of Illicit Trafficking in NDPS Act 1985 (Detention of a Person Under the Act). 4. Drugs Control Act 1940 (Definition, Power of Chief Commissioner Under the Act). 5. Drugs & Cosmetics Act 1945 (Definition, Adulterated, Misbranded, Spurious Drugs and Cosmetics, Offences and Penalties).

Semester- II

2S Forensic Science (Forensic Chemistry)

Total Laboratory sessions: 21

Marks: 50

List of Practicals

1. Identification of food adulteration - vegetable oil, Cold drinks etc. (2 nos).
2. Quantitative or qualitative study of drug opiates. (2 nos).
3. Examination of fire arson cases by GC, TLC. (1 nos).
4. Detection and determination of various adulterants in alcohol, by colour tests. (Qualitative analysis) (2 nos.).
5. Chemical analysis of explosive materials (Gun powder)- Colour test, Microscopic examination. (2 nos).
6. Analysis of alcohol from blood (quantitative by GC). (2 nos).
7. Extraction methods of drugs, Poisons. (2 nos).
8. Colour Tests for identification of poisons, drugs. (2 nos).
9. Plant, animal, Metallic poison analysis. (2 nos.).
10. Polymer Testing.
11. Separation of Sampling Material by TLC (drugs, poison etc.) (2 nos).
12. Study of Steroids (separation by TLC).
13. Examination of chemicals used in Trap cases by UV-visible spectroscopy. (2 nos)
14. Examination of other metal.

Distribution of Marks for Practical Examination.

Time: 6 – 8 hours

(One Day Examination)

Marks: 50

Exercise- I	.....	12
Exercise- II	.....	12
Exercise- III	.....	12
Viva-Voce	.....	07
Record	.....	07
	-----	
Total:		50



B. Sc. Part II

~~B. Sc. Part II~~ ~~252~~ ~~45~~

~~Ku. Chandeikar~~ ~~Janardan~~ ~~Wabale~~

Ku. Chandeikar  
Janardan  
Wabale

FORENSIC SCIENCE

Draft Syllabus of B.Sc. Part- II (Semester- III & IV)

3S Forensic Science (Basics of Forensic Physics)

(Effective from session 2016-17)

The examination in Forensic Science of Third semester shall comprise of one theory paper, internal assessment and practical examination. Theory paper will be of 3 Hrs. duration carry 80 marks. The internal assessment will carry 20 marks. The practical examination will be of 6 to 8 hours duration and carry 50 marks.

The following syllabus is prescribed on the basis of six lectures per week and 6 practical periods per batch per week. Each theory paper has been divided into 6 units. There will be one question in every unit with internal choice for each of 12 marks & one compulsory question covering all the syllabus of Semester-III (8 marks).

B.Sc. Part- II (Semester- III)

3S Forensic Science (Basics of Forensic Physics)

Total Lectures: 84

Marks: 80

Note: Figures to the right hand side indicate number of lectures.

Unit I Laser and Fiber Optics 14L

Introduction, Production of LASER, Types of LASER, Properties and applications of LASER, Optical fibers, Propagation of light through optical fibers, angle of acceptance and numerical aperture, losses, Solar cells.

Unit II Radio Activity 14L

Introduction, Review of nuclear composition, nuclear properties and half life, Radioactive decay scheme, Applications of radio isotopes, Radiometric dating.

Unit III Ballistics 14L

Introduction, types of ballistic, internal, external and terminal ballistics, velocity recoil, theory of recoil, barrel pressure measurement, ballistics coefficient, angle of elevation of the barrel.

Unit IV Experimental techniques 14L

Forensic Photography, introduction, 35mm film/digital SLR camera. Digital photo imaging, ISO number, Exposure index, photo imaging evidences, angle, scale, depth of field, light, ambient light, colour temperature, flash/strobe. Crime scene investigation.

210  
500

Magnetic Measurement and FET characteristics), Radiation Detection, Geiger Muclier counter, optical fiber communication system, Piezoelectricity and piezoelectric measurements

**Unit V Exterior Ballistics**

**141.**

Introduction, General consideration, Parabolic trajectory of a bullets, Vaccum trajectory and calculation of remaining velocity, Air resistance, Bullet drop, Wind deflection, Gyroscopic drift, Twist verses stability, Canting, shooting up/down, velocity of falling shot and falling bullet, Escape velocity, Mazimum horizontal and vertical range of shot pellets Ricochet: Critical angle for ricochet for the bullet and the surface, Relationship between the angle of incidence and ricochet. Stability in flight after ricochets, Lethal effects of ricochet bullet.

**Unit VI Forensic Microscopy**

**(141)**

Introduction, Basics of microscope, compound microscope- parts and properties, comparison microscope, Stereomicroscope, Polarizing microscope- polarization and applications, Micro spectrophoto meter. Scaning Electron Microscope (SEM). Trasmission Electron Microscope (TEM).

**Semester- III**

**3S Forensic Science (Basies of Forensic Physics)**

**Total Laboratory sessions: 21**

**Marks: 50**

**List of Experiments:**

*The working of compound microscope*

1. Laser Parameter
2. Combination of lenses
3. Determination of angle of prism A
4. Newton's rings
5. Study of absorption coefficient of given sample
6. Bridge rectifier (to study load regulation)
7. Measurement of Hall voltage
8. FET characteristics
9. Determination of density of given sample (gravimetric analysis)
10. Determination of resistivity of four probe method
11. Simultion of Bullet trajectory
12. Frequency of AC mains
13. Thermal analysis of given sample using DSC/TGA
14. Working with compound microscope and working with comparison microscope
15. Measurement of recoil (sample Calculation) and determination of remaining velocity
16. Classification and measurements of bullets

Distribution of Marks for Practical Examination.

Time: 6 – 8 hours	(One Day Examination)	Marks: 50
Exercise- I	.....	12
Exercise- II	.....	12
Exercise- III	.....	12
Viva-Voce	.....	07
Record	.....	07
-----		
Total:		50

Syllabus Prescribed for B.Sc. Part- II (Semester- IV)

B.Sc. Part- II (Semester- IV)

4S Forensic Science (Basics of Forensic Biology)

Total Lectures: 84

Marks: 80

Note: Figures to the right hand side indicate number of lectures.

Unit I

14L

A) Cell Biology, Organic And Biochemical Compounds (5L)  
 \*Cell theory, \*Cell Structure and Function in Prokaryotes and Eukaryotes, Composition of blood, study of blood components and its functions and body fluid analysis.

B) Human Physiology And Anatomy (5L)  
 Skeletal Muscle physiology and Nervous system Physiology, coordination systems, brain functions and receptor organs. Mechanism of blood circulation, cardiac mechanism.

C) Microbiology And Biotechnology (4L)  
 Microscopy \*Principles and types Recombinant DNA technology and its application in Health and Diseases, Western and Southern Blot techniques (Satyanarayana)

Unit II Crime Scene Investigation

14L

Protection of Biological Evidences, Documentation, Chain of Custody, Recognition of Biological evidences encountered in various cases, Analysis of Biological Fluid, Saliva, Semen, Vaginal Fluid, Urine, Serological Techniques, Identification of Blood, Blood Grouping (2<sup>nd</sup> Book), Human & Non-human Human & Animal Hair morphology.

Unit III

(Richard Lee) 14L

Structural & definitive properties of Chromosomes, Human Genome, Sources of DNA evidence, Method of DNA extraction, DNA databasing, Forensic Anthropology, Forensic Odontology, Forensic Pathology, Luminal use in

Unit IV

14L

Forensic Entomology: Basic Principle of Insect Biology, Life Cycle, Estimation of Time of Death, Preservation of Sample, Forensic Botany: Identification of Plant specimen, Analysis

Study of Teeth  
 missing case study of skeleton  
 Maternity/Paternity  
 R. Anandappa

of pollen & aquatic microorganisms, Techniques for dating specimens using plant A  
Dendrochronology, Algal colonisation, Application of plant ecology.

Unit V Forensic Serology

Determination of human and animal origin from bones, hairs, nails, skin, body tissue, fluids /strains. Blood groups – biochemistry and genetics of ABO, Rh, Mn systems, stains and other fluids / stains Identification of wild life materials such as skin, fur, bones, nails, horn, teeth, flowers and plants by conventional and modern methods. Identification of Pug marks of various animals census of wild life population. Crime Scenes, Confiscated Bird Goods, Anthropological Arte facts.

Unit VI

14L

✓ (A) Forensic Microbiology And Palynology

[7L]

Development of forensic microbiology, Types and identification of microbial organisms/ fungi of forensic significance, Techniques in forensic microbiology. [Understanding Bioterrorism: - Types of biological agents – Category A, B, C. Planning and response to bioterrorism – Preparedness Biosurveillance, Biodefence. Epidemiology of Bioterrorism, Punishments for Bioterrorism act Under Prevention of Terrorism Act, 2002. Study of spore, powdered minerals and pollens of forensic importance, Use of pollen grains & spores in criminal or civil investigation, Applications of Forensic Palynology.

(B) DNA Profiling And Its Forensic Significance

[7L]

History of DNA fingerprinting, Human genetics - Heredity, Alleles, Mutations & Population Genetic. Molecular Biology of DNA. Forensic Application of recombinant DNA technology/ Forensic Biotechnology, Human Genome Project, Variations, Polymorphism in DNA system - DNA markers RELP, RAPD, VNTRs, SNP, Autosomal - STR, Y-STR, Mitochondrial DNA. Forensic Significance of DNA Profiling.

Random amplified polymorphic DNA

Semester- IV

Single-nucleotide polymorphism

4S Forensic Science (Basics of Forensic Biology)

Total Laboratory sessions: 21

Marks: 50

Experiment for Biology:

Sayli

1. Antigen-antibody rection (blood groupings)
2. Microscopic Comparison of a) Animal Hair b) Human Hair
3. Presumptive Tests for Blood
  - a. Phenolphthalin
  - b. Benzidine
  - c. Leucomalachite Green (LMG)
  - d. Luminol
4. Confirmatory Tests for Blood by Crystallization Assays
5. Species Identification from various biological fluids

Electrophoresis

## FORENSIC SCIENCE

Draft Syllabus of B.Sc. Part- III (Semester- V & VI)

5S Forensic Science (Forensic Psychology)

(Effective from session 2017-18)

The examination in Forensic Science of Fifth semester shall comprise of one theory paper, internal assessment and practical examination. Theory paper will be of 3 Hrs. duration and carry 80 marks. The internal assessment will carry 20 marks. The practical examination will be of 6 to 8 hours duration and carry 50 marks.

The following syllabus is prescribed on the basis of six lectures per week and 6 practical periods per batch per week. Each theory paper has been divided into 6 units. There shall be one question in every unit with internal choice for each of 12 marks & one compulsory question covering all the syllabus of Semester-III (8 marks).

B.Sc. Part- III (Semester- V)

5S Forensic Science (Forensic Psychology)

Total Lectures: 84

Marks: 80

Note: Figures to the right hand side indicate number of lectures.

Unit I : The Science of Psychology 14L

Concepts of psychology- Definition of psychology, goals of psychology, History of psychology- Development of psychology, role of psychologist, Different perspectives in Psychology- Modern perspectives, Humanistic, behaviouristic, cognitive, psychodynamic. Types of psychology professions- Psychiatrist, Psychologist, Counselor. The science and research methods- Interview, observation, case study method Professional and Ethical issues in psychology- APA code of conducts for Psychologist.

Unit II : Theories of Personality 14L

Understanding personality: Definition- mainly all port's definition, stressing uniqueness, enduring characteristics, temperament. Approaches - Psychodynamic (Freud, Jung & Adler). Humanistic (Rogers & Maslow) Dispositional approaches - Type (Jung, Type A & B, Rotter and Big - 5 and Trait (Catelli) Behavioral Approaches - Locus of control and Social learning theory. Assessment of personality - Questionnaires, Rating Scales and Projective tests, biological model assessment of personality. Psychological theories: Learning behavioral theory, Psycho analytic theory, Cognitive theory, REBT.

Unit-III 14L

A) The Content of Forensic Psychology [4L]

History of Forensic Psychology (Historical Perspective), Defining Forensic Psychology. Importance of Forensic Psychology.

B) Applying Social Psychology in the interpersonal aspects of legal system [5L]

Role of media in trial

Before the trial begins: 1. Effect of police procedure and media coverage, 2. Eye Witness Testing: Problems and Solutions. The Central participation in trial, Effect of Attorney, Judges, Jurors, and Defenders.

**C) Legal Aspects of Forensic Psychology**

[5L]

Introduction. Historical Background. Survey into Psychological evidence in court Ethical and Professional Issues. The role of Forensic Psychology. Civil cases; Criminal cases.

difference betn SM

**Unit IV: Personality Disorders**

14L

Defining and Diagnosing Personality Disorders. Odd-Eccentric Personality Disorders. Dramatic-Emotional Personality Disorders. Anxious-Fearful Personality Disorders. ~~Alternative Conceptualization of Personality Disorder.~~ Stress and Health: Stress Factors in the stress reaction. Coping with the stress. Statistics in Forensic Psychology. Descriptive Statistics, Inferential Statistics.

Treatment - Psychopathy

Psychoanalytical

Descriptive 1m

**Unit V :**

14L

**A) Essentials of Forensic Psychology**

[6L]

Development of forensic psychology, Ethical standards of forensic psychology, Scientific methods used in forensic psychology, Importance of study of forensic psychology.

**B) Causes of criminal behaviour and Psychological theories**

[8L]

Psychological Factor & delinquency, ADHD & conduct disorder, Psychopathy & antisocial personality disorder, Sexual disorder, Substance abuse, Treatment.

**Unit VI : Investigative psychology**

14L

Criminal psychological profiling-Nature, definition. Psychological tests used Criminal psychological profiling. Psychological autopsy, Forensic hypnosis (Narco analysis), Polygraph, Stalking, The Psychology of violence.

**Semester- V**

**5S Forensic Science (Forensic Psychology)**

**Total Laboratory sessions: 21**

**Marks: 50**

1. Reaction Time: Comparison of RT under simple and disjunctive conditions.
2. Concept Formation: Comparison of the speed of development of 2 types of concepts.
3. Thinking and Problem Solving.
4. Correlation coefficient Raven's Standard Progressive Matrices (SPM) and Abstract Reasoning (AR) scores.
5. Eysenck Personality Questionnaire
  - Conduction of Psychological tests - Intelligence test:
6. Wechsler's adult intelligence scale
7. Wechsler's intelligence scale for children
8. Standard progressive matrices by Raven.
  - Personality test:
9. Eysenck personality inventory
10. 16.P.F. by R.B. Cattle
11. Thematic apperception test.
12. Rorschak inkblot test
13. Aptitude test: Differential aptitude test.
14. Measuring Locus of control.

## Distribution of Marks for Practical Examination.

Time: 6 – 8 hours	(One Day Examination)	Marks: 50
Exercise- I	.....	12
Exercise- II	.....	12
Exercise- III	.....	12
Viva-Voce	.....	07
Record	.....	07
	-----	
<b>Total:</b>		<b>50</b>

## Forensic Science

## 6S Forensic Science (Digital and Cyber Forensics)

Total Lectures: 84

Marks: 80

Note: Figures to the right hand side indicate number of lectures.

## Unit I

A) Introduction to Operating System → system software  
 Basics of Operating System, memory structure, concurrency, scheduling, synchronization & memory management, process description and control. Introduction to Operating System (Batch Operating System, Distributed operating system, etc) Introduction to Windows and Linux operating System. *types* *what's types function* *function*

14L\*

[5L]

History of comp. FRS in india

B) Introduction to Internet  
 World Wide Web, E-mails, Chat, Search Engines, Network Security--Threats, Vulnerabilities, Access Control, Malicious Code (Virus, Worms, Trojans, etc.) Introduction to Security and Security model (CIA triad). *A vs* *notes* *cyber security*

[5L]

Notes Introduction to comp.

C) Cyber Crime & Digital Evidence  
 What is cyber crime, types of cyber crimes, Digital evidence, Digital Vs Physical evidence, nature of digital evidence, precautions while dealing with digital evidence.

[4L]

## Unit II

A) Incident Response *what is incident*  
 Introduction to Incident Response Process (What is Computer Security Incident, What are the goals of Incident Response, Who is involved in Incident Response Process, Incident Response Methodology, Formulate a Response Strategy, Investigate the Incident.), Preparing For Incident Response, Overview of Preincident Preparation, Identifying Risk, After Detection of an Incident.

14L

[8L]

B) Cyber Forensic Tools and Utilities  
 Introduction, Examining a Breadth of Products, Cyber Forensic Tools Good, Better, Best: (What's the Right Incident Response Tool for Your Organization?) Tool Review Forensic FTK

*data collection & analysis separate* [6L]

Sr. No.	Subject Code	Title of Paper	Teaching Ex. type						Examination Scheme						Total		
			Marks of Assessments per unit			Credits			Theory			Practical					
			Theory	Practical / Tutorial	Total	Theory	Practical	Total	Duration in Hrs.	Max. Marks		Minimum passing grade point	Duration in Hrs.	Max. Marks		Minimum passing grade point	
										Theory	Internal			Practical			Internal
<b>Semester-III</b>																	
9.1	233WP55	Working with Parents and Community	-	4	4	-	2	2	-	-	-	-	3	35	15	4	50
9.2	233CH56	Child and Human Rights OR 3GIC	-	4	4	-	2	2	-	-	-	-	3	35	15	4	50
9.3	233EL157	Elective-I	3	4	7	3	2	5	2.0	45	30	4	3	35	15	4	125
9.4	233EL158	Elective-II	3	4	7	3	2	5	2.0	45	30	4	3	35	15	4	125
9.5	233EL159	Elective-III	3	4	7	3	2	5	2.0	45	30	4	3	35	15	4	125
<b>Total</b>			<b>9</b>	<b>20</b>	<b>29</b>	<b>9</b>	<b>10</b>	<b>19</b>		<b>225</b>				<b>250</b>			<b>475</b>
<b>Elective-I :</b> 233ELI.1 Development of Self 233ELI.2 Advanced Child Development 233ELI.3 Family and Child Welfare			<b>Elective-II :</b> 233ELII.1 Projective Techniques of Psychological Testing 233ELII.2 Behavioural Problems, Child Guidance and Counseling 233ELII.3 Family and Marriage Counseling			<b>Elective-III</b> 233ELIII.1 Mental Health in Developmental Perspectives 233ELIII.2 Child with special Needs 233ELIII.3 Family Dynamics											
<b>Semester-IV</b>																	
10.1	243PE60	Personal Empowerment OR 4GIC	3	4	7	3	2	5	2.0	45	30	4	-	-	50	4	125
10.2	243CT61	Current Trends and Issues in Human Development	3	4	7	3	2	5	2.0	45	30	4	-	-	50	4	125
10.3	243SW62	Scientific Writing	3	4	7	3	2	5	2.0	45	30	4	-	-	50	4	125
10.4	243 DR 63	Dissertation Report Viva Seminar	-	-	-	-	-	3	-	-	-	-	-	75	-	4	75
			-	-	-	-	-	1	-	-	-	-	-	25	-	4	25
			-	-	-	-	-	1	-	-	-	-	-	25	-	4	25
<b>Total</b>			<b>9</b>	<b>12</b>	<b>21</b>	<b>9</b>	<b>6</b>	<b>30(15+3+2+2)**</b>		<b>225</b>				<b>275</b>			<b>500</b>

Note: Students will have to Select any one paper from each of the Elective-I,II & III mentioned in Semester-III.

o: Dissertation work,

\*\* : Seminar, Viva



Sr. No.	Subject Code	Title of Paper	18														
			Verfahren & Typ						Leistungsbeurteilung								
			Hours of Lectures per week			Credits			Theory			Practical					
			Theory	Practical / Tutorial	Total	Theory	Practical	Total	Duration in Hrs.	Max. Marks	Minimum passing grade point	Duration in Hrs.	Max. Marks	Minimum passing grade point			
Semester-III																	
9.1	233WP55	Working with Parents and Community	-	4	4	-	2	2	-	-	-	-	3	35	15	4	50
9.2	233CH56	Child and Human Rights OR 3GIC	-	4	4	-	2	2	-	-	-	-	3	35	15	4	50
9.3	233EL157	Elective-I	3	4	7	3	2	5	2.0	45	30	4	3	35	15	4	125
9.4	233EL158	Elective-II	3	4	7	3	2	5	2.0	45	30	4	3	35	15	4	125
9.5	233EL159	Elective-III	3	4	7	3	2	5	2.0	45	30	4	3	35	15	4	125
<b>Total</b>			<b>9</b>	<b>20</b>	<b>29</b>	<b>9</b>	<b>10</b>	<b>19</b>		<b>225</b>				<b>250</b>		<b>475</b>	
<b>Elective-I :</b> 233ELI.1 Development of Self 233ELI.2 Advanced Child Development 233ELI.3 Family and Child Welfare			<b>Elective-II :</b> 233ELII.1 Projective Techniques of Psychological Testing 233ELII.2 Behavioural Problems, Child Guidance and Counseling 233ELII.3 Family and Marriage Counseling			<b>Elective-III</b> 233ELIII.1 Mental Health in Developmental Perspectives 233ELIII.2 Child with special Needs 233ELIII.3 Family Dynamics											
Semester-IV																	
10.1	243PE60	Personal Empowerment OR 4GIC	3	4	7	3	2	5	2.0	45	30	4	-	-	50	4	125
10.2	243CT61	Current Trends and Issues in Human Development	3	4	7	3	2	5	2.0	45	30	4	-	-	50	4	125
10.3	243SW62	Scientific Writing	3	4	7	3	2	5	2.0	45	30	4	-	-	50	4	125
10.4	243 DR 63	Dissertation Report	-	-	-	-	-	3	-	-	-	-	-	75	-	4	75
		Viva	-	-	-	-	-	1	-	-	-	-	-	25	-	4	25
		Seminar	-	-	-	-	-	1	-	-	-	-	-	25	-	4	25
<b>Total</b>			<b>9</b>	<b>12</b>	<b>21</b>	<b>9</b>	<b>6</b>	<b>30(15+3+12)**</b>		<b>225</b>				<b>275</b>		<b>500</b>	

Note: Students will have to Select any one paper from each of the Elective-I, II & III mentioned in Semester-III.

\*: Dissertation work,

\*\* : Seminar, Viva

**Semester IV Paper-XIII****SPECTROSCOPY-II**

60 Hours (Four hours/week) 12 Hrs. / unit Max.Marks 50

**Unit-I :** A) Emission spectroscopy based upon plasma: Arc and spark atomization, spectra from higher energy sources, emission spectroscopy based upon plasma sources, atomic fluorescence method based upon plasma atomization. Emission spectroscopy based upon arc and spark sources. X-ray fluorescence and its principle, instrumentation and application in analytical chemistry. 6L

B) Photoelectron spectroscopy: Basic principle, photoelectric effect, ionization process, Koopmans theorem PES and X-PES, PES spectra of simple molecule, ESCA, chemical information from ESCA. Auger electron spectroscopy-basic idea. surface characterization by spectroscopy and microscopy, (SEM). 6L

**Unit-II :** A) X-ray diffraction :Interaction of x-ray with matter, scattering and diffraction. Bragg method Debye-Sherrer method of X-ray structural analysis of crystals, index reflection, identification of unit cell from systematic absence in diffraction pattern structure of simple lattice and x-ray intensities structure factor, its relation to intensity of electron density procedure for x-ray structure analysis. 4L

B) Electron diffraction : Scattering intensity Vs scattering angle, wierl equation, measurement techniques, elucidation of structure of simple gas phase molecules. Low energy electron diffraction and structure of surface. 4L

C) Neutron diffraction: Scattering of neutrons by solids and liquids magnetic scattering, measurement techniques. Elucidation of structure of magnetically ordered unit cell. 4L

**Unit-III A)** Raman spectroscopy: Classical and quantum theories of Raman effects, Pure rotational and vibrational and vibrational-rotational Raman spectra, selection rules, mutual exclusion Raman spectroscopy, coherent anti-Stokes Raman spectroscopy (CARS). Applications for the study of active sites of

metalloproteins.

6L

**B)** Electron Spin Resonance Spectroscopy :  
Introduction

, basic principle. zero field splitting and Kramers degeneracy, factors effecting the "g" values, hyperfine splitting, determination of "g" values. Instrumentation, working of instruments, sensitivity, concentration, choice of solvent. presentation of ESR spectra, application of ESR to study the free radicals, structure determination, reaction velocities, application to inorganic compounds including biological system and to inorganic free radicals such as  $\text{PH}^{\cdot-}$ ,  $\text{F}^{\cdot-}$ ,  $[\text{BH}]^{\cdot-}$ , determination of oxidation state of

**Unit-IV :** Mossbauer spectroscopy: Basic principle, spectral parameters and spectrum display. Doppler shift. recoilless emission of radiation. isomer shift, quadrupole splitting, magnetic hyperfine splitting. application of the techniques to the studies of 1. Bonding and structure of  $\text{Fe}^{+2}$ , and  $\text{Fe}^{+3}$  compounds including those of intermediate spin (2)  $\text{Sn}^{+2}$  and  $\text{Sn}^{+4}$  compounds - Nature of M-L bond, coordination number, Structure and (3) Detection of oxidation state and in equivalent MB atoms. Mossbauer spectroscopy of Biological Systems. 12L

**Unit-V :** Structural Problem : Problems based on IR, Mass, UV, PMR,  $^{13}\text{C}$  NMR data and structure determination of organic molecules / inorganic compounds. 12L

**Books suggested**

- 1) Spectroscopic identification of organic compound-RM Silverstein, GC Bassler and TC Morrill, John Wiley
- 2) Introduction to NMR spectroscopy-RJ Abraham, J Fisher and Ploftus Wiely
- 3) Application of spectroscopy to organic compound-JR Dyer, Printice Hall
- 4) Organic spectroscopy-William Kemp, ELB with McMillan
- 5) Spectroscopy of organic molecule-PS Kalsi, Wiley, Esterna, New Delhi
- 6) Organic spectroscopy-RT Morrison, and RN Boyd
- 7) Practical NMR spectroscopy-ML Martin, JJ Delpenche, and DJ

Martyin

- 8) Spectroscopic methods in organic chemistry-DH Willson, I Fleming
- 9) Fundamentals of molecular spectroscopy-CN Banwell
- 10) Spectroscopy in organic chemistry-CNR Rao and JR Ferraro
- 11) Photoelectron spectroscopy-Baber and Betteridge
- 12) Electron spin resonance spectroscopy-J Wertz and JR Bolten
- 13) NMR –Basic principle and application-H Guntur
- 14) Interpretation of NMR spectra-Roy H Bible
- 15) Interpretation of IR spectra-NB Coulthop
- 16) Electron spin resonance theory and applications-W Gordy
- 17) Mass spectrometry organic chemical applications, JH Banyon

**Semest  
er IV  
Paper  
XIV**

**General Analytical Chemistry**

Total Lectures: 60Hours, 4Hours per week, 12Hours/unit Total Marks: 50

**Unit-I : 12L**

**Radiochemical Methods:** Elementary working, principles of Geiger Muller, Ionisation, proportional and l-ray counters. Radiotracer techniques, application of radiotracers in analytical chemistry. Neutron activation analysis (NAA): Principle, technique and applications in preparation of some commonly used radioactive isotopes. Isotopic Dilution Analysis (IDA), substoichiometric IDA, experimental technique and applications of IDA, advantages and limitations of IDA and comparison of IDA with NAA. Principle of Radiometric titrations, types, Experimental techniques and its applications. Carbon dating. Numericals.

**Unit-II : Online Analyzers 12L**

**Automation in Chemical Analysis:** Introduction, Classification of automated methods, principles and techniques of auto-analyzers employed for microanalysis with emphasis on the basis sequences in operational modes in segmented and non-segmented flow and

applications. Selection of online analyzers.

Flow Injection Analysis: Introduction, principal, theoretical aspects of FIA, techniques, pretreatment of sample in packed reactors, components of FIA apparatus, Factors affecting FIA and applications for the determination  $F^-$ ,  $Cl^-$ ,  $PO_4^{3-}$ ,  $SiO_4^{2-}$ ,  $NO_3^-$ ,  $NO_2^-$ ,  $SO_4^{2-}$ ,  $BO_3^{3-}$ ,  $Ca^{2+}$ ,  $Mg^{2+}$ ,  $Al^{3+}$ ,  $Mn^{2+}$ ,

## Unit-IV: Analysis of Food, Body fluids and Drugs: 12L

- A) **The chemical and nutritional composition of food:** analysis of trace elements such as Pb, As, Cd in food, Analysis of Tea, Milk, Spices. Chemical preservation of food, Analysis of sodium benzoate and sodium metabisulphite, Analysis of adulterants in food, Analysis of artificial sweeteners in food and colouring agents.
- B) **Clinical Chemistry and Drug Analysis:** Composition of blood, collection and preservation of samples, clinical analysis, serum electrolytes, blood glucose, blood urea nitrogen, uric acid, albumin, globulin, barbiturates, acid and alkaline phosphatases. Immunoassay :principles of radio immunoassy(RIA) and applications. The blood gas analysis trace elements in the body. Narcotics and dangerous drugs, classification of drugs, screening by gas and thin layer

Cr<sup>6+</sup>, Fe<sup>3+</sup> in water.

## Unit-III : Optical Methods Of Analysis: 12L

- A) **Molecular Luminescence Spectroscopy:** Introduction, Molecular fluorescence, phosphorescence and Chemiluminescence's, theory, factors affecting fluorescence and phosphorescence, instrumentation and analytical applications. Applications of fluorimetry. Fluorescence quenching. Photoacoustic spectroscopy: Theory, Instrumentation, PAS-gases and condensed systems, chemical and surface applications. Qualitative and quantitative analysis.
- B) **Inductively Coupled Plasma Atomic Emission Spectroscopy (ICPAES):** Principles, atomization and excitation, ICP-source, Instrumentation and applications.

chromatography and spectrophotometric measurements

## Unit-V : Fuel analysis: 12L

Solid, Liquid and gaseous fuels. Characteristics of ideal fuels. Ultimate and proximate analysis of coal, heating values, grading of coal, liquid fuels-flash point, aniline point, knocking, antiknock compounds, octane number, cetane number and carbon residue. Gaseous fuels, producer gas and water gas, determination of calorific value. Analysis of fuel Gas. Numerical problems.

### List of Books-

1. Day and Underwood: Quantitative Analysis
2. A. I. Vogel: A text book of quantitative Inorganic analysis.
3. Flaschka: EDTA Titration
4. Meites and Thomas: Advanced Analytical Chemistry.
5. G. W. Ewing: Instrumental Methods of Chemical Analysis.
6. R. S. Drago: Physical Methods in Inorganic Chemistry
7. G. D. Christian: Analytical Chemistry
8. S. M. Khopkar: Basic Concept of Analytical Chemistry.
9. Kolltath and Ligane: Polarography
10. R.D.Braun: Instrumental methods of chemical Analysis
11. Willard, Merritt and Dean: Instrumental methods of Analysis
12. Strouts, Crifillan and Wison: Analytical Chemistry.
13. J. W. T. Spinks and R. J. Woods: Introduction to Radiation Chemistry.
14. S. A. Skoog and D. W. West: Fundamental Of Analytical Chemistry
15. R. V. Dils: Analytical Chemistry

5  
**Semester  
IV Paper-  
XV  
Special  
Paper-III**

**Inorganic Chemistry (Photoinorganic & Organometallic Chemistry)**

**Total Lectures: 60Hrs, 4 Hrs per week, 12**

**Hrs/unit Total Marks-50 Unit-I : 12L**

- A) **Basics of Photochemistry:** Absorption, excitation, photochemical laws, quantum yield, electronically excited states-life times-measurements of the times. Flash photolysis, stopped flow techniques, Energy dissipation by radiative and no-radiative processes, absorption spectra, Frank-Condon principles; photochemical stages-primary & secondary processes.
- B) **Properties of excited states:** Photochemical kinetics, Calculation of rates of radiative processes.

**Unit-II**

12L

- A) **Excited States of Metal Complexes:** Electronically excited states of metal complexes, charge transfer spectra, charge transfer excitations, methods for obtaining charge transfer spectra.
- B) **Ligand field Photochemistry:** photosubstitution, photo oxidation & photoreduction.
- Liability and selectivity, zero vibrational levels of ground state and excited state, energy content of excited state, zero-zero spectroscopic energy, development of the equations for redox potentials of the excited states.

**Unit-III**

12L

- A) **Redox reactions by Excited Metal Complexes:** Energy transfer under conditions of weak interaction & strong interaction – exciplex formation, conditions of excited states to be useful as redox reactants, excited electron transfer, metal complexes as attractive candidates (2,2-bipyridine & 1,10-Phenanthroline complexes.), illustration of reducing and oxidizing character of ruthenium (II); role of spin-orbit coupling, lifetime of these processes. Application of redox processes of electronically excited states for catalytic

6  
purposes, transformation of low energy reactants in to high-energy products, chemical energy in to light.

- B) **Metal Complex Sensitizers:** Metal Complex Sensitizers, electron relay, metal colloid systems, and semiconductor supported metal or oxide systems, water photolysis, nitrogen fixation & carbon dioxide reduction.

**Unit-IV :** 12L

**Organotransition Metal Chemistry:**

Alkyls and Aryls of Transition Metals:

Types, routes of synthesis, stability & decomposition pathways of alkyls & aryls of transition metals. Organocopper in Organic synthesis.

Compounds of Transition Metal –Carbon Multiple bonds: Alkylidenes, alkylidynes, low valent carbenes & carbynes–synthesis, nature of bond, structural characteristics, nucleophilic & electrophilic reactions on ligands, role inorganic synthesis.

**Unit-V :** 12L

**Transition Metal Pi Complexes**-Carbon multiple bonds. Nature of bonding, structural characteristics & synthesis, properties of transition metal pi-Complexes with unsaturated organic molecules, alkenes alkynes, allyl, diene, dienyl, arene & trienyl complexes. Application of transition metal, organometallic intermediates in organic synthesis relating to nucleophilic & electrophilic attack on ligands, role in organic synthesis.

**Books:**

1. Elschenbroich Ch. and Salzer A.: Organometallics, VCH, Weinheim, NY.
2. Balzani Vand Cavassiti V.: Photochemistry of Coordination compounds, AP, London
3. Purcell K.F. and Kotz J.C., An Introduction to Inorganic Chemistry, Holt Sounder, Japan.
4. Rohtagi K.K. and Mukharjee, Fundamentals of Photochemistry, Wiley eastern
5. Calverts J.G. and Pitts J.N., Photochemicals of Photochemistry, John Wiley
6. Wells, Introduction of Photochemistry
7. Paulson, Organometallic Chemistry, Arnold
8. Rochow, Organometallic Chemistry, Reinhold
9. Zeiss, Organometallic Chemistry, Reinhold
10. Gilbert A. and Baggott, J., Essential of Molecular Photochemistry, Blackwell Sci. Pub.
11. Turro N.J. and Benjamin W.A., Molecular Photochemistry

12. Cox A and Camp, T.P. Introductory Photochemistry, McGraw-Hill
13. Kundall R.P. and Gilbert A., Photochemistry, Thomson Nelson Coxon J and Halton B., Organic Photochemistry, Cambridge University Press.

6  
**Semester  
IV Paper-  
XVI  
Special  
paper-IV**

**Inorganic Chemistry (Materials Chemistry)**

Total Lectures: 60Hrs, 4 Hrs per week, 12 Hrs/unit Total Marks-50

**Unit-I : Glasses, Ceramics & Composites: 12L**

**Glass:** A general idea of Glassy state, types, their composition & properties, glass formers & modifiers, optical glass, coloured glasses, lead glass, neutron absorbing glass. **Ceramics:** General introduction, types, manufacturing process, structure, mechanical properties.

**Unit-II 12L**

A) **Liquid Crystals:** Mesomorphic behaviour, thermotropic liquid crystals, positional order, bond orientational order, nematics & smectic mesophases; smectic-Nematic transition clearing temperature-homeotropic, planar & schlieren textures twisted nematics, chiral nematics, molecular arrangement in smectic A & smectic C phases, optical properties of liquid crystals. Dielectric susceptibility & dielectric constants. Lyotropic phases & their description of ordering in liquid crystals.

B) **Bio-materials:** Biomineralisation, controlled formation of biological composites, bone & other mineralised tissues, materials of construction, applications (General aspect only).

**Unit-III : 12L**

**Nanoparticals & Nanostructural materials**  
:Introduction, methods of preparation, physical properties, and chemical properties. Molecular Precursor routes to inorganic solids:- Introduction, sol-gel chemistry of metal alkoxide, hybrid organic-inorganic compounds

**Nanoporous Materials:** Introduction, Zeolites & molecular sieves, determination of surface acidity,

6  
porous lamellar solids, composition-structure, preparation & applications.

B) **Solid State Reaction:** General principles, reaction rates, reaction mechanism, reaction of solids, factors influencing reactivity, photographic process.

**Unit-IV 12L**

A) **Fertilizers:** Classification of fertilizers, nitrogen fertilizers, phosphate fertilizers, N, P, K fertilizers,  $H_3PO_4$  production without using  $H_2SO_4$ .

### B) **Coordination Polymers:**

Natural polymers and reactions yielding coordination polymers. Synthesis of coordination polymers. Use of polymeric ligands in synthesis of coordination polymers. Metal coordination polymers. Silicon polymers. Organosilicon polymers. Synthesis and their uses.

### **Unit-V:**

**12L**

**Catalysis:** Basic principals, thermodynamic and kinetic aspects, industrial requirements, classification, theories of catalysis, homogeneous and heterogeneous catalysis. Introduction, types & characteristics of substrate-catalyst interactions, kinetics and energetic aspects of catalysis, selectivity, stereochemistry, orbital symmetry and reactivity. Catalytic reactions of coordination and Organometallic compounds including polymerization activation of small molecules, addition to multiple bonds, hydrogenation, Zeigler-Natta polymerization of olefins, hydroformylations, oxidations, carbonylations and epoxidation.

### **Books Suggested:**

1. Barsoum, M.W., Fundamentals of Ceramics, McGraw Hill, New Delhi
2. Ashcroft, N.W. and Mermin, N.D., Solid State Physics, Saunders College
3. Callister, W.D., Material Science and Engineering, An Introduction, Wiley
4. Keer, H.H., Principles of Solid State, Wiley Eastern
5. Anderson J.C., Lever K.D., Alexander J.M and Rawlings, R.D., ELBS
6. Gray G.W. Ed. Thermotropic Liquid Crystals, John Wiley
7. Kelkar and Hatz Handbook of Liquid Crystals, Chemie Verlag.
8. Kalbunde K.I., Nanoscale Materials in Chemistry, John Wiley, NY.
9. Shull R.D., McMichael R.D. and Swartzendrub L.J., Studies of Magnetic Properties of Fine particles and their relevance to Materials Science, Elsevier Pub. Amsterdam
10. Breck D.W., Zeolite Molecular Sieves: Structure Chemistry and Use, Wiley Chichester, Eng.
11. Morrish A. H., Handeda K., Zhou X. Z. In Nanophase Materials: synthesis, properties, applications, Kulwer, London.



6  
**Semester**  
**IV Paper**  
**XV**  
**Special**  
**Paper-III**

Organic Chemistry (Organic Synthesis: II)

**Total Lectures: 60Hrs, 4 Hrs per week, 12 Hrs/unit Total Marks-50 Unit-I : A) Chemo and Regio Selectivity. 6L**

Selectivity in organic synthesis, chemo and regio selectivity, stereoselective and stereospecific reactions, Kinetic and Thermodynamic control in reaction.

**B) Application of organometallics in organic synthesis.**

Use of Organometallic compounds of Mg, Li, Zn, B, Sn and organocopper compounds in organic synthesis

.Organotransition metal reagents of C, R, Fe, Co, Rh, Ni and Pd.

**6L**

**Unit-II : Designing the synthesis based on retrosynthetic analysis**

**12  
L**

A disconnection approach to the synthesis of organic compound. Different consideration in designing target molecule, concept of synthons, FGI, Chemoselectivity, regioselectivity, specificity, stereoselectivity, general strategy choosing a disconnection. Types of bond disconnection, some of the applications of these concepts in designing the synthesis of common important class of the compounds.

**Unit-III: A) Protection and Deprotection of functional groups**

12L

6  
Protection and deprotection of functional groups like, hydroxyl, amino, carbonyl and carboxylic acid groups, techniques employed for these.

**B) Phase Transfer Catalysis and Crown ethers.** Their methods of preparation and application in Organic Synthesis, Mechanism of Phase transfer reaction.

**Unit-IV A) Selective Organic Name Reaction 12L**

Stark-Enamine reaction, Michel addition, Favorski reaction, Mannich reaction, Sharpless asymmetric epoxidation, Ene reaction, Baeyer-Villiger reaction.

**B) Reagents in Organic Synthesis:** Use of following reagents in Synthesis and functional group transformations such as complex metal hydrides, Gilman reagents, Lithium dialkylcuprate LDA, DCC, Trimethyl silyl Iodide, Tributyl Tin hydride, Woodward and Prevost Hydroxylation, DDQ, Peterson Synthesis, Wilkinson's Catalyst, Becker Yeast.

**Unit-V: A) Polynuclear Hydrocarbons:**

12

**L** Introduction, Comparative study of the aromatic character of linear and nonlinear Ortho fused Polynuclear Hydrocarbon. General methods of preparation of fluorine, anthracene and phenanthrene.

**B) Heterocyclic Compounds:**

Nomenclature and familiarity with the heterocyclic ring (3-7 members containing up to 3 heteroatoms). Detailed chemistry of Pyrozole, imidazole, oxazole, thiazole, thiazine, pyrimidines, pyrazines and zepines

**Books suggested.**

- 1) Principle of organic synthesis. ROC Norman & JM coxon
- 2) Modern synthetic reaction. H.O.House W.A.Benjamin
- 3) Organic synthesis, The disconnection approach-S.Warren
- 4) Designing organic synthesis-S.Warren
- 5) Some modern methods of organic synthesis-W.carruthers,
- 6) Advance organic reaction.Mechanism & structure-Jerry march
- 7) Advance organic chemistry Part-B-F.A.caray & RJ sundberg,plenum P.
- 8) Organic reaction and their mechanism-PS kalsi
- 9) Protective group in organic synthesis-TW Greene,& PGM
- 10) The chemistry of organo phsphorous-AJ kirbi,&SG Warren
- 11) Organo silicon compound-C.Eabon
- 12) Organic synthesis via Boranes-HC.Brown
- 13) Organo borane chemistry-TP onak
- 14) Organic chemistry of boron-W. gerrard
- 15) Fundamentals of photochemistry-KK Rohatgi & Mukharji
- 16) Photochemistry-Cundau & Gilbert
- 17) Aspects of organic phoptochemistry-WM horspoot
- 18) Phptochemistry-JD calvert
- 19) Photochemistry-RP Wayne

**SEMESTER-IV**

Paper XVI

**ORGANIC CHEMISTRY (Natural Product-II)**

Unit-I : Synthesis Polymers and Rubbers -

12L

A) Synthesis Polymers- Introduction, types of polymerization, Mechanism of condensation Polymerization, Addition polymerization free radical cationic, anionic and copolymerization, chain transfer agents, stereoregulated polymers. Atactic, Isotactic and syndiotactic polymers.

- B) Study of synthetic Rubbers: Buna S SBR, cold rubber, Buna N, NBR, Butyl Rubber, polyisoprene, polyurethanes, vulcanization mechanism, foaming agents, plasticizers, stabilizers, silicones.

**Unit-II : General aspects of drug: 12L**

Historical, Definitions used in drug chemistry- pharmacy, pharmacology, pharmacodynamics, pharmacodynamic agents, metabolite and antimetabolites, gram positive and gram negative Bacteria, Virus, Actinomycetes, Mutation, Chemotherapy, Nomenclature of medicinal compounds.

Classification of drugs on basis of their Therapeutic actions.

1. Chemotherapeutic agents
  2. Pharmacodynamic agents
- Mechanism of Chemotherapeutic action:

1. Biological defences
2. Chemical defences
  - a) Surface active agents
  - b) Metabolic Antagonism

Assay of Drugs:

1. Chemical assay
2. Biological assay
3. Immunological assay

**Unit-III DRUGS DESIGN: 12L**

Development of new drugs, procedures followed in drug design. Concept Of lead compound and modification concept of Prodrugs and Softdrugs structure activity relationship (SAR) Factors affecting bioactivity resonance, inductive effect, isosterism, Biosterism, Spatial consideration, theories of drug activity occupancy theory, Rate theory induced tit theory, Quantitative structure activity relationship.

History and development of QASAR, Concept of drug receptor interaction, Physico-Chemical parameter. Lipophilicity, Partition coefficient Electronic ionization constants, Steric Shelton and surface activity parameters and redox potential. Free Wilson analysis, Hansch analysis LD-50, ED-

50(Mathematical derivatives of equations included)

**Unit-IV : MEDICINAL CHEMISTRY 12L**

- A) Antibiotics: Introduction, Penicillin V And G, Streptomycin, Chloramphenicol, Tetracyclins.

- B) Antimalarial : Chemotherapy of malaria, Aminoquinolines, pamaquine, chloroquine and sulphones.
- C) Antipyretic and Analgesic: Aspirin, salol, phenacetin, antipyrin.

## Unit-V: Vitamin and Natural Pigments 12

### L

- A) Vitamins: Structure determination and chemistry of Thiamine (Vitamin B1), Ascorbic acid (Vitamin C), Vitamin E and A.
- B) Natural Pigments: Chemistry of Carotenes, anthocyanins, General study of porphyrins, structure and synthesis of Hemoglobin and chlorophyll.

### Books suggested :

- 1) Chemistry of alkaloids-SW Pelletier.
- 2) Chemistry of steroids-LF Fisher & M Fisher.
- 3) The molecules of nature-JB Hendrickson.
- 4) Biogenesis of natural compounds-Benfield
- 5) Natural product chemistry & biological significance, J. Mann, R. S. Devison, J. B. Hobbs, D. V. Banthripde & J. B. Horborne.
- 6) Introduction to flavonoids-BA Bohm, Harwood
- 7) Chemistry of naturally occurring quinines-RH Thomson
- 8) The systematic identification of flavonoids-Marby, Markham, & Thomson
- 9) Text book of organic medicinal chemistry-Wilson, Geswold
- 10) Medicinal chemistry Vol I & II-Burger
- 11) Synthetic organic chemistry-Gurudeep Chatwal.
- 12) Organic chemistry of natural products Vol I & II-OP Agrawal
- 13) Organic chemistry of natural products-Gurudeep Chatwal
- 14) A textbook of pharmaceutical chemistry-Jayshree Ghosh
- 15) Synthetic dyes series-Venkatraman
- 16) Chemistry process industries-Shreve & Brink
- 17) Principles of modern heterocyclic chemistry-LA Paquette
- 18) Heterocyclic chemistry-J. Joule & G. Smith
- 19) Heterocyclic chemistry-Morton
- 20) An introduction to chemistry of heterocyclic compounds-JB Acheson
- 21) Introduction to medicinal chemistry-A Gringuade
- 22) Wilson & Geswold text book of organic medicinal & pharmaceutical chemistry-Ed. Robert F. Dorge
- 23) An introduction to drug design-SS Pandey, & JR Demmock

- 24) Goodman and Gilman's pharmacological basis of therapeutics-
- 25) Strategies for organic drug synthesis & design-D Lednicer
- 26) Polymer science-V. Govarikar

- 27) Principle of polymer chemistry-PJ flory  
 28) An outline of polymer chemistry-james q.allen  
 29) Organic polymer chemistry-KJ Saunders.

**Semester  
 IV Paper-  
 XV  
 Special  
 Paper-III**

**Physical Chemistry**

60 Hours (4-Hours/week)      50 Marks      12 hours/Unit

**Unit-I : Liquid Crystals:**

- A) Mesomorphic behavior, thermotropic liquid crystals, nematic and smectic meso phases, smectic and nematic transitions, and clearing temperature, twisted nematics, chiral nematics molecular arrangement in smectic A and Smectic C phases, optical properties of liquid crystals  
 6L
- B) General properties of liquids: liquid as dense gases, liquid as disorder solid, different types of intermolecular forces in liquids, theory of liquids.      6L.

**Unit-II Isotope Effect:**

Equilibrium isotope effects, equilibria in solution, primary kinetic isotope effect, semi classical treatment, quantum mechanical tunneling, reactions of Muonium, isotope effects of heavy atoms, secondary kinetic isotope effect.

12L

**Unit-III Reactions in solutions:**

- A) Reaction between ions: Influence of solvent, dielectric constant & ionic strength, pre-exponential factor, single sphere activated complex.      6L.
- B) Ion dipole & dipole-dipole reaction, Diffusion controlled reaction, influence of hydrostatic pressure, substituent and correlation effect. Hammett equation, compensation effect, diffusion controlled reaction: full microscopic and partial microscopic diffusion controlled and ionic reactions.

6L.

**Unit-IV Chemical kinetic methods:**

- A) Basic principle of chemical relaxation method, chemical relaxation in two and multi-step systems, thermodynamic aspect of chemical relaxation.      6L.
- B) Experimental methods for relaxation kinetics and applications: Temperature jump method, electrical field jump method, ultrasonic relaxation method.      6L.

**Unit-V Reaction Dynamics:**

- A) Molecular dynamical calculations for  $H + H_2$ ,  $Br + H_2$ , and more complex reactions. Chemi-luminescence: highly dilute flames, diffusion flames. 6L
- B) Molecular beams: Stripping and rebound mechanism, state to state kinetics, influence of reactant vibrational energy and rotational energy, spectroscopy of transition species. 6L

**List of Books:**

- 1) Physical chemistry by P.W. Atkins & dePaula 7<sup>th</sup> Edition
- 2) Chemical Kinetics by K.J. Laidler. III<sup>rd</sup> Edition. Pearson Education.
- 3) Liquid State by J.A. Pryde.
- 4) Theotropic Liquid Crystals by G.W. Gray, Wiley
- 5) Hand Book of Liquid Crystals by Kelkar & Hatz, Chemie Verlag.
- 6) A Dynamic Liquid State, A. F.M. Barton, Longman.
- 7) Chemical Kinetics & Dynamics by J.I. Steinfeld, J.S. Francisco & W.L. Hase. Printice Hall. 1989.
- 8) Kinetic & Mechanism of Chemical Transformation by J. Rajaram & J. Kuriacose, McMillion.

**Semester  
IV Paper-  
XVI  
Special  
Paper-IV  
Physical Chemistry**

60 Hours (4-Hours/week)      50 Marks      12 hours/Unit

**Unit-I Nuclear Chemistry:**

- A) General characteristics of radioactive decay, decay kinetics parent daughter decay growth relationship.  $\alpha$ -decay,  $\alpha$ -decay, nuclear de-excitation, Secular and transient equilibrium,  $\alpha$ -particle energy spectrum, Geiger-Nuttal's Law, Theory of  $\alpha$ ,  $\beta$  and  $\gamma$  decay process. 6L.
- B) Detection and measurement of activity: The electrometer, the ionization chamber, electro pulse counter, scintillation, semiconductor, thermo-luminescence and neutron detector. 6L.

**Unit-II Nuclear reactions:**

Bathe's notation, types of nuclear reactions, conservation in nuclear reaction, reaction cross section, compound nucleus theory, experimental evidence of Bohr's theory: Experiments of Ghoshal, of Alexander and Simonoff specific nuclear reactions, trans uraniens, photonuclear reactions, thermonuclear reaction, fusion reactors, origin and evolution of elements. 12L

**Unit-III Nuclear fission:**

- A) Process of nuclear fission, fission fragments and their mass and charge distribution. Fission energy, fission cross-section and threshold. Theory of nuclear fission, fission neutrons, other types of nuclear fissions. 6L.
- B) Nuclear reactors: Nature's nuclear reactor, Natural Uranium reactor, classification of reactors critical size of thermal reactors, the breeder reactors. Reprocessing of spent fuel, nuclear waste management. 6L.

**Unit-IV Radiation Chemistry:**

Interaction of radiation with matter, Radiation track spurs and d-rays, linear energy transfer, Bathes equation for linear energy transfer, Bremsstrahlung effect. Passage of neutron through matter, Interaction of g-radiation with matter: photoelectric effect and Compton effect, pair production phenomenon, units of measuring radiation absorption, radiolysis of water, radiolysis of some aqueous solutions.

12L.

**Unit-V A) Radiation dosimetry:** Unit of radiation energy, chemical dosimeter, Fricke dosimeter and ceric sulphate dosimeter, conversion of measured dose values, Distribution prp of water, free radicals in water, radiation induced color centers in crystals. 6L.

**B) Applications of radioactivity:** Probing by isotopes, the Szilard-Chalmers reaction, cow and milk system. Principle and applications of radioisotopes as tracers, radioisotopes as source of electricity. 6L.

**List of Books:**

- 1) Introduction to radiation chemistry by J.W.T. Spinks and R.J.Woods.
- 2) Essentials of Nuclear chemistry by S.J.Arnikaar.

**Semester  
IV Paper  
XV  
Special  
Paper-III  
(Unit**

**Processes**

)

**Industrial Chemistry**

60hrs (4hrs/week). 12hrs/unit

50 Marks

**Unit-I A) Nitration:** Introduction, nitrating agents, equipment for nitration, manufacture of nitrobenzene, Ortho and para nitrochlorobenzene.

- B) Amination by reduction:** Introduction, methods of reduction metal & acid, sulphide reduction, metal & alkali reduction, manufacture of aniline, meta nitro aniline
- C) Halogenation:** introduction, reagents of halogenation, aromatic halogenation, manufacture of chlorobenzene, dichlorofluoromethane

- Unit-II A) Sulphonation:** introduction, sulphonating agents, factor affecting sulphonation, equipment, manufacture of benzenesulphonic acid, sulphonation of anthraquinone
- B) Oxidation:** introduction, oxidizing agents, vapour & liquid phase oxidation, manufacture of acetic acid, acetaldehyde, benzoic acid.
- C) Hydrogenation:** introduction, catalyst used for hydrogenation, hydrogenation of vegetable oil, manufacture of methanol,

- Unit-III A) Esterification:** Introduction, esterification by organic acids, esters by adding unsaturated systems, manufacture of ethylacetate, cellulose acetate.
- B) Hydrolysis:** introduction, hydrolysis agents, acid hydrolysis alkali hydrolysis, enzymatic hydrolysis, factors affecting hydrolysis,.
- C) Alkylation:** Introduction, alkylating agents, factors affecting alkylation, manufacture of ethyl benzene, phenyl ethyl alcohol

## Unit-IV - Petroleum Refining and Petrochemical Technology :

- A) Petroleum refining practice
- Petroleum Refining in India
  - Indian Standards for Motor gasoline, Kerosene and Diesel
  - Atmospheric and vacuum distillation of crude
  - Petroleum coking and visbreaking
  - Fluidised catalytic cracking, catalytic reforming, catalytic alkylation, catalytic isomerisation.
  - Hydrocracking & Hydrotreating
  - Lube processing.
- B) Petrochemical Industry :
- Petrochemical Industry in India
  - Petrochemical Feed stocks.
  - Naphtha cracking & separation and purification of olefins to get ethylene, propylene, butylenes etc.
  - Manufacture of BTX aromatics
  - Butadiene & Xylenes separation techniques.

- Important monomers like, Styrene, DMT & Caprolactum.



## Unit-V - Polymers

- 1) Nomenclature, classification of polymer : Natural and synthetic polymers, organic and inorganic polymers, thermoplastic and thermosetting polymers, plastic elastomers, fibres and liquid resin, block & graft copolymers.
- 2) Types of polymerization: Addition (chain) : Polymerization- free radical, ionic, coordination and their mechanism, condensation (step) polymerization polycondensation, polyaddition, ring opening, linear and cross-linked and their mechanism, copolymerisation.
- 3) Techniques of polymerization : Bulk, solution, suspension and emulsion polymerization.
- 4) Molecular weight and size : Number-average and weight-average molecular weights viscosity-average molecular weight, degree of polymerization, significance of polymer molecular weight, size of polymer molecule; molecular weight determination: by Osmometry (membrane & vapour phase), end group analysis, viscometry and light scattering methods.
- 5) Physical characteristics of polymers : Glass transition temperature and crystallinity of polymer, Determination of Glass transition temperature.
- 6) Manufacturing, properties and uses of following polymers:
  - i) Natural and synthetic rubber
  - ii) Synthetic fibers – polyesters, polyamides, rayons
  - iii) Synthetic plastics : Polyolefins, polyurathanes
  - iv) Silicones

### List of Books-

1. Unit Process in Organic Synthesis, by P. H. Groves
2. Modern Petroleum Technology by G. D. Hobson and W. Pohl.
3. Petroleum refining and engineering by W. L. Nelson.
4. Petroleum refining technology and economics by J. H. Gary and G. E. Hardwork.
5. The Petroleum chemical industry by Goldstein and Waddams.
6. Petroleum processing handbook by W. E. Bland and R. L. Davidson.
7. The Text book on Petrochemical by Dr. B. K. Bhaskar Rao, Khanna Publishers New Delhi.
8. Modern Petroleum refining Processes by Dr. B. K. Bhaskar Rao, Oxford, IBH, 1984
9. Petroleum product handbook, V. B. Guthrie.
10. Textbook of polymer science by F. Bill Mayer, Wiley Inter Science.

11. Polymer Science by V. Govarikar, N. Viswanathan and J. Sreedhar, New Age International (P) Ltd. Publishers New Delhi
12. Physical chemistry of polymers by D. D. Deshpande, Tata McGraw Hill.
13. Principles of polymer chemistry By P. J. Flory, Cornell Univ. Press.
14. Introduction to polymer chemistry by R. B. Seymour McGraw Hill.
15. A Practical Course in polymer chemistry by S. J. Pnnea, Pergamon press.
16. Laboratory preparation of macro chemistry by E. M. M. Effery McGrawHill.

## Semester IV Paper XVI Special Paper-IV

(Chemical Processes Industries)  
Industrial Chemistry

60hrs (4hrs/week). 12hrs/unit

50 Marks

### Unit-I :

#### Dyes

12L

- i) Chemistry of dyes :- Introduction, classification of dyes on the basis of structure and the mode of application to the fibre. Colour and chemical constitution of dyes. General methods of preparation of important azodyes, Cyanindyes and anthraquinone vat dyes.
- ii) Chemistry of intermediates :- Introduction to the history of dyes. Natural to synthetic dyes.
  - 1) Manufacturing, properties and uses of following polymers:
    - i) Natural and synthetic rubber
    - ii) Synthetic fibers – polyesters, polyamides, rayons
    - iii) Synthetic plastics : Polyolefins, polyurathanes
    - iv) Silicones

Mediates: - chloronitrobenzene

Nitroanilines, diaminobenzenes.

Napthalene intermediates :- Naphthyl sulphuric acids,

Naphylamine sulphuric acids.

Mescallaneous

- i) Amino anthraquinones, methyl & methylamino

anthraquinones, Disperse dye intermediates,  
disperse  
– reactive intermediates.

- ii) Analysis & applications of dyes :- Different methods used in analysis, Nitrate value determination, Coupling value, titanium chloride reduction, metal estimations – Cu, Ni, Cr etc.

Dyeing methods :- Dyeing methods for direct, acid, reactive disperse, vat, cationic, sulphur, indigo and azoics.

**Unit-II : Sugar Industries 12L**

Manufacturing of sugar from sugarcane :  
Introduction, agriculture, harvesting, preparation of cane for mealings, juice extraction, diffusion, juice purification, evaporation, crystallisation (production of raw sugar), centrifugation, sugar refining, decolouring, purification, filtration, crystallisation grade analysis.

**Analysis of bagasse and molasses, byproducts of sugar industries.**

**Unit-III: Pulp and paper industries 12**

- A) Chemistry of paper making, raw materials-
- physical properties of wood, classification of woods, plants used in pulp & paper, grass.
  - Chemical composition of wood, non-woody fibers used in pulping
  - Lignin-lignification of wood, chemical aspects of lignin formation.
  - Structure & properties of lignin
- B) Pulping:
- Preparation of pulp, wood, chips
- Manufacture of mechanical pulp, woods used, types, grades & uses.
- Equipment for ground wood pulping process
- Semichemical pulping, wood preparation, digesters
- Steam cooking
- Utilisation of secondary fibres. Rag pulping
- C) Bleaching
- bleaching of wood pulp-bleaching practice
  - stock preparation-internal sizing of papers
  - Filling paper manufacture - Additives

- types of paper machine - sheet formation
- press section - drying of papers
- cylinder mould type - calendaring
- Speciality papers-injection moulding

**Unit-IV : Pharmaceuticals****12**

**L** Product profile study of the following drugs and intermediates with particular stress on the manufacturing process engineering problems involved, quality control, equipment and economics ;

- i) Sulpha drugs :- Sulphaguanidine, sulphamethoxazole.
- ii) Antimicrobial :- chloramphenicol, streptomycin, Tetracyclines, ciprofloxacin.
- iii) Analgesic :- anti-inflammatory, Acetyl Salicylic acid, Ibuprofen, paracetamol.
- iv) Vitamin – Vit. A, Vit. B<sub>6</sub>, Vit. C
- v) Barbiturates :- Pentobarbital
- vi) Beta-blockers :- propranolol, atenolol, Beta-Nifedine, (Antihypertension )
- vii) Cardiovascular agents :- Methyldopa, enalapril maleate, Benazepril.
- viii) Antihistamines – Chlorpheniramine maleate,
- ix) Antidepressants – Resperidone, sertraline
- x) Anticancer drugs & anti-aids.

**Unit-V: Agrochemicals****12L**

Inorganic insecticides :- Arsenic insecticides, fluoroinsecticides

Insecticides of plant origins: - Nicotine, nicotine, pyrethroids, rotenoids, analgin, allethrin.

Chlorinated hydrocarbon:- DDT, dieldrin, sulphenex, DDT, endosulphan.

Organophosphorus Insecticides :-

Dithiophosphoric acid derivatives :- Malathion, dimethoate, dimecron.

Diphosphoric acid derivatives :- Parathion, methyl parathion, thiophos, chlorthion, paraoxon.

Pyrophosphoric acid derivatives. Sulphotepp, sohradan.

Other organophosphorus

Insecticides. Isopertox, trichlorofin.

Carbamate insecticides.

Carlang, isolom, phylolan,

bygon. Fungicides:-

Inorganic Fungicides:-

Sulphur, limesulphur, copper sulphate, Bordeaux paste, Bordeaux paint, Burgundy, copper oxychlorite.

Organomercuric compounds:-  
Ethyl mercuric chloride, cereasn Dithiocarbamates-  
Ziram, thiram, Zinc, captan.  
Miscellaneous fungicides :- Polpet, Bavistin

### List of Books-

1. Synthetic dyes by Venkatram (VOL I & II)
  2. Fundamental processes of dye chemistry, by Fietz.
  3. Dyes and Intermediates by Adrahaedt
  4. Chemical Process Industries by R. N. Shreves and M. J. A. Brink.
  5. Pulp and paper chemistry and chemical Technology by James P. Casey
  6. The chemistry of cellulose by Emit Ptauseg, John Wiley and sons, New York.
  7. Indian Pharmacopoeia, 1985
  8. British pharamacopoeia, 1990
  9. Textbook of Organic Medicinal and Pharmaceutical Chemistry by Willson, Jisvold, Dejja, Lippinett Toppan.
- 10 Essentials of Medicinal Chemistry by Korolkovas and Burkhatter-Wiley-Interscience.
11. Pharmaceutical Dosage forms
  12. Pesticites-Color Publications, P. L. Bombay
  13. Elements of Plant Protection by L. L. Pyenson, John Wiley and sons.
  14. Chemistry of Pesticides by N. N. Melnikov Springer-Verlag, New York
  15. Fungicites in Plant Disease control by Y. L. Nines, Oxford and IBH Publishing company New Dehli.
  16. Methods Pesticides Analysis by Sree Ramuly, U. I. Oxford and IBH Publishers.
  17. Charles E. Dryden, Outline of Chemical Technology Edited by M. Gopal Rao and Marshall Siting, East West Press 2<sup>nd</sup> Edition 1973.

### Semest er-IV Paper XV

Analytical Chemistry  
Analysis of commercial  
products

Total Lectures: 60Hrs, 4Hrsper week, 12Hrs/unit Total Marks-  
80

### Unit-I : 12L

Pharmaceutical analysis:-

Requirement of a quality control laboratory for pharmaceutical units, SOP of sophisticated instruments.

source of impurities in pharmaceutical raw materials such as chemicals, reagents and solvents, atmospheric and microbial contaminants, packing errors, chemical instability, container contamination, physical changes, temperature effects, manufacturing and storage effects. General manufacturing processes, stability studies, shelf life fixation for formulated products. Introduction to pharmaceutical formulations, Standardization, Evaluation analysis of common drugs, Antibiotics-Chloramphenicol, Ampicilline, Terramycine.

Vitamins- Vitamin B<sub>12</sub>, B<sub>6</sub>, Vitamin K  
Sulpha drugs-Sulphaguandine,  
Sulphapyrazine,  
Sulphanilamide Analysis of common drugs (aspirin, paracetamol etc..)

## Unit-II : 12L

**a) Analysis of petroleum and petroleum products-** Introduction, constituents and fractionation, Quality control requirements of petrol and petroleum products, safety and hazardous aspects. Analysis of petroleum products-specific gravity, viscosity, doctor test, sulphuric acid absorption, aniline point, vapour pressure and colour determination, cloud point, pour point. Determination of water, neutralization value, ash content estimation of sulphur and lead in petrol.

**b) Analysis of Explosive** -General methods, heat of explosion, hygroscopicity, moisture by Karl Fischer titration, qualitative tests of explosives, qualitative analysis of explosive mixtures, Dynamites. Blasting caps and electric detonators, primers, liquid propellants and solid propellants

## Unit-III : 12L

Analysis of Paints, soap and detergents

**Analysis of Paints and Pigments**-Preliminary inspection of sample, Test on the total coating. Separation of pigments, binder and thinner of latex paints,

determination of volatile and non volatile constituents, flash points, separation of pigments, estimation of binders and thinners. Modification of binder. Identification and analysis of thinner.

### Analysis of soaps-

General idea of soaps and detergents, sampling, separation, identification, determination of soap composition-fatty acids, total anhydrous soap and combined

alkali, potassium, water, determination of inorganic fillers and soap builders, determination of other additives.

**Analysis of Detergents**- types, method of analysis, sampling, separation, identification of components, determination of surfactants, determination of surfactants-anionic, cationic, non-ionic. Determination of Abrasives, Ammonia, Carbonates, Cellulose, Glycerine, Silicates, Sulphates, Phosphates, moisture content, saponification value. Analytical techniques used for analysis of soaps and detergents

## Unit-IV :

12L

### Forensic Analysis-

General introduction of forensic analysis, sampling, sample storage, sample dissolution, classification of poisons, lethal dose, significance of LD-50 and LC-50, general discussion of poisons with special reference to mode of action of cyanide, organophosphate and snake venom.

Analytical toxicology: Isolation, Identification, Estimation of poisonous materials such as lead, mercury and arsenic in biological samples. Quantification of drugs, insecticides, alkaloids and other products of synthetic and natural origin, ethyl alcohol, methyl alcohol, Zinc phosphides, effects of Kerosene and cooking gas. General discussion, Diagnosis and Management of poison, food poisoning, narcotic, stimulants, paralytic, antihistamine.

## Unit-V :

12  
L

Analysis of cosmetics, creams, lotions and hair dyes:-

- a) **Composition of creams and lotions:** Determination of water, propylene glycol, non-volatile matter and ash content, analysis of borates, carbonates, sulphates, phosphate, chloride, Titanium and Zinc oxide.
- b) **Analysis of face powder:** Estimation of boric acid, Mg,

Ca, Zn, Fe, Al and Ba

- c) Analysis of deodorants and antiperspirants- composition, analysis of fats and fatty acids, boric acid, zinc, iron, aluminium, lead, copper, titanium, phosphorus and urea.
- d) Analysis of ingredients of hair dyes.
- e) Analysis of Vanishing cream
- f) Analysis of Lipsticks

## List of Books-

1. Pharmacopoeia of India Volume I and II.
2. Aids to the Analysis of Food and Drug by Nicholls
3. Standard Methods of Chemical Analysis. 6th Ed. Vol I & II(D.Van.Nostard comp) by F.J.Welcher
4. Forensic pharmacy by B.S Kuchekar, A.M Khadatare (NiraliPrakashan)
5. Treatise on Analytical Chemistry Vol..I & II by L.M.Kolthoff.
6. Separation Chemistry in Chemistry and Biochemistry. By RoyKeller, M Decker Inc
7. G. D. Christian: Analytical Chemistry
8. Handbook of Analysis and Quality, Control for Fruits and Vegetable Products 2<sup>nd</sup> Ed Mc.Graw hill) by S.Ranganna.
9. Encyclopedia of Industrial chemical Analysis Vol I to 20 (JohnWiley) Riech
10. Cosmetics by W D Poucher (Three volumes)
11. Willard, Merritt and Dean: Instrumental methods of Analysis
12. Strouts, Crifillan and Wison: Analytical Chemistry.
13. Textbook of Forensic pharmacy- B. M. Mithal 9th Edn (1993)National Centre, Calcutta. V. Malik, Drug and Cometics Act.
14. Textbook of Forensic Pharmacy by B M Mithal 9th edition 1993,National Centre Kolcutta
15. Forensic Pharmacy by B.S Kuchekar, and A.M Khadatare NiraliPrakshan

## Semest er-IV Paper XVI

Analytical Chemistry (Special Paper-IV)

Applied analytical chemistry

Total Lectures: 60Hrs, 4Hrsper week, 12Hrs/unit Total Marks-80

### Unit-I

:

### 12L

Agricultural analysis-I

**Soil analysis-** Classification and composition , Soil formation, weathering, (especially SRMs), composition soil sampling,field description of soils, physical analysis,determination of major and minor constituents,exchange capacity,soil reaction,chemical

analysis as a measure of soil fertility. Analysis of constituents such as Nitrogen, Phosphorus, Potassium and micronutrients.

**Stock feeds analysis** - feeding stuffs,qualitative analysis and quantitative analysis.

**Plant analysis-** Preparation of sample, moisture determination- methods of ashing,methods of plant



analysis- starch, sugars, determination of mineral constituents (Fe, Mn, Mo, Si, Ca, Mg, P, S, C and N).

**Unit-II : Agricultural Analysis-II 12L**  
**Analysis of Fertilizers-** Sampling, sample preparation.

Analysis of nitrogen, phosphorus and potassium. Nitrogen: urea nitrogen, total Kjeldahl nitrogen method, Ammonia nitrogen, phosphorus: total phosphorus. available and non-available, alkalimetric ammonia molybdophosphate method, potassium : potassium by sodium tetraphenylborate method.

**Pesticides and insecticides analysis-** Introduction, classification, Analysis of organochlorine, organophosphorus and carbonate pesticides, analysis of DDT, gammexane, endosulphan, ziram, malathion, thiram, thiometon, simazine and chloridane . Green technologies in agriculture industries and water resource managements

**Unit-III 12L**  
**Analysis of minerals, ores and alloys**

- a) Minerals and ores-Hematite, pyrolusite, gypsum, dolomite chromate, bauxite, limestone, ilmenite and uranium ores.
- b) Metal and alloys analysis- iron, different kinds of iron, steel, Cu-Ni alloy, solder, bronze, aluminium alloy, ferroalloys of silicon, molybdenum, chromium, titanium and vanadium.

**Unit-IV : 12L**

**Industrial pollution-** Sugar industry, paper and pulp industry, nuclear power plant, polymer drugs, radionuclide analysis, disposal of wastes and their management. Principles of decomposition Biodegradability, classification of hazardous substances and water, chemical classes of hazardous

Case studies-Bhopal gas, Chernobyl, Three Mile Island, Minamata disasters.

**Unit-V : Analysis of mineral materials:**

**12L**

wastes, hazardous substances to health better industrial process. Industrial Operation and Green Methodology . Introduction and evolution of green chemistry, green reagents, solvents and catalysts

**Hazardous substance analysis-** nature, source, treatment and disposal of hazardous waste, classification of hazardous substances and wastes, origin, toxic substances, chemical, classification hazardous wastes, physical and chemical methods of waste treatment and preparation of waste and ultimate disposal of hazardous waste.

- a) **Cement**-Loss on ignition,insoluble residue,total silica ,sesquioxide s, lime, magnesia, ferric oxide,sulphuric anhydride,air and dust pollution from cement plants,atmospheric dispersion of pollutants in cement industry.
- b) **Glass and Glass-Ceramics-**  
Introduction,composition,methods of analysis- sampling and sapling preparation,composition analysis- preliminary testing,decomposition.Chemical method for the individual constituents-Si,B,Pb,Zn,Al,Cl,Mg,Ti.

### List of Books-

1. Agricultural Analysis. By Kanwar
2. A. I. Vogel: A text book of quantitative Inorganic analysis.
3. Soil Analysis. By Jackson.
4. Encyclopedia of Industrial Methods of Chemical Analysis. By F D Snell ( All senus).
5. G. W. Ewing: Instrumental Methods of Chemical Analysis.
6. Standard Methods of Chemical Analysis. By F J Welchar
7. G. D. Christian: Analytical Chemistry
8. S. M. Khopkar: Basic Concept of Analytical Chemistry.
9. Handbook of Air Pollution. By Stern, APHA, 1980.
10. Fundamentals of Analytical Chemistry 6th edition by D.A.Skoog,D.M.West and F.S.Holler
11. Industrial Chemistry by B.K.Sharma.
12. Strouts, Crifillan and Wison: Analytical Chemistry.
13. Principle and practice of Analytical chemistry by F.U.Fifield and D.Keuley 3rd edition,Blackie and sons Ltd..
14. S. A. Skoog and D. W. West: Fundamental Of Analytical Chemistry.
15. Pollution Control in Process Industries by S.P.Mahajan.

### Semester

#### IV

#### Practical-VII

#### Inorganic Chemistry Special

Pracitcal Workload 9 Hrs./week Time: 9-12 hours Marks: 100

- Unit-I**
- 1) Extraction and absorption spectral study of chlorophylls from green leaves.
  - 2) Determination of Phosphates from cold drink samples by spectrophotometry.

- 3) Analysis of talcum and nyclin powders (Mg-complexometry, ZnO/H<sub>3</sub>BO<sub>3</sub>)
- 4) Determination of iron in soap bar.
- 5) Analysis of N, P, K from fertilizer
- 6) Analysis of cement/paint/soil.

**Unit-II :** Study of complex formation:

- 1) To determine the formula and formation of a complex by spectrophotometry (Job's/ mole/Slope ratio methods)
- 2) To determine stepwise proton-ligand and metal-ligand stability constant of complex by Irving-Rossotti method.
- 3) To determine the instability constant of complex by potentiometry (AgNH<sub>3</sub>, Ag-thiosulphate)
- 4) To determine the composition and formation constant of a Fe-SSA complex by conductometry.
- 5) Determination of composition and stability constant of complex by polarography.

**Unit-III:** Inorganic reaction mechanism:

Kinetics and mechanism of following reactions:

- 1) Substitution reactions in octahedral complexes (Acid/Base hydrolysis)
- 2) Redox reactions in octahedral complexes.
- 3) Isomerization reaction of octahedral complexes.
- 4) Enzyme kinetics in presence of metal ions.
- 5) To determine the corrosion rate of metal strip.
- 6) To study the 1,10 phenanthroline as corrosion inhibitor for mild steel in sulphuric acid.
- 7) To study the adsorption and desorption of gases on heterogeneous catalyst.

**Unit-IV: Solid State:**

- 1) Preparation of oxides and mixed oxides (Mn O , NiO, Cu O,

2 3 2

Fe<sub>3</sub>O<sub>4</sub>, ZnFe<sub>2</sub>O<sub>4</sub>, ZnMn<sub>2</sub>O<sub>4</sub>, CuMn<sub>2</sub>O<sub>4</sub> and NiFe<sub>2</sub>O<sub>4</sub>)

- 2) Preparation of Silica and Alumina by sol-Gel technique.
- 3) To study the electrical conductivity of ferrites, Magnetites, doped oxides and pure samples and determine band gap.

**Unit-V :** Two/Three steps synthesis and characterization:

Synthesis of metal complexes/Polymers/Lanthanide complexes and their structural characterizations by possible physical methods such as: elemental analysis (N, S, M % etc.), m.p. Solubility, MW, molar conductance, magnetic moment, thermogravimetric analysis, IR and electronic spectral data, determination of crystal field parameters (minimum five)

**Book Suggested:**

1. Synthesis and Characterization of Inorganic Compounds, W. L. Jolly, Prentice Hall.
2. Inorganic Experiments, J. Derck Woollins, VCH.
3. Practical Inorganic Chemistry, G. Mairand, B. W. Rockett, Van Nostrand.
4. A Text Book of Quantitative Inorganic Analysis, A. I. Vogel, Longman.
5. EDTA Titrations. F. Laschka
6. Instrumental Methods of Analysis, Willard, Merit and Dean (CBS, Delhi).
7. Inorganic Synthesis, Jolly
8. Instrumental Methods of Chemical Analysis, Yelri Lalikov
9. Fundamental of Analytical Chemistry, Skoog D.A. & West D.M Holt Rinehart & Winston Inc.
10. Experimental Inorganic Chemistry, W.G. Palmer, Cambridge.
11. Solid state Chemistry, N.B. Hanney
12. Introduction to Thermal Analysis, Techniques & Applications, M.E. Brown, Springer
13. Preparation and Properties of solid state Materials, Wilcox, Vol. I & II, Dekker
14. The Structure and Properties of Materials Vol. IV, John Wulff, Wiley Eastern.

The Practical examination will be based on the Inorganic Chemistry. Time: 6-8 hours (Two days examination) Marks:

100

I) Exercise-1 (Synthesis & Analysis)	- 40 Marks
II) Exercise-2 (Kinetics/complex)	- 40 Marks
III) Record	- 10 Marks
IV) Viva- Voce	- 10 Marks

**SEMESTERIV**

Practical VII Organic Chemistry Special

**Pracitcal Workload 9 Hrs./week Time: 9-12 hours Marks: 100**

**Unit-I : QUALITATIVE ANALYSIS.**

Separation of the components of a mixture of three organic compounds (three solids, two solids and one liquid, two liquids and one solid, all three liquids and identification of any two components using chemical methods or physical techniques. Purification of the compounds by crystallization, chromatographic techniques (Minimum of 12 mixtures to be done)

**UNIT-II: ORGANIC ESTIMATION****Organic Estimation.**

1. Estimation of nitrogen.
  2. Estimation of halogen.
  3. Estimation of sulphur.
- Spectrophotometric/calorimetric Estimation.
4. Estimation of streptomycin sulphate.
  5. Estimation of B-12.
  6. Estimation of amino acids.
  7. Estimation of proteins.
  8. Estimation of carbohydrates.
  9. Estimation of Ascorbic acid.
  10. Estimation of Aspirin.
  11. Solvent extraction of oil from oil seeds and determination of saponification value, iodine value of the same oil.

**Organic practical :**

Two Days Examination - 9-12 Hrs.                      100 Marks

**Distribution of marks:**

Unit I .....	40
Unit II .....	40
Record	10
Viva-voce	10
<b>TOTAL</b>	<b>100</b>

**BOOKS SUGGESTED:-**

1. Textbook of practical organic chemistry qualitative and quantitative

6. Small scale organic preparation-P.J. Hill
7. Practical organic chemistry-H. Dupont Durst & George W. Gokal.
8. Experimental organic chemistry Part I & II, P. R. Singh, D. S. Gupta & K.S. Bajpai.
9. Vogel's textbook of practical organic chemistry-A.R. Tatchell

**Semest  
er IV  
Practica  
I-VII**

**Physical Chemistry Special**

Practical Workload 9 Hrs./week    Time: 9-12 hours    Marks: 100

**Use of Computer Programmes 5 terms of practicals.**

Treatment of experimental data, X-Y plots, programs with data preferably from physical chemistry practical. Students will operate two packages I) MS-Word and II) MS-Excel.

**Part-A**

- 1) To find out Energy of activation & Temperature coefficient of hydrolysis of methyl / ethyl acetate
- 2) To find out Energy of activation of the reaction between potassium persulphate & potassium iodide.
- 3) Determination of partial molar volume of solute and solvent in binary mixture.
- 4) To study the variation of solubility of calcium sulphate with ionic strength and hence determine thermodynamic solubility product.
- 5) To study the adsorption of acetic acid on charcoal and prove the validity of Freundlich and Langmuir adsorption isotherm.
- 6) To determine the critical micelle concentration of soap.
- 7) To determine the molecular weight of high polymer by viscosity measurement.
- 8) To find out partition coefficient of Iodine/Benzoic/Salicylic acid between benzene and water.  
analysis (Vol I & II)- A.I. Vogel.
2. Elementary practical organic chemistry small scale preparation (Langman)- A.I. Vogel.
3. A handbook of organic analysis.-H.T. Clark.
4. Systematic qualitative organic analysis -H. Middleton.
5. Advanced practical organic chemistry-N. K. Vishnoi.

**Part-B**

- 1) Determination of half wave potential of metal ions by polarography.
- 2) Simultaneous determination of suitable of metal ion by polarography
- 3) Analysis of aspirin conductometrically and potentiometrically
- 4) Determination of sodium, potassium, lithium and calcium by Flamephotometric individually and mixture.
- 5) Electronics measurement of resistance with multimeter and use of Wistone Bridge for accurate measurement of resistance.
- 6) Determine the dipole moment of given liquid.

- 7) Plot the current voltage curve for copper sulphate and sulphuric acid using bridge platinum electrode.
- 8) Determine the transport number of ions by moving boundary method.
- 9) Determine the composition of binary mixture spectrophotometrically

## Physical Chemistry Practical :

### Distribution of marks:

Two Days Examination - 9-12 Hrs.	100 Marks
Unit A .....	40
Unit B .....	40
Record	10
Viva-voce	10
<hr/>	
TOTAL	100

## Semest er IV Practical -VII

### Industrial Chemistry Special

Practical Workload 9 Hrs./week Time: 9-12 hours Marks: 100

### Multi step organic Synthesis:

- 1) Nitrobenzene - m-dinitrobenzene – m-nitroaniline- m-nitrophenol.  
Anthranilic acid – phenylglycine orthocarboxylic acid – indigo
- 2) Cyclohexanone – cyclohexanone oxime – caprolactum.
- 3) Preparation of P- bromoaniline from aniline.
- 4) Preparation of Synthetic Zeolites.
- 5) Determination of 'N' and 'P' nitrogen and phosphorus containing fertilizer respectively by suitable methods.
- 6) Determination of Iron and Calcium from Cement by suitable methods.
- 7) Determination of Lead (Pb) from Opal Glass by suitable methods.
- 8) Experiments based on distillation under reduced pressure, fractional and steam distillation.
- 9) Measurement of flash point, ignition point, kinematic viscosity by U-tube method.
- 10) Estimation of Copper from – fungicides.
- 11) Determination of pesticide contents in the soil.
- 12) Preparation of Methyl orange, Methyl red, orange II, Fluorescein,

- 13) Quinoline, Anthraquinone.  
Quantitative estimations of important commercially available drugs.

- 14) Qualitative analysis of commercial available drugs including chromatographic technique.
- 15) Preparation of simple drugs involving two or three steps.
- 16) Preparation of melamine – HCHO resin.
- 17) Determination of number average molecular weight ( $M_n$ ) by endgroup analysis by conductometric method.
- 18) Determination of average molecular weight of polymer by viscometric method.
- 19) Determination of reducing sugar in cane juice.
- 20) Determination of moisture content and ash content of wood sample.
- 21) Experiments based on simple & fractional crystallization.
- 22) Analysis of nonfibrous materials used in pulp industries such as caustic soda as  $\text{Na}_2\text{O}$ , Soda ash as  $\text{Na}_2\text{O}$ , lime as  $\text{CaO}$ .
- 23) Extraction of essential oils from medicinal plants (Tikhadi).
- 24) Separation of Chromium (VI) & Chromium (III) by TLC in wastewater sample from electroplating industry.
- 25) Preparation of selected pesticide formulations in the form of dusts, emulsions, sprays.
- 26) Determination of calorific value of fuels.

### Distribution of marks:

The Practical examination will be based on the syllabus for Industrial Chemistry (Elective Paper).

Time: 9-12 hours (Two days examination)	Marks: 100
I) Exercise -1 (Synthesis)	- 40 Marks
II) Exercise-2 (Analysis)	- 40 Marks
III) Record	- 10 Marks
IV) Viva- Voce	- 10 Marks
<hr/> Total	<hr/> - 100 Marks

### List Of Books-

1. Practical Engineering by S. S. Dara.
2. Laboratory Preparation of Microchemistry by E. M. M. Effery, McGrawHill.
3. Practical Course in Polymer Chemistry by S. J. Pnnea, Pargaman Press
4. Practical Pharmacognosy by T. B. Willis.
5. Practical Pharmacognosy by T. N. Vasudevan.
6. Indian Pharmacopea-1985, British Pharmacopea-1990.
7. Handbook of Drugs and Cosmetics by Mehrotra
8. Methods of Pesticide Analysis by Sree Ramuly U. I. Oxford and IBH Publishing Co.



9. Methods of testing for petroleum and petroleum products. IS 1448-1960 Part I to Part IV. Published by ISI New Delhi 1967
10. IP Stands for Petroleum and products Published Applied Service Publisher Ltd. London, 33<sup>rd</sup> Edition 1974.
11. American Stds. For testing Materials, New York 1967.
12. Textbook of Inorganic Chemistry by A. I. Vogel.
13. Instrumental Methods of Analysis by Willard, Merit and Dean
14. Industrial Chemicals, Faith et. al. Wiley Interscience New York
15. Textbook Of Practical Organic Chemistry by I. C. Voley.
16. Industrial Organic Chemistry by J. K. Stille
17. Unit Operations by Kale
18. Reagents for Organic Synthesis Fisher and Fisher.
19. Technique of Organic Chemistry Vol I, Part I- IV A. Weishberger.

## Semester IV

### Analytical Chemistry Practicals (Special)

**Total Hours: 90 hrs. (9 Hours per week)**

**Marks:**

**100**

- 1) Solvent extraction of Al/Mg or Mg/UO<sub>2</sub> using 8- hydroxy quinoline complex and determination by spectrophotometry.
- 2) Separation and estimation of copper and cobalt on cellulose Column.
- 3) Analysis of pyrolosite with respect to I) iron II) Manganese
- 4) Assay of sulphur drugs
- 5) Analysis of vit. C in juice and squashes
- 6) Determination of sap value and iodine value of oil.
- 7) Determination of p- nitrophenol by colorimetry.
- 8) Determination of iron in syndets by colorimetric method.
- 9) Determination of Phenol by Conductometry.
- 10) Potentiometric determination of thiourea.
- 11) Estimation of calcium/sodium in the sample of dairy whitener by flame photometry.
- 12) Analysis of pigments with respect to Zn and Cr.
- 13) To determine the amount of each copper and bismuth or copper and iron (III) from the given mixture at 745 nm by spectrophotometric titration using solution of
- 14) EDTA identification of sulphur drug in tablets and ointments by TLC.
- 15) Fertilizer analysis for N, P, K
- 16) Analysis of iodized table salt for its iodine content.
- 17) Estimation of the purity of given azo dye colorimetrically.
- 18) Chemical analysis of chilly and turmeric powder.
- 19) Simultaneous estimation of Cl and I by potentiometric method.

- 20) Colorimetric determination of simple ions (nitrate/nitrite, toxic heavy metals).
- 21) Analysis of soap and detergent.
- 22) Determination of alcohol from beverages using dichromate.
- 23) Determination of amount of Zinc from the given mixture by Nephelometric/Turbidimetric titration using Ba (NO<sub>3</sub>)<sub>2</sub> or
- 24) Pb (NO<sub>3</sub>)<sub>2</sub> Analysis of Pharmaceutical mixture
- 25) Simultaneous determination of Vitamic C and iron
- 26) Analysis of some common pesticides in soil and detergents
- 27) To determine the amount of each para nitro phenol from the given mixture by spectrophotometric method using standard solution of NaOH (max-280 nm)
- 28) Estimation of sodium benzoate/sodium metabisulphite and salicylic acid in food
- 29) ) Analysis of chrome steel alloy for chromium
- 30) Agricultural analysis of soil sample, animal feed and milk powder for Ca, Fe and P content.
- 31) Any other relevant expt. may be added

The Practical examination will be based on the following topics of Analytical Chemistry (Special Papers).

**Time: 6-8 hours (one day)**

**100**

I) Exercise -1	- 40 Marks
II) Exercise-2	- 40 Marks
III) Record	- 10 Marks
IV) Viva- Voce	- 10 Marks

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Total    -100 Marks

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**M.Sc.  
(Chemistry  
) Semester-  
IV**

**Practical-VIII - Project Work**

**Time : 9 Hrs. Per Week**

The Students will develop utilities and practical skills through the following exercises in their subject of specialization. For the research project designed by the teacher based on the student's interest and capabilities should be worked out.

The project will be evaluated by external and internal examiners.

**Study Tour:** Educational / Industrial tour is compulsory for M.Sc.

**Chemistry.**

(i) Semesters I / II : Visit to local industry.

(ii) Semester III / IV : Education tour to visit the industry / Research Laboratory.

## List of equipments/apparatus required for the M.Sc. Chemistry Semester-I to IV Practicals.

1. Conductivity meter	03 nos./batch
2. pH meter	03 nos./batch
3. Potentiometer	03nos./batch
4. Polariometer	02 nos./batch
5. Centrifuge machine	02 nos./batch
6. Vaccum Pump	01 no./batch
7. Hot air oven	01 no./batch
8. Blower hot & cold	03 nos./batch
9. Stop watch	10 nos./batch
10. Weight box con. 100 gm.	10 nos./batch
11. Analytical double pan balance	10 nos./batch
12. One pan electrical balance	10 nos./batch
13. Tripple beam balance	02 nos./batch
14. Melting point apparatus	02 nos./batch
15. Spectro photometer	02 nos./batch
16. Water still 01 no./lab	
17. Colorimeter	02 nos./batch
18. Thermostate	01 no./batch
19. Electrodes platinum	03 nos./batch
Silver	03 nos./batch
Glass	03 nos./batch
Reference	03 nos./batch
20. Heating mentle	02 nos./batch
21. Glass double distillation unit	01 no./lab
22. Flamed Photometer	01 no./batch
23. LCR meter 01 no./lab	
24. Polarppgraph with recorder	01 no./lab
25. U.V. visible spectrophotometer	1 no./lab
26. Standard cell	02 nos./batch
27. Muffle furnace	01 no./lab
28. D.C.Voltmeter	01 no./lab
29. Infrared lamp	05 nos./lab

30. Refrigerator
31. Magnetic stirrer 2 ml, 5 ml.
32. Dimmer state
33. Abbe's refractometer
34. Sodium lamp for polarimeter
35. T.L.C. Kit
36. Calorimeter
37. Bomb Calorimeter
38. BOD analyser
39. Water analysis kit
40. Computer-386/486
41. U.V.Lamp 02 no./lab
42. Ice making machine
43. LCR bridge
44. HPLC
45. Deioniser
46. Ion exchange column's
47. Turbidity meter
48. Optical densitometer
49. Orsat apparatus (gas analysis)
50. Interferometer (ultrasound)
51. Youy's balance
52. Hydraulic press
53. Shaking machine
54. G.M.Counter
55. Electrophorasis apparatus
56. Karl-Fisher Titration apparatus
57. Power supply (regulator)
58. Regulated furnace
59. Thermocouple
60. Vaccum oven
61. Top pan balance  
etc.,

## List of glasswares (main) for Chemistry Semester-I to IVPr

1. Soxhlet set
2. Kjeldahl's apparatus set  
(for Nitrogen element estimation)
3. Distillation unit
4. Separating funnel

5. Steam distillation unit	02 nos./batch
6. Vacuum desiccator	01 no./batch
7. Paper chromatography chamber	03 nos./batch
8. Silica crucibles	20 nos./batch
9. Sintered glass crucibles g4/g5	20 nos./batch
10. Spot test plates	10 nos./batch
11. Wash bottles	10 nos./batch
12. Density bottles	10 nos./batch
13. Viscometer	10 nos./batch
14. Kipp's apparatus	10 nos./batch
15. Beakers, capacity :50 ml, 100 ml, 250 ml, 400 ml, 500 ml, 1000ml,	
16. Conical flask : 100ml, 250 ml.	
17. Burettes with stop cock, capacity : 2ml, 5 ml, 10ml, 25 ml.	
18. Lambda pipette	02 nos./batch
19. Volumetric flasks, capacity: 10 ml, 25 ml, 50 ml, 100 ml, 250 ml, 500 ml, 1000ml.	
20. Measuring cylinder, capacity : 10 ml, 25 ml, 50 ml, 100 ml, 500 ml, 1000ml	
21. Pipette, capacity: 1 ml, 2 ml, 5 ml, 10 ml, 25 ml.	
22. Stalagmeter	10 nos./batch
23. Thermometer (b-24) 0 to 360°C (quick fit)	05 nos./batch
24. Water suction pump (glass)	05 nos./batch
25. Filtration flasks with buckner funnels 50 ml	10 nos./batch
100ml	10 nos./batch
250ml	10 nos./batch
500ml	10 nos./batch
26. Quick fit stand joints b-14, b-19, b24	
27. China dishes	10 nos./batch
28. Dessicators	10 nos./batch
29. Thiel's tube for melting point	05 nos./batch
30. Quick fit water condensers b-19, b-24	10 nos./batch
31. Quick fit flasks, Capacity 50 ml, 100 ml, 250ml, 500 ml, 1000 ml.	10 nos./batch

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M.Sc. Physics

Prospectus No. 2015124

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PUBLISHED BY  
**Dineshkumar Joshi**  
Registrar  
Sant Gadge Baba  
Amravati  
University  
Amravati-444602

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2. Introduction to Atomic Spectra: HG Kuhn.
3. Spectroscopy Vol. -I,II & III - Walker & Straughen
4. Introduction to Molecular Spectroscopy - G.M.Barrow
5. Spectra of Diatomic Molecules - Herzberg8.Molecular Spectroscopy - Jeanne L McHale
6. Molecular Spectroscopy - J.M.Brown
7. Spectra of atoms and molecules - P.F.Bemath
8. Modern Spectroscopy - J.M.Holias
9. Elements of Spectroscopy - Gupta, Kumar, Sharma, Pragati Prakashan, Meerut.

### Text Books :

- (1) Introduction to Atomic Spectra- H.E.White
- (2) Fundamentals of Molecular Spectroscopy - C.B.Banwell

## 3PHY-4(i) : DIGITALTECHNIQUES

**Unit-I** : Fundamental Digital Devices:

The transistor as a switch Basic logical operation like OR, AND and NOT , ExOR, NAND, NOR Electronic Circuit operations using Various Logic Families devices like TTL(Std, Schotky, LP, HP), C-MOS, Comparison on Fan inFan out, Propagation delays, voltage levels, power consumption packing density etc. Merits and Demerits. NOR and NAND devices as basic building blocks, Classification of Logic Circuits

**Unit-II** : Combinational Logic Design :

Boolean algebra – Simplification of logic circuits Boolean algebraic methods, rules, limitations Demorgan's theorems  
- Exclusive OR gate, Simplification of logic circuits using K'Map Method and complementary K'Map min terms/max terms. Half Adder, Full Adder, 7483 IC, Adder-2-Subtractor, Arithmetic circuits for Binary Multiplier, Binary Divider,

**Unit-III** : Devices and converters:

Multiplexer : 2:1, 4:1, 8:1 and 16:1, De-multiplexer : 1:2:,1:4,

1:8 and 1:16, Decoder IC 7445, 7447, 74138, Encoder hexkey, ASCII key ,SSD display Devices, CK/CA SSD codes ,Data selector etc. 2-Bit ALU,, 4-Bit ALU-74181.

**Unit-IV** : Sequential Logic Design:



Bi-stable Multivibrator, Flip - Flops : the RS Flip-Flop, JK Flip - Flop - JK master slave Flip - Flops - T Flip - Flop - D flip - Flop - Shift registers - SIPO, PISO, SISO, PIPO, Universal Shift operations using various ICs, Data latches, Controlled buffers, Unidirectional & Bidirectional controlled buffers. Counters Synchronous and Asynchronous and combination counters.

**Unit-V** : Memory Devices:

Concept of a memory cell using DFF, Working of the memory cell for each type Static and dynamic random access memories SRAM and DRAM, CMOS and NMOS, non-volatile - NMOS, magnetic, optical and ferroelectric memories, charge coupled devices (CCD). Read-only Memory (ROM) and applications. Random Access Memory (RAM) and applications. Memory Organization, Memory Map, Memory devices classification and features, , Programmable, OTP Memory, EPROM, EEPROM, Memory map, Designing memory organization, Serial Expansion, Parallel Expansion using 6264, 2764, etc

### References :

R. P. Jain & Anand, Pittman, Malvino & Leach, Tokheim, D. C. Green, Floyd

**OR**

### 3 PHY-4(ii) : CONDENSED MATTER PHYSICS-I

**UNIT-I** : Band Structure - Electron levels in periodic potential (Kronig-Penny Model), Bloch theorem - statement and proof. Crystal momentum, number of orbitals in a band, band index and the concept of effective mass. Motion of electrons in bands, Reduced, periodic and extended zone schemes, Construction of Fermi surface. Nearly free electron model: qualitative proof for origin of gap in periodic potential and perturbation theory. Tight binding model: assumptions and applications to SC, FCC and

BCC structures.

**UNIT-II** : Magnetism: Atomic Magnetic Moment, Larmor Precession, Diamagnetism: Classical and Quantum Theory, Paramagnetism: Origin of permanent magnetic moment, Ideal Magnetic Gas, Classical and Quantum Mechanical Treatments of Paramagnetism, Paramagnetism in rare earth ions, Paramagnetic cooling.

**UNIT-III :** Ferromagnetism: Weiss Theory, Heisenberg Model of Molecular Field Theory, Spin Waves And Magnons, Curie-Weiss Law, Theory of Ferri and Antiferro Magnetism, Domains And Domain Walls.

**UNIT-IV :** Dielectrics: Concept of dielectrics, Macroscopic and Local electric fields, Claussius. Mosotti relation, Types of Polarization mechanisms, complex dielectric constant, relaxation time, Concept of Ferroelectricity, Theories of ferroelectricity, Antiferroelectricity, Piezo electricity.

**UNIT-V :** Superconductivity: Introduction, Meissner effect, D.C. resistivity, the heat capacity, flux quantization, Type I and II superconductors. Superconducting energy gap, coherence length, London penetration depth, BCS theory, Ginzberg- Landau theory, DC and AC Josephson effects, SQUID, Introduction to high Tc superconductors.

### References:

1. Solid State Physics, N W Ashcroft and N D Mermin (Cengage Learning India Pvt Ltd, 2009).
2. Introduction to Solid State Physics, C. Kittel (John-Wiley, 8<sup>th</sup> Ed. 2005).
3. Introduction to Solids, L V Azaroff (Tata-McGraw Hill, 1984).
4. Introduction to Modern Solid State Physics, Yuri M Galperin.
5. Solid State Physics, R. L. Sigal, Ram Nath Kedar Nath & Co., Publishers Meerut.

## 3PHY-4 (iii) : ANALOGUE COMMUNICATION

**UNIT-I :** Amplitude Modulation- Generation of AM waves - Demodulation of AM Waves - DSBSC modulation. Generation of DSBSC waves, coherent detection of DSBSC waves SSB modulation, Generation and detection of SSB waves. Vestigial sideband modulation. Frequency Division multiplexing (FDM).

**Unit-II :** Radar block diagram, an operator radar frequency, pulse considerations. Radar range equation, derivation of radar range equation, minimum detectable signal, receiver noise, signal to noise ratio, integration of

rader pulses. Radar cross section. Pulse repetition frequency. Antenna parameters. System Losses and Propagation losses. Radar transmitters, receivers. Antennas, Displays.

**UNIT-III :** Klystrons, Magnetrons and traveling Wave Tubes, Velocity modulation, Basic principles of two cavity Klystrons and Reflex Klystrons, principles of operation of magnetrons. Helix Travelling Wave Tubes, Wave Modes. Transferred electron devices, Gunn Effect, Principles of operation. Modes of operation, Read diode, IMPATT diode, TRAPATT Diode.

**Unit-IV :** Advantages and disadvantages of microwave transmission

, loss in free space, propagation of microwaves atmospheric effects on propagation, Fresnel Zone problem, ground reflection, fading sources, detectors components, antennas used in MW communication systems.

**Unit-V :** Satellite communications : Orbital satellites, geostationary satellites, orbital patterns, look angles, orbital spacing, satellite systems. Link modules.

### **Text and Reference Books :**

1. "Microelectronics" by Jacob Millman, McGraw-Hill, International Book Co., New Delhi, 1990.
2. "Optoelectronics : Theory and Practice" Edited by Alien Chappal McGraw Hill Book Co., New York.
3. "Microwaves" by K.L. Gupta, Wiley Eastern Ltd., New Delhi, 1983.
4. "Advanced Electronics Communications systems" by Wayne Tomasi, Phi. Edn.
5. "Electronic Devices and circuit theory" by Robert Boylestad and Louis Nashdsky PHI., New Delhi-110001, 1991.

### **TUTORIAL : ELECTRONICS:**

1. Radiowave propagation in free space.
2. Tropospheric & ionospheric propagation.
3. Applications of counters & shift registers.
4. Dedicated systems using microprocessor.
5. Sampling Theorem - sample and hold circuits,
6. Second and higher order filter design concepts.
7. A/D & D/A interfacing.
8. Photo electric effect.

9. Photo emissive cells.
10. Microwave amplification.
11. Klystron and Gunn Oscillator characteristics.
12. Concepts of wave guides.

13. Microwave propagation.
14. Design considerations of microwave links.

### **Different types of Radar systems.**

- i) Weather Radars
- (ii) Cyclone detection radars
- (iii) Moving target indicators.

Frequency considerations in satellite communications.

**In addition to above, the tutorial will also consist of solving problems given in the Text and Reference books.**

OR

### **3PHY-4 (iv) Photonics-1: Fundamentals of Photonics**

**Unit-I :** Maxwell's equations, Maxwell's wave equations for a vacuum, solution of the general wave equation, Group and Phase velocity, generalized solution of the wave equation, transverse electromagnetic wave, flow of electromagnetic energy, electric dipole radiation, Fundamentals of geometrical optics, Ray tracing, paraxial approximation, Aberrations, Designing Optical set-ups, Thin lens theory

**Unit-II :** Fundamentals of Modern Optics: Wave propagation, wave particle duality, Kramers - Kronig relations, Electromagnetic fields in homo and inhomogeneous dispersive media, diffraction theory, Polarization of light.

**Unit-III :** Fourier Optics: Plane waves, spatial frequency, Optical Fourier Transform, Diffraction of light, special function in Photonics and their Fourier transform, convex lens and its function, Image formation, spatial filters, Holography, Applications of Holography.

**Unit-IV :** Near Field optics: The evanescent waves, Goos-Hänchen Shift, generation of evanescent waves, Photon tunneling microscope, scanning near field optical microscope, probe to detect the evanescent

field.

**Unit-V :** Radiation pressure of laser light, Optical Tweezers and its applications, Raman-optical tweezers, Laser cooling of atoms, Bose Einstein Condensate, Atom laser.

#### **References**

- 1) Keigo Iizuka, "Elements of PHOTONICS Vol. 1 (In free space and special media) and 2 (for fiber and integrated optics)," Wiley Series in Pure and Applied Optics.

- 2) Eugene Hecht, "Optics (International Edition)," Addison Wesley, (2003).
- 3) F G Smith, T A King and D Wilkins, "Optics and Photonics: An Introduction," John Wiley & Sons, Ltd, San Francisco, USA, (2007).
- 4) David J. Griffiths, "Introduction to Electrodynamics (3<sup>rd</sup> edition)," Pearson Publishers.
- 5) Born and Wolf, "Principles of Optics: Electromagnetic Theory of Propagation, Interference and Diffraction of Light," Cambridge University Press.
- 6) Joseph W Goodman, "Introduction to Fourier Optics," McGraw-Hill.
- 7) Hand Book/Optics, Vol. 1-IV, Optical Society of India, McGraw Hill

### **3PHY-5(i) : LAB COURSE ON DIGITALTECHNIQUES**

It is necessary to perform atleast seven experiments from the listgiven below.

The experiments based on theory course are desirable.

1. Digital I: Basic Logic Gates, TTL, NAND, and NOR.
2. Digital II: Combinational Logic.7483, BCD Adder, A-2-S
3. Designing various binary counters using JKMSFF.
4. Designing various Shift resisters using JKMSFF
5. Study of Multiplexer : 2:1, 4:1, 8:1 and 16:1, De-multiplexer : 1:2:, 1:4, 1:8 and 1:16, Multiplexers and De-multiplexers.
6. Designing Memory using ICs of required organization  
Solving problems using K' Map
7. Design consideration of Combinational logic design circuits for HA/FA/ Subtractor,
8. Design consideration of Multiplier, Divider etc using ICs.
9. Design consideration of Synchronous/asynchronous Modulo N Counters and Decade Counter,
10. Design consideration of SIPO, PISO, SISO, PIPO, Universal Shiftoperations,
11. Design consideration of, Memory expansion problems

### **3PHY-5(ii): LAB COURSE ON CONDENSED MATTER PHYSICS**

It is necessary to perform atleast seven experiments from the listgiven below.

The experiments based on theory course are desirable.

1. Determination of Magnetic Susceptibility of Material by Quincke's Method.
2. Study of Magnetic Properties (Coercivity, retentivity, saturation magnetization and hysteresis loops) of ferromagnetic samples (soft iron, hard steel & nickel).
3. To study variation of Dielectric constant of a given solid / liquid with temperature.
4. Determinations of specific heat of graphite sample.
5. Determination of magnetic susceptibility of a solid by Guoy balance method.
6. Determination of Curie temperature of a given sample.
7. Determination of Lande's g-factor of DPPH using Electron Spin Resonance Spectrometer.
8. Determination of band gap of semiconductor by variation of conductivity with temperature.
9. Determination of band gap by absorption coefficient measurement.
10. Demonstration of Meissner effect.
11. Determination of adiabatic compressibility of a given liquid.
12. Determination of Thermoelectric Power of a substance.

### **3PHY-5(iii) : LAB COURSE ON ANALOGUE TECHNIQUES**

The experiments from serial no. 1 to 5 are compulsory & perform any two experiments from others. It is expected that the teacher may perform open ended experiments.

1. Pulse amplitude modulation and demodulation.
2. Pulse position modulation and demodulation.
3. Pulse width modulation and demodulation.
4. Study of delta modulation and demodulation.
5. Characteristics of antenna.
6. Study of amplitude modulator.
7. Study of frequency modulator.
8. Study of FSK modulator and demodulator
9. Study of super-heterodyne receiver.
10. Study of fibre optics voice transmission and reception.

### **3PHY-5 (iv) Lab on Photonics-1**

**A student should perform at least seven experiments from the following list. In the examination he will be asked to perform one experiment only**

- 1) Handling, cleaning, maintenance of optical components and laser

systems. Laser safety demonstration.

- 2) Characterization of laser beam.
- 3) Setting up of two and multi-beam Interferometer.
- 4) Measurement of UV-Visible Absorption spectra of standard samples.
- 5) Measurement of refractive index of the transparent material using Mach-Zahnder Interferometer.
- 6) Conversion of continuous wave laser into pulsed laser.
- 7) To study relaxation oscillation of diode laser.
- 8) Temporal pulse shaping of laser beam.
- 9) To study various polarized states of light.
- 10) To record and study Laser Induced Breakdown spectroscopy signal of known and unknown samples. **(Demo)**  
Setting up of high power interferometer demonstrative experiment.

## M.Sc. Semester - IV

### 4PHY-1: NUCLEAR AND PARTICLE PHYSICS

#### Unit-I : General Properties of Atomic Nucleus:

Nuclear charge, Nuclear Mass, (Atomic Number and Mass Number), Meaning of isotopes, Isobars, Isotones, Isomers, Isodiapheres with examples, Nuclear Radius, Classification of Nuclear radius, (Electrical and Potential Radius) Determination of Nuclear Radius by electron scattering (Hofstadter's Experiment), Mirror Nuclei method, Mass Defect, Binding energy, Variation of Binding energy per nucleon with mass number, Semi empirical Mass Formula, Mass Parabola.

Quantum Numbers for individual nucleons (Principal, Orbital, Radial, Spin, Total, Iso-spin, Quantum Numbers) Parity, Quantum Statistics; Nuclear Angular Momentum, Nuclear Magnetic Moment, Nuclear Magnetic Dipole Moment, Measurements of nuclear magnetic moment by Rabi's method and Block's method, Problems.

#### Unit-II : Nuclear Forces:

Deuteron, Ground state properties of

Deuteron, (Properties of Nuclear Forces, number, Range and depth of potential, excited States of Deuteron), Neutron-Proton scattering at low energies (Scattering length, phase shift, spin dependence, Coherent scattering, shape independent effective range theory; Proton-Proton scattering at low energies, similarity between n-n and p-p forces), Meson Theory of Nuclear forces, spin dependence of Nuclear forces.

**Beta Decay and Nuclear Models:** Three forms of  $\beta$  decay, continuous nature of  $\beta$ -ray energy spectrum, difficulties encountered in explaining  $\beta$ -ray energy spectrum, Pauli's Neutrino hypothesis (properties of neutrino and explanation of  $\beta$ -decay using Pauli's Neutrino hypothesis), Assumption of Fermi's theory of  $\beta$ -decay, Fermi-Kurie Plots, Seargents

Plots. Detection of Neutrino (Cowan Experiment), non conservation of Parity in  $\beta$ -decay (Wu's experiment).

Liquid drop model of Nucleus, Magic numbers, Evidences in support of Magic Numbers, Shell Model.

**Unit-III :** Neutron Physics, Properties of neutrons, classification of neutrons according to their energy, neutrons sources, neutrons detectors, slowing down of fast neutrons, absorption of neutrons. Reactor Physics : neutrons multiplication, types of reactors, General considerations for reactor design, four factor formula, moderators.

**Unit-IV :** Nuclear Detectors - Gas filled, solid state and high energy detectors. Wilson cloud chamber, Spark Counter. Particle Accelerators - Need for particle accelerators, classification, wave guide type linear accelerator, focusing in linear accelerators, Betatron, Synchrotron, Synchrotron as a radiation source.

**Unit-V :** Particle Physics : Classification of elementary particles, types of interactions between elementary particles, symmetry and conservation laws, Basic ideas of CP and CPT invariance, the quark model, Lie algebra, SU(2) and SU(3) multiplets (Meson and Baryon states), the General model.

## Reference Books :

- (1) Nuclear Physics, Second Edition - Irving Kaplan, Addison-Wesley Publishing - Massachusetts.
- (2) Concepts of Nuclear Physics - Bernard L. Cohen, Tata McGraw-Hill Publishing Co. - New Delhi.
- (3) Elements of Nuclear Physics - Pandya M.L.

- (4) Nuclear Physics : An Introduction - S.B. Patel, Wiley Eastern Limited- New Delhi.
- (5) Nuclear Physics : Theory and Experiment : R.R. Roy and B.P. Nigem, New Age International (P) Ltd.-New Delhi.
- (6) Nuclear Physics - D.C. Tayal, Himalaya Publishing House, Bombay.
- (7) Nuclear Physics - S.N. Ghoshal, S. Chand & Company, New Delhi.



- (8) Elementary - Particle Physics - Committee on Elementary Particle Physics Universities Press (India) Ltd., Hyderabad.
- (9) The Elements of Nuclear Reactor - Glasstone Samuel, D. Van Nostrand Company- New Jersey.

## 4PHY-2 : OPAMP THEORY AND ITS APPLICATIONS

- Unit-I** : Differential amplifier - circuit configurations, Four types, DC analysis- AC analysis – Detail study of dual input balanced output differential amplifier -, inverting and non-inverting inputs CMRR- constant current bias level translator.
- Unit-II** : Block diagram of a typical Op-Amp -Analysis Open loop configuration inverting and non-inverting amplifiers. Op- amp with negative feedback - voltage series feed back - effect of feed back on closed loop gain input persistence output resistance bandwidth and output offset voltage - voltage follower.
- Unit-III** : Practical op-amp Op-Amp parameter definition and illustration, input offset voltage - input bias current - input offset current offset voltage, CMRR, frequency response. DC and AC amplifier; summing, scaling and averaging amplifiers, instrumentation amplifier, integrator and differentiator
- Unit-IV** : Oscillators principles - Oscillator types - frequency stability  
 - response - The phase shift oscillator. Wein bridge oscillator, LC - tunable oscillators - Multivibrators - Monostable and Astable – comparators. PLL circuit and its applications. OPAMP as butter worth filter (low pass, high pass and band pass only).
- Unit-V** : Analogue computation, active filters, comparators, logarithmic and anti-logarithmic amplifiers, sample and hold amplifiers, waveform generators, Square and triangular wave generators, pulse generator. Applications of Linear ICs OPAMP as instrumentation amplifier, Digital to Analogue converter : ladder and weighted register type.

Analogue to Digital converter : Counter type and successive approximation type

### Reference Books :

1. OP Amps and Linear Integrated Circuits- Gaikwad R. A. : Prentice – Hall of India Pvt. Ltd.
2. Electronic Devices and Circuits , Vol. II – Godse A. P. and Bakshi U. A., Technical Publications, Pune .

## List of Experiments:

It is necessary to perform atleast seven experiments from the list given below.

The experiments based on theory course are desirable.

1. Application of OPAMP as inverting, non-inverting and summing amplifier.
2. Applications of OPAMP as differentiator and integrator.
3. OPAMP as square and triangular waveform generator.
4. OPAMP as instrumentation amplifier for measurement of temperature.
5. Study of ADC and DAC.
6. Study of PLL and its applications.
7. OPAMP as Butterworth filter low pass, high pass and band pass circuit.
8. ADC using ICs DAC using opamp and WRM, R-2-R Ladder
9. Design consideration of ADC/DAC Using Opamp and other ICs
10. Digital Clock using Counters, Frequency meters.

## 4PHY-3(i) : MICROPROCESSOR PROGRAMMING AND INTERFACING

**Unit-I :** 8085 Microprocessor: Basic 8085 microprocessor architecture and its functional blocks, 8085 microprocessor clock signals, address, data and control buses, instruction cycles, machine cycles, and timing states, Basic instruction set, instruction timing diagrams.

**Unit-II :** Programming of 8085 microprocessor: HLL, LLL and ALP Writing assembly language programs, looping, counting and indexing operations, stacks and subroutines, conditional call and return instructions, debugging programs.

**Unit-III :** 8085 Interfacing: Bus interfacing concepts, timing for the execution of input and output (I/O) instructions, I/O address decoding, memory and I/O interfacing memory mapped I/O interfacing of matrix input keyboard and output display, Serial I/O lines of 8085 and the implementation asynchronous serial data

communication using SOD and SID lines,

**Unit-IV :** Programmable Interface and peripheral devices: PPI IC 8255A programmable peripheral interface Block Diagram, Control words, Modes of Operations and applications, 8251 SIO, USART block diagram functions. 8279 programmable keyboard/display interface controller.

**Unit-V :** 8253/8254 programmable interval timer, Interrupt structure of 8085: RST(restart) instructions, vectored interrupt, interrupt process and timing diagram of interrupt instruction execution, 8259 Ainterrupt controller, principles block transfer(direct memory access) techniques 8257 direct memory access controller.

### Text Books:

1. Microprocessor, Architecture, Programming and Application with 8085-Gaonkar, John Wiley Eastern, Ltd, Publication
2. Microprocessors and interfacing-Douglas V Hall, Tata Mc-Graw Hill publication

### Reference Books:

1. Microcomputer Systems: The 8086/8088 family-Yu-Chen Lin, Glen A Gibson, Prentice Hall of India Publication
2. The 8086 Microprocessor : programming and interfacing the PC-Kenneth J Ayala, Penram publication
3. The 8086 family: John Uffenbeck, Prentice Hall of India publication.

**OR**

### 4PHY-3(ii): CONDENSED MATTER PHYSICS-II

**Unit-I :** Imperfections in Crystal: Mechanisms of plastic deformation in solid, Dislocations, stress & strain field of screw dislocation, elastic energy of dislocations, Slip, Cross slip, climb, Dislocation Multiplications, stress needed to operate Frank Read Source.

**Unit-II :** Dislocation reaction, Partial Dislocations and stacking faults in close packed structures, Thompson Tetrahedron.  
Experimental methods of observing dislocation and

stacking fault.

**Unit-III :** Interacting electron gas, Hartree & Hartree-Fock approximation, Correlation energy, Screening, dielectric function, Thomas-Fermi and Lindhard Theory, Frequency dependent Lindhard screening, Screening of Hartree-Fock approximation. Introduction of Fermi Liquid Theory.

**Unit-IV :** Point Defects: Types of point defects, concentration of point defects, description of point defect within the framework of band model, diffusion and ionic conduction, recombination process of imperfection, optical transitions at imperfections.

**Unit-V :** Lattice disorders: Types of lattice disorders, localized states, Anderson model, and density of states: Impurity band semiconductor, amorphous semiconductors, transport in disordered lattice, hopping probability, fixed and variable range hopping, conductivity in impurity bands and in amorphous semiconductors.

### References:

1. Introduction to Dislocations, Derek Hull and D J Bacon, Butterworth-Heinemann.
2. Introduction to Solid-State Theory, Otfried Madelung, Springer.
3. Solid State Physics, N W Ashcroft and N D Mermin (Cengage Learning India Pvt Ltd, 2009).
4. Introduction to Solid State Physics, C. Kittel (John-Wiley, 8<sup>th</sup> Ed. 2005).

**OR**

### 4PHY-3(iii): DIGITAL COMMUNICATION

**UNIT-I :** Digital Communications:

Pulse-Modulation Systems : Sampling theorem- Low-Pass and Band-pass signals, PAM, Channel BW for a PAM signal. Natural sampling. Flat-top sampling. Signal recovery through Holding, Quantization of signals, Differential PCM, Delta Modulation, Adaptive Delta modulation, CVSD,

**UNIT-II :** Digital Modulation Techniques : BPSK, DPSK, QPSK, FSK.

Introduction to PSK, QASK, BFSK, and MSK. Mathematical Representation of Noise : Sources of noise. Frequency domain representation of noise, Effect of filtering on the probability Density of Gaussian noise, spectral component of noise, Effect of a filter on the power spectral density of noise.

Superposition of noises. Mixing involving noise. Linear filtering, Noise Bandwidth, Quadrature Components of noise. Power spectral density of  $n_c(t)$ ,  $n_s(t)$  and their time derivatives.

**UNIT-III** : Data Transmission : Baseband signal receiver, probability of error. Optimum filter. White noise. Matched filter and probability of error. Coherent reception, Correlation, PSK, FSK, Non-coherent detection of FSK, Differential PSK, QPSK, Calculation of error probability for BPSK, BFSK, and QPSK.

**Unit-IV** : Noise in pulse-code and Delta-modulation systems : PCM transmission, Calculation of Quantization noise, output- signal power. Effect of thermal noise, output signal-to-noise ratio in PCM, DM, Quantization noise in DM, output signal power, DM output - signal - to quantization - noise ratio, Effect of thermal noise in Delta modulation, output signal-to-noise ratio in DM.

**UNIT-V** : Mobile Radio and Satellites : Time Division multiple Access (TDMA), Frequency Division Multiple Access (FDMA), ALOHA, Slotted ALOHA, Carrier Sense Multiple access (CSMA), Poisson distribution protocols.

### **TEXT AND REFERENCE BOOKS:**

1. Barry B. Brey, "The Intel microprocessors 8086/8088, 80186/80188, 80286, 80386, 80486, pentium and pentium pro-processor architecture, programming, and interfacing", 4th Edition, PHI, 1999.
2. Douglas V. Hall, "Microprocessors and interfacing, programming and Hardware", 2nd Edition, McGraw Hill, international edition, 1992.
3. Muhammad Ali Maxidi and Janice Gillispie Mazidi, "The 80x86 IBMPC and Compatible computers (Volume I & II), 2nd Edition, PrenticeHall international, 1998.
4. Taub and Schilling, principles of communication system, 2nd edition, TMH, 1994, Simon Hykin communication system, Third Edition, John Wiley and Sons, INC, 1994.

### **4PHY-4(i):ADVANCED**

#### **MICROPROCESSOR**

#### **AND**

#### **MICROCONTROLLER**

**Unit-I** : 8086 Microprocessors: Architecture and organization of 8086 microprocessors family, bus interface unit, 8086 hardware pin signals, timing diagram of 8086 family microprocessors, simplified read/ write bus cycles, 8086 minimum and maximum modes of operation, 8086 memory addressing, address decoding, memory system design of 8086 family, timing considerations for memory interfacing, input/output port addressing and decoding, introduction to 8087 floating point coprocessor and its connection to host 8086.

**Unit-II :** 8086 assemble language programming:Addressing modes, 8086 instruction formats and instruction set, data transfer, arithmetic, bit manipulation, string, program execution transfer and program control instructions, machine codes of 8086 instructions, assemble language syntax, assembler

directives, initialization instructions, simple sequential and looping programs in assemble language, debugging assembly language programs.

**Unit-III:** The 8051 Architecture : 8051 microcontroller, Hardware –oscillator, clock, program counter, data pointer, A and B CPU registers, Flags and the program status word (PSW)  
, Internal memory, Internal RAM , the stack and stack pointer, special function register (SFR), internal ROM. I/O pins, ports and circuits External memory, counters and Timers serial data input/output, Interrupts.

**Unit-IV :** 8051 Assembly Language Programming Introduction , structure of assembly language, assembling and running on 8051 program, Data transfer types , addressing modes, PUSH and POP operations, Arithmetic, Logic , JUMP, LOOP, CALL instructions, time delay, I/O programming, serial port programming.

**Unit-V :** Applications : Interfacing of LCD, Keyboard, ADC, DAC and Sensor interfacing. Microcontroller Application Development Tools : Use of Keil software 8051 development tool.

## Reference Books :

1. The 8051 Microcontroller and embedded system using assembly and C - Mazidi, Mazidi McKinlay
2. The 8051 Microcontroller – Ayala - third edition.
3. Microcontroller – Architecture, Programming, Interfacing and system design – Rajkamal 4 8051 Microcontroller – McKenzie.
4. Microprocessors & Interfacing – Programming & hardware By D. V. Hall (TMH)
5. The 8088 AND 8086 microprocessors By Walter A. Trebel & Avtar Singh (PHI)

6. 8086 Microprocessor By Uffenbeck (PHI)
7. The Intel Microprocessors 8086/8088, 80186/80188, 80286, 80386, 80486, Pentium and Pentium Pro Processor Architecture, programming and interfacing. By Barry B. Brey (PHI)

8. The 8051 Microcontroller: Architecture, programming and applications By Kenneth J. Ayala (Penram International)
9. The 8051 Microcontroller and Embedded Systems By Mazidi & Mazidi(PHI)

## 4PHY-4(ii) NANO SCIENCE AND NANOTECHNOLOGY

- Unit-I** : Free electron theory and its features, Idea of bandstructures, Insulators, semiconductors and conductors, Reciprocal space, Energy bands and gaps of semiconductors, Effective masses, Fermi surfaces, Localized particles, The Bloch theorem, band structure in three dimensions. Electron transport in semiconductors in 3D (bulk), 2D (thin film) and low dimensional systems.
- Unit-II** : Different methods for preparation of Nanostructured materials, Bottom up and top down process, sol-gel, electrodeposition, chemical bath deposition, thermal evaporation methods, ball milling, pulsed laser deposition, chill block melting and gas quantization method.
- Unit-III** : Different methods for measuring the properties of Nano-materials, Structure determination: Atomic structures, crystallography and powder diffraction method, determination of particle size from XRD peaks. Microscopy: Transmission electron microscopy, Field ion microscopy, scanning microscopy.
- Unit-IV** : Size dependent properties, quantum size effect, quantum dot, quantum wire and quantum well. Mechanical and electrical properties of nano-structured materials, single electron tunneling, infrared detectors, quantum dot lasers. Super Conductivity at Nano Scale.  
Hopping conduction, Polaron conduction.
- Unit-V** : Carbon nanostructures, nature of carbon bond, carbon clusters:  $C_{60}$ , Structure of  $C_{60}$  carbon anotubes, Applications of carbon nanotubes: computers,

fuel cells, chemical sensors, catalysis, Single electron transistor (no derivation), Molecular machine, applications of nanomaterials in energy, medicine and environment.

### Reference Books:

1. Introduction to Nanotechnology – C. P. Poole, John Wiley and Sons
2. Nanotechnology Appin. Lab BPB publication New Delhi
3. Nanomaterials – A. K. Bandyopodhyay, New Age Publication

4. Physics of semiconductor nanostructures K. P. Jain Narosa Publication
5. Nanotechnology, Rakesh Rathi, S Chand & Company, New Delhi
6. Introduction to Nanoscience & Nanotechnology by K. K. Chattopadhyay and A. N. Banerjee, Publisher: PHI Learning and Private Limited.

## 4PHY-4 (iv) Photonics-2: Optical fibre and applications

**Unit-I** : Optical fibers: Classification, total internal reflections, Goos Hanchen shifts, Analysis of optical wave guides- ray and wave optics, characteristic equation of step index fiber, modes and their cut-off frequencies, single and multimode fibers, linearly polarized modes, power distribution

**Unit-II** : Graded index fiber, propagation constant, leaky modes, power profiles, dispersions, impulse response, types of couplings, Birefringent effects, polarization maintaining fibers, Fabrication techniques, Photonic crystal fiber.

**Unit-III** : Optical Communications: Optical transmitters, Optical receivers, system design and performance, coherent and multi channel light wave systems, optical amplifiers, dispersion compensation, Optical signal processing.

**Unit-IV** : Optical devices: Optical modulators, Optical Transducers, Optical switches, All optical logic gates, Photonic circuits, Optically integrated devices, Optical sensors.

**Unit-V** : Optoelectronic devices: Wide bandgap semiconductors, light emitting diodes (LED's), Diode lasers, fiber lasers, Wave division multiplexing network optical devices, Advances in waveguides and waveguide devices, Plasmonic waveguides.

### Reference:

- 1) Ajoy Ghatak and K Thyagarajan, "Introduction to fiber optics," Cambridge University Press (1999).
- 2) G P Agarwal, "Fiber-Optic Communication systems (second edition),"

- 3) Pallab Bhattacharya, "Semiconductor Optoelectronic devices," Prentice Hall (1996).
- 4) Shun Lien Chuang, "Physics of Optoelectronic Devices," Wiley Series in Pure and Applied Optics, John Wiley & Sons Ltd. (1995).
- 5) S. O Kasap, "Optoelectronics and Photonics: Principles and Practices," Pearson Education (2001).



- 6) Various Research Journal Papers on Optical and optoelectronic devices.

## 4PHY-5:

### (A) Compulsary lab

#### experiments: OPAMP-List

#### of Experiments:

11. Application of OPAMP as inverting, non-inverting and summing amplifier.
12. Applications of OPAMP as differentiator and integrator.
13. OPAMP as square and triangular waveform generator.
14. OPAMP as instrumentation amplifier for measurement of temperature.
15. Study of ADC and DAC.
16. Study of PLL and its applications.
17. OPAMP as Butterworth filter low pass, high pass and bandpass circuit.
18. ADC using ICs DAC using opamp and WRM, R-2-R Ladder
19. Design consideration of ADC/DAC Using Opamp and other ICs
20. Digital Clock using Counters, Frequency meters.

### Respective laboratory specialization:

#### (B) Microprocessors Lab

#### List of Experiments : (Any Five )

##### Experiment : Problem 1

- (A) 4 single byte numbers are stored at consecutive memory location starting at "X" write and implement a program which will transfer first two numbers in BC pair and the other two in DE pair respectively.
- ”[a] Using LDA instruction.” [b] Using LHLD instruction.
- ”[c] Using register-indirect instruction.
- ”[d] Compare these programs in the context of memory requirements.
- (B) 4 single byte numbers are stored in registers B,C,D & E respectively. Write and implement the programme which

will transfer the contents of the registers B,C,D,E to the memory block starts at X successively, respectively.

”[a] Using STA instruction.

- ”[b] Using SHLD instruction.
- ”[c] Using register indirect instruction.
- ”[d] Compare these programs in the context of memory requirements.
- (C) Two double byte nos. are stored at two memory location starts at X & Y resply. Write and implement the program which exchanges the information between X & Y resp.[i.e. X—Y & X+1—Y+1]
- ”[a] Using direct instructions {LDA}
- ”[b] Using register indirect instruction.”[c] Using LHLD & XCHG instruction.
- ”[d] Compare these programs in the context of memory requirements.
- (D) 4 single byte nos. are stored consecutively in memory starting at “X”. Write and implement a program
- ”[a] Using register indirect instruction, without loop.
- ”[b] Using forming loop i.e. branch control group instruction.”[c] Compare the program in the context of memory requirements

## Experiment Problem 2:

- ”(A) The 4 numbers are N1=F7, N2=6A, N3=32, N4=1C. Write a programme which will perform following arithmetic. store the result in some memory location [N1-N2]+[N3-N4].
- ”[a] Using immediate instruction.
- ”[b] Using register indirect instruction [assume in this case nos. are stored consecutively in memory starting at “X”]
- ”[c] Optimise the programme.”
- (B) Two 5-byte nos. are stored at “X” & “Y” memory blocks. Write a programme to subtract the lower number from the higher number and stores a result in memory block starts at “Z”

- ”[a] Using register indirect instruction without loop.
- ”[b] Using loop [i.e. branch control group instruction]
- ”[c] Optimise the programme.

- (C) Two double byte decimal nos. are stored at memory locations X & Y resp. Write a programme which will obtain product of these two nos. in decimal equivalent and stores a result at Z.

### Experiment Problem 3

- (A) Write a programme which will display "HELP" in freely running fashion.
- (B) Write a programme for Hexadecimal counter which will count the nos. from 00 to 40 and stops after. Implement a delay of 1 sec. and display the counts in data field.
- (C) Write a programme which will produce blinking display alternately of following words.  
"Hallow" & "Welcome"

### Experiment Problem-4

- (A) Write programme for Hexadecimal counter which will count nos. from 0 to 21 and stops after. Implement a delay of 1.5 sec. and display the counts in data field of display.
- (B) Write a programme which will display your name, father's name & surname. "Come in Lab." alternatly. Implement a delay of 2sec.

### Experiment Problem-5

- (A) Write a programme which will add 3 double-byte numbers and stores the result in HL pair (the possible final carry).
- (1) Using ADC instructions.
  - (2) Using DAD instructions.
  - (3) Compare the programmes in the context memory requirements.
- (B) Write a programme to count number of logical '1' in following hexa decimal numbers. And to count the numbers which involve less than 5 logical 1's  
C7, B8, A3, 74, 32, 17, D2, E8, 7E, 29, 3C.
- (C) Two double byte decimal nos. are stored consecutively in memory which starts at "X". Write a programme to add these nos. and stores the result in decimal form at the next memory locations.
- """ [1] Using register indirect without loop.
- """ [2] Using loop i.e. branch control group instruction. """ [3] Optimise the programme.

### Experiment Problem-6

- (A) Write a programme for the following type of display. WORD :- ANURADHA  
" [1] Character will come from one side slowly in the display field." " [2] Stay for longer time and  
"" [3] Go away from other side slowly,
- (B) Five single byte nos. are stored at memory starts at X. Write programme
- (i) which will find the largest of these nos. & store it at (X+5) location
  - (ii) Which will find the smallest of these nos. & stores it at (X+6) location.

### Experiment Problem-7

- (A) 4 single byte numbers are stored at "X" consecutively & 4 other single byte numbers are stored at Y. Write a program to exchange these information between memory blocks X & Y.
- [1] Using register indirect instruction.
  - [2] Using LHLD, SHLD & XTHL instruction.
  - [3] Compare the programs in the context of memory
- (B) Two single byte nos. 0A & 25 are stored at memory location X and X+1. Write a programme which will obtain the product of these nos. Find total time required for the execution of this program.
- (C) Write a programme which will arrange the following numbers in (i) ascending order (ii) descending order. A3, B6, F9 (The numbers are stored at memory starting at 'X'). Finally the arranged numbers must occupy the same memory locations.

### Experiment Problem-8 Application of 8085 microprocessor.

- (A) Study of DAC Card. Generation of waveforms of definite frequency.
- (1) Generate the square wave
  - (2) Generate the triangular wave
  - (3) Generate the ramp wave
  - (4) Measure the freq. of each wave by using CRO
- (B) Study of 8255 in mode 0 operation.
- (1) Construct the display panel for three characters.
  - (2) Write and execute the programme for three digit decimal counter.
- (C) Study of 8255 in mode 0 operation
- (1) Construct the display panel for 3 characters.
  - (2) Write and execute the programme for free running display of your name.

### Experiment Problem-9: Application of 8085 microprocessor.

- (A) Study of 8253 timer at mode 0, mode 1 & mode 2 operation.
- (B) STUDY of 8253 timer at mode 3, mode 4 & mode 5 operation.
- (C) 8085 microprocessor based on experiments viz. ADDITION, SUBTRACTION,

**(B) CONDENSED MATTER PHYSICS-II****Laboratory Experiments:**

It is necessary to perform at least seven experiments from the list given below.

**The experiments based on theory course are desirable.**

1. Determination of Lattice parameters using powder photograph /graph.
2. To study lattice dynamics of monoatomic and diatomic molecules.
3. Measurement of Hall coefficient of given semiconductor.
4. Study of Crystal structure by Laue's Pattern.
5. To study variation of ionic conductivity of a given sample with temperature.
6. Determination of Electrical Conductivity of a given material by Four Probe Method.
7. Measurement of photoconductivity of a sample.
8. Study of dislocation motion.
9. Measurement of dislocation density by etch-pit method.
10. Deposition of nanometer size thin films and determination of its thickness.
11. Determination of Poisson's ratio of glass by Cornu's method.

**(B) Digital Communication**

Laboratory Course:

The experiments from serial no. 1 to 5 are compulsory & perform many two experiments from others. It is expected that the teacher may perform open ended experiments.

1. Pulse Amplitude Modulation / Demodulation
2. Pulse position / Pulse width Modulation / Demodulation.
3. FSK Modulation Demodulation using Timer / PLL
4. Microwave characterization and Measurement
5. PLL circuits and applications.
6. Fibre Optics communication.
7. Study of Transmission line.
8. Characteristics of Yagi Antenna
9. Design of digital filters using MATLAB.

Setting up of new experiments on the following :

10. Mobile communication via satellites.
11. Cellular communications
12. Bandwidth consideration in INTERNET.
13. ISDN
14. Wide Area Network

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- 1) To set up fiber optic voice communication system.
- 2) To determine numerical aperture of given optical fiber.
- 3) Determination of bending loss in multi mode fibers.

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- 6) To study Pockel's effect.
- 7) To study Sculpting of plastic optical fiber tip.
- 8) To fabricate all optical fiber beam splitter.
- 9) Study of Second Harmonic Generation in crystals.
- 10) Pulsed laser deposition of thin films. (Demo)
- 11) Microlithography using High power Nd:YAG laser. (Demo)**

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**Unit-I : Genetic Engineering****a) Enzymes used in recombinant DNA technology:**

Endonucleases, ligases, Enzymes to modify DNA molecules.

- b) **Vectors:** Plasmids, plant vector, bacteriophages, cosmids, phagmides, animal viruses, plants viruses, special vectors.

**UNIT II : Genes cloning in prokaryotes & Eukaryotes:** Isolation of gene, Methods of gene transfer, Selection and screening of recombinant DNA, nucleic acid hybridization and dot curves, southern, northern and western blotting techniques, dot and slot blots, colony hybridization.

**UNI III : Cloning strategies:**

- a) Cloning from m-RNA and genomic DNA, synthesis of gene, gene probes, gene banks, gene libraries, mapping of gene, DNA sequencing, RFLP, DNA finger printing, site direct
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mutagenesis.

- b) Polymerase chain reaction & gene amplification.

**Unit-IV : Plant Biotechnology:**

- a) Culture media and plant cell culture  
 b) Tissue culture, micropropagation and somaclonal variation  
 c) Production and use of haploid cell culture  
 d) Protoplast culture, regeneration and somatic hybridization  
 e) Gene transfer method in plants, transgenic plants and animals.

**Unit-V : Application of Biotechnology:**

- a) Application in agriculture, plants and animal improvement.  
 b) Enzyme biotechnology  
 c) Protein engineering, immunotoxins and drug designing  
 d) Metabolic engineering for over production of metabolites.  
 e) Use of microbes in industry and agriculture  
 f) Application to medical sciences, gene therapy, genetic counseling, diagnosis of diseases and phenomenon of ageing.  
 g) Control of environmental pollution, recovery of minerals and restoration of degraded lands

## PAPER-XIV CLINICALVIROLOGY

**Unit-I : Plant Viruses:** Classification, life cycle and replication of tobacco mosaic virus (TMV), PVX, PVY, CMV, TSWV, CaMV, Cynophages, Mycoviruses

**Unit-II : Bacterial Viruses:** Life cycle, Structure and replication of following RNA and DNA phages: Ox 174 phage, T4 phage; Lambda phage. (Lyric and glycogenic Cycle); Ft phage; MS2, f2, QB phages and Mud phage and O6 phage.

**Unit- III : a) Oncogenic Viruses (Tumor Viruses) :** Classification of viruses characteristics of virus transformed cell or tumor cell.

- i) DNA - Containing Tumor Viruses :
- ii) RNA - Containing Tumor Viruses : Retroviruses (oncornaviruses) .

**Unit- IV : a) AIDS viruses: Retro viruses, HIV Unit- V : Viroids and Prions.**

## PAPER-XV MICROBIALTECHNOLOGY

**Unit - I :** Isolation and screening of microorganisms, maintains of isolates/ strains, Inoculum developments, sterilization, strain improvement, process development, Downstream processing, In situ recovery of products. General scale up procedure Solid-state fermentations Manufacturing cost estimation Principal and general consideration in downstream processing.

**Unit-II: a) Fermentation of acids:** Aspartic acid, L glutamic acid and Gluconic acid.

- b) Modern trends in Microbial Productions:** Bioplastic (PHB, PHA) Biopolymer (Dextran, alginates, xanthan, Pullulan)

**Unit- II Fermentation Of enzymes and Amino acids:** Amylase, Protease. Riboflavin, cyanocobalamine,

**Unit- III : Enzyme biotechnology:** Immobilization of enzymes -

(glucose -isomerase) Methods, bioreactors and application in industry. Enzyme electro catalysis. Biosensors- Bioelectodes, Optrons, Immunological biosensors.

**Unit-IV : Fuel Biotechnology:** Biofuels, Energy crops, Biogas, Bioethanol, Biobutanol, Biodiesel, Biohydrogen.

## Unit- V : Biofertilizers and Biopesticides.

- Basic concept: PSM, N<sub>2</sub> Fixer, S-solubilizers etc, K-solubilizers
- Biomass production
- Formulation (Carrier based, dried, liquid, and mixed inoculum)
- Application methods
- Inoculation quantity concept.
- Biopesticides: Bacterial, fungal, viral etc.
- Biocontrol mechanism,
- Preparation and application of Biopesticides

## PAPER-XVI

### MEDICAL MICROBIOLOGY

#### Unit-I : Pathogenic bacteria and laboratory diagnosis:

*Staphylococci, Streptococci including pneumococci, Mycobacterium tuberculosis and M. leprea*

#### Unit-II Pathogenic bacteria and laboratory diagnosis:

*Escherichia, Klebsiella, Proteus, Salmonella, Shigella, Pseudomonas, Bordetella, Haemophilus, Vibrio, Campylobacter, Treponema, Borrelia, Leptospira, Corynebacteria, Mycoplasma and Rickettsia.*

#### Unit-III Pathogenic fungi and their laboratory diagnosis:

*Microsporium, Trichophyton, Epidermophyton, Candida albican, Cryptococcus neoformans, Blastomyces dermatitidis and Histoplasma capsulatum.*

#### Unit- IV Parasites and their laboratory diagnosis:

*Entamoeba histolytica, Leishmania donovani, Trypanosoma spp., Plasmodia species, Taenia saginata, Taenia solium Echinococcus granulosus, Hymenolepis nana, Ascaris lumbricoides, Enterobius vermicular and Wuchereria bancrofti.*

#### Unit V : Clinical Microbiology: Normal microbial flora of human body, sore throat and pneumonia, UTI, Diarrhaial diseases, Meningitis, Bacterimia, septicimia, Infective Endocarditis, PUO, STD,

Hospital acquired infections, Prophalactic imuunization, antimicrobial therapy, Antimicrobial sensitivity testung, Hospital waste management, Vechicals and vectors.

**PRACTICAL-VII****APPLIED MICROBIOLOGY AND BIOTECHNOLOGY  
RECOMBINANT DNA TECHNOLOGY**

- 1) Agarose gel Electrophoresis
- 2) Restriction Digestion of DNA
- 3) DNA Ligation
- 4) DNA Molecular size Determination
- 5) DNA Fingerprinting
- 6) Southern hybridization
- 7) Restriction Mapping
- 8) In vitro Transcription
- 9) Southern Blotting
- 10) Northern Blotting
- 11) Plasmid preparation
- 12) Genomic DNA isolation.
- 13) Gene Cloning
- 14) Bacterial Gene expression.
- 15) Bacterial Transformation
- 16) Bacterial Conjugation
- 17) Bacterial Transduction
- 18) Whole Blood DNA extraction.
- 19) Educational tour and submission of report.

**Project work (Marks****50) Distribution of marks in****University Practical Examination:**

- |                                    |   |           |
|------------------------------------|---|-----------|
| 1. Long Experiments (At least two) | - | 15 marks. |
| 2. Short Experiments               | - | 10 marks. |
| 3. Viva-voce examination           | - | 05 marks  |
| 4. Spotting                        | - | 05 marks  |
| 5. Practical record book           | - | 05 marks  |
| 6. Internal Assessment             | - | 10 marks  |

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<b>Total</b>	<b>-</b>	<b>50 marks</b>
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**Distribution of marks in Project work Examination:**

- |                        |   |          |
|------------------------|---|----------|
| 1. Valuation project   | - | 40 marks |
| 1. Internal Assessment | - | 10 marks |
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**Total****- 50 marks**

## Project Work -

### Examination of Project Work :

1. The examination should be held at the centres of practical examination.
2. There shall be panel of examiners including Head of the department and the Supervisor of the Student.
3. There should be at least 2 to 3 external examiners for a batch of up to 10 Students or 3 to 5 external examiners for a batch of more than 10 Students.
4. The Students should submit the project reporty within 20 days after the last/final theory paper in University examination.
5. The date of Viva-voce examination on project work should be within the 30 days after the completion of theory examination

### Distribution of marks in Project work examination:

- |  |                |
|--|----------------|
| 1. Evaluation of Project   | 20 marks       |
| 2. Viva--voce (Jointely by internal and<br>marktsexternal examiners) | 20             |
| 3. Internal Assessment   | 10 marks       |
|  | Total 50 marks |

### Books recommended for M.Sc. Part-I & Part-II (Microbiology)

1. Biophysical Chemistry - Upadhyay & Nath (Himalaya Pub.)
2. Practical Biochemistry - Plummer (TMH Pub.)
3. Principal of Biochemistry - Lehninger (CBS Pub.)
4. Practical Biochemistry - Jayraman (Wiley Estern Pub.)
5. Physical Biochemistry - Morrison (Oxford)
6. Enzyme - Dixon &. Webb
7. Fundamentals of Enzymology - Lewis (Oxford)
8. Bacterial metabolism - A.H. Rose
9. Biochemistry - West & Toad
10. Out line of Biochemistry - Corn & Stump. (Wiley Eastern Pub.)
11. Soil Microbiology - Alexander (Wiley Eastern Pub.)
12. Genes VIII - Lewin (Oxford)

13. Element of Biotechnology - P.K. Gupta. (Rastogi Pub.)
  14. Fundamentals of Biotechnology - Purohit & Mathur (Agro Bot. Pub.)
  15. Essentials of molecular biology - Freifelder D. (Narosa Pub.)
  16. A textbook of biotechnology - Duby (S. Chand Pub.)
  17. Molecular Biology - Freifelder D. (Narosa Pub.)
  18. Microbial Genetics - Freifelder D. (Narosa Pub.)
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19. Text Book of Molecular Biology - Shastry & Other (Macmillan)
20. Hand Book of Tissue Culture (ICAR Pub.)
21. A textbook of Biotechnology - H.D. Kumar (E.W. pub.)
22. Basic Biotechnology Rev. Iganacimuthu (TMH Pub.)
23. Plant viruses - Mandahar (S. Chand & Co.)
24. Microbiology Lewis. (Harper)
25. Microbiology - Fundamentals & Application - Purohit. (Agro Botanical Pub.)
26. Industrial Microbiology - Casida (Wiley Eastern pub.)
27. Press Scott and Dunn's Industrial Microbiology.
28. Microbiology - Anantnarayan & Panikar (Orient Longman)
29. A text book of Microbiology, — P. Chakraborty (Central Pub.)
30. Medical Microbiology - Ichhapunani & Bhatia (J.P. Brothers)
31. Essential of Medical Mycology - Evans & Genitals (Churchill and Livingston)
32. Genetics by Strickbeger (Prentice Hall)
33. A short textbook of recombinant DNA technology Watson. (Black Well)
34. Molecular Biotechnology - Prime Rose - (Black Well.)
35. Immunology by Shetty - (Wiley Eastern Pub.)
36. Molecular biology of genes. Watson - (Begamin Cumming)
37. Recombinant DNA technology - Rodriguez (Begamin Cumming)
38. Advances in molecular genetics. Puhlar. (Begamin Cumming)
39. Molecular cloning - A lab manual. (Cold spring harbor lab pub.)
40. Concept of molecular biology - Rastogi (Wiley Eastern Pub.)
41. Genetic Engineering - Sandhy Mitra (Macmillan)
42. Elementary Microbiology Vol. I Vol. II (Fundamental of microbiology and microbial world) Ed. by. H.A. Modi. (Akta Prakashan)
43. Applied microbiology. Ed. by H.A. Modi. (Akta Prakashan)
44. Environmental Microbiology. Ed. by H.A. Modi (Akta Prakashan)
45. Fundamentals of Dairy Microbiology by J.B. Prajapati (Akta Prakashan)
46. Bio-Fertilizer. By Vyas & Modi (Akta Prakashan)
47. Biochemistry. By D. Das (Academic Pub.)
48. Biophysics & Biophysical Chemistry. By D. Das. (Academic Pub.)
49. Modern Immunology. By A. Das Gupta (Jaypee Pub.)
50. A textbook of microbiology by P. Chakraborty (New Central Book Agency)
51. Principal of gene manipulation by Old & Prim Rose (black well pub.)
52. Agricultural microbiology by Rangaswami & Bagyaraj (PHI)

53. An introduction to recombinant DNA by A.E.H. Emery (ELBS)
54. Concepts in Biotechnology by D. Bakasubramuniam and other (University Press.)
55. Introduction to genetics Engineering by D.S.T Nicholl (Cambridge)
56. Genetics by P.K. Gupta (Rastogi Pub.)
57. Genetics by Sandhya Mitra (TMH)
58. Applied plant biotechnology by Iganacimuthu (TMH)
59. Immunodiagonostics S.C. Rastogi (Wiley Eastern Pub.)
60. Immunology by Roitt. (Black well)
61. A textbook of Microbiology. R.C.Dubey and D.K.Maheshewari. (S.Chand & Company)
62. Genetics - A.V.S.S. Sambamurty (Narosa Pub.)
63. Concept of Molecular Biology. P.S.Varma & V.K. Agrawal. (S.Chand & Company)
64. General Microbiology S.B. Sullia and S. Shantharam. (Oxford & IBH)
65. Modern Concept of Biotechnology. H.D.Kumar (Vikas Pub.)
66. Fundamentals of Enzymology - Price and Steven (Oxford Sci.Pub.)
67. Gene VII - Lewis (Oxford Science Publication)
68. Molecular Cell Biology, Berk, Lipursky, Baltimore, Darnell and Matsudaira (W.H. Freeman and Company)
69. Biotechnology - Rhem and Reead
70. Standard methods of Biochemical analysis - S.R. Thimmaiah (Kalyani Publisher).
71. Laboratory Manual of Bacterial Genetics - Institute of Microbial Technology - Chandigarh.
72. A textbook of Industrial Microbiology - Wulf Crueger and Annekiese Cruger (Panima Publishing Corporation)
73. An Introduction to electrophoresis - K. Anbalgan (The Electrophoresis Institute, Salem Dist.S. India.)
74. Waste water microbiology - Gabrian Bitton (John Wiley & Sons)
75. Environmental Microbiology- Ralph Mitchell (John Wiley and Sons).
76. Microbial Biotechnology - Fundamentals of applied Microbiology - Alexander N. Glazer, and Hiroshi Nikoidu (W.H. Freeman and Company)
77. Gene structure and expression - John D. Hawkins (Cambridge University Press)
78. Biotechnology - John G. Smith, (Cambridge University Press)
79. Plant Biotechnology - S. Ignacimuthu S.J. (Oxford and IBH, New Delhi)
80. Advanced molecular biology - R.M.Twyman (Viva book Pvt.Ltd.)

**Criterion – I- Curricular Aspects [QIM – 1.3.2]**

81. Introductory Microbiology - J.Heritage, E.G.V. Evans and R.A.Killington (Cambridge University Press)
82. General Microbiology - Schiegel (Cambridge University Press)
83. Gene Structure - Hawkins (Cambridge University Press)
84. Modern Concepts of Biotechnology - H.D.Kumar, (Vikas Publishing Pvt.Ltd.)
85. A textbook of Microbiology - R.C.Dubey and D.K.Maheshwari (S.Chand & Company)
86. Biotechnology - Applications and Research - Edited by Paul Cheremisinoff and Robert Ouellete (Technomic Pub.Co.Inc.)
87. Basic and Clinical Immunology - Daniel Stites, Abba Terr & Tristram Parslow (Prentice Hall International INC)
88. A Text Book of Biochemistry with Clinical correlation - Edited by Thomas Devlin (John Wiley and Sons, INC).
89. Microbiology Laboratory - Fundamentals and Application, George Wistreich (Prentice Hall)
90. Microbiology - A Laboratory Manual - James Cappucino and Natalie Sherman (The Benjamin / Cummings Pub.Co.Inc.)
91. Foundations in Microbiology - Kathleen Talaro & Arthur Talaro (Wm.C. Brown Publishers)
92. Principles of Microbiology - Ronald Atlas Mosby.
93. Fundamentals of Microbiology - Alcamo (Benjamin / Cummings Pub.Co.Inc.)
94. Sale and Molecular Biology - Concepts and experiments - Gerald Karp (John Wiley and Sons, INC).
95. Cellular and Molecular Immunology - Abul Abbas, Andrew Lichman & Jordan Pober (W.B.Saunders Co.)
96. Biochemistry-Zubay (Wm C.Brown Publishers)
97. Life-An Introduction to Biology - Beck, Liem & Simpson (HarperCollins Publishers)
98. Genetics - A.V.S.S. Sambamurthy (Narosa Publication)
99. Water Pollution - V.P.Kudesia, (Pragati Prakashan Meerut)
100. Physicochemical Examination of Water, Sewage and Industrial waste  
- N. Maniwasakam (Pragati Prakashan, Meerut)
101. Textbook of Biochemistry - O.P.Agrawal, G.R.Agrawal (Goel Publishing House, Meerut)
102. Textbook of Medical Mycology- Jagdish Chander (Interprint, New Delhi)
103. An introduction to Plant tissue and Cell culture - N.C.Kumar (Emkay Publication Delhi)
104. Short Protocols in Molecular Biology - Edited by Ausubel, Brent, Kingston, Moore, Seidman, Smith and Struhl (John Wiley and Sons)



**Criterion – I- Curricular Aspects [QIM – 1.3.2]**

105. Molecular Cell Biology - Darnell, Lodish and Baltimore, (Scientific American Books)
106. Technological Applications of Biocatalysts - Published on behalf of Open University and University of Greenwich (Butterworth-Heinemann).
107. Microbiology-Principle and Explorations - J.G.Black (John Wiley and Sons)
108. Techniques for engineering Genes - Published on behalf of Open University and University of Greenwich (Butterworth-Heinemann).
109. Biotechnological Innovations in Energy and Environmental management - Published on behalf of Open University and University of Greenwich (Butterworth-Heinemann).
110. Medical Microbiology- Mims, Playfair, Roitt, Wakelin and Williams (Mosby)
111. Principles of Enzymology for the Food Sciences (John Whitaker, Marcel Dekker, Inc.)
112. Biostatistics - A Foundation for analysis in Health Sciences - W.D. Daniels, John Wiley and Sons.
113. Basic Statistics - C, Dunn
114. How Computers Works - Ron White, Techmedia.
115. How the Internet works - Preston Gralla, Techmedia.
116. Bioinformatics - 1998 - Baxevanis
117. Bioinformatics - 2000 - Haggins & Taylor OUP.
118. Fundamentals Biostatistics- Sadguru Prakash, Emkay Publication, New Delhi.
119. Bioinformatics for Beginners - Dr.K.Mani & N.Vijayaraj (Kalai Kathir Achchagani Pub. Coimbatore)
120. Instant Notes - Bioinformatics - West head, Parish and Twyman (Viva Publication) New Delhi.
121. Schaum's Outlines - Biochemistry, Kuchel & Ralston (TMH Edition)
122. Schaum's outlines - Microbiology (TMH Edition)
123. Schaum's outlines - Molecular and cell Biology (TMH Edition)
124. Principles of Genetics - R.H.Tamarin (TMH Edition)
125. Biotechnology DNA - Protein A Laboratory project in molecular Biology. Thiel, Bissen & Lyons (TMH Edition)
126. General Enzymology, Kulkarni and Deshpande, Himalaya Publishing House.
127. Modern Approaches to Soil and Agriculture and Environmental Microbiology, Shiva Aithal and Nikhilesh Kulkarni, Himalaya Publishing House.

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