SAMBALPUR UNIVERSITY

COURSES OF STUDIES
FOR THE
THREE YEAR DEGREE
SCIENCE

(PASS & HONOURS)
(UNDER 10+2+3 PATTERN)
(For the session start from 2014-15)

FIRST	UNIVERSITY EXAMINATION,	2015
SECOND	UNIVERSITY EXAMINATION,	2016
FINAL	UNIVERSITY EXAMINATION,	2017

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(ORISSA)

[Note: Users are advised to use 'Akruti' for Odia and Hindi]

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xi. Polymer Science
xii. Remote Science
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COURSES OF STUDIES FOR THREE YEAR DEGREE COURSE IN SCIENCE

A: General Instructions

A Candidate for Three Year Bachelor's Degree in Science shall be required to pass the following examinations.

i. First University Examination
ii. Second University Examination
iii. Final University Examination.

The entire course of Three Year Degree Science Pass contains a total of 1400 Marks. Which include compulsory course of 300 Marks, elective course of 300 Marks and Pass course of 800 Marks. Similarly, the Honours course contains a total of 1800 Marks, which include compulsory course of 300 Marks, elective course of 300 marks, Pass course of 400 Marks and Honours course of 800 Marks.

The following are the subjects:

Compulsory Courses:

1.	English	50 Marks
2.	M.I.L. (Any of the languages from Oriya Hindi, Bengali, Telugu, Santali, Urdu and Alternative English	50 Marks
3.	Information Technology or Indian Society and Culture	100 Marks
4.	Environmental Studies	100 Marks

Optional Pass Courses:

A candidate in B.Sc. (Pass) shall choose Two pass subjects each carrying 400 marks from the following subjects:-

1. Botany, 2. Chemistry, 3. Computer Science & Data Processing, 4. Electronics, 5. Environmental Science, 6. Geology, 7. Mathematics, 8.Physics, 9. Statistics, 10. Textile Science and 11. Zoology.

He may chose one out of two of his Optional Pass Course from the following vocational subjects.

1. Computer Applications, 2. Food Science and Quality Control, 3. Industrial Chemistry, 4. Industrial Fish and Fisheries, 5. Sericulture & 6. Information Technology (400 +400 =800).

Provided that (i) No. of student shall be allowed to take Mathematics and /or Statistics with Botany and/or Zoology as pass subject; and (ii) No. student shall be allowed to take Mathematics and/or Statistics with Botany and/or Zoology as subject combination or honours and pass in Pass subjects. (iii) No Student shall be allowed to take Physics or Chemistry Pass/Honours without Mathematics as a Pass/Major elective. Simultaneously, No student shall be allowed to take Botany/Zoology as Pass/Honours without Chemistry as a Pass/Major elective.

Further Provided that:

i. A candidate shall not be allowed to take Mathematics as a subject in which there is practical examination, id he did not pass in that subject in the intermediate/Higher Secondary Examination (+2 Examination) or any other equivalent Examination. A candidate may however, take

Anthropology. Computer Sc./Computer Application. Environmental Science, Food Science and Quality Control, Industrial Fish and Fisheries, Sericulture, Psychology, Geology and Mineralogy, Geography without having passed that subject in his Higher Secondary/Intermediate Examination subject to availability of subjects in the College.

ii. No candidate shall be allowed to take Statistics if he has not passed either in Statistics or in Mathematics in Intermediate Examination/Higher Secondary Examination or any other equivalent examination.

iii. No student shall be allowed to take sericulture; if he/she has not passed +2/Higher Secondary Examination in Science with Physics, Chemistry and Biology and a student shall allowed to take Sericulture at +3 level with Zoology as other subjects.

iv. No student shall be allowed to take Industrial Chemistry if he/she has not passed +2/Higher Secondary Examination in Science with Chemistry, as one of the Optional subject and a student shall be allowed to take Industrial Chemistry at +3 level with Chemistry as other subject.

v. No student shall be allowed to take Food Science and Quality Control if he/she has passed +2 Higher Secondary Examination with Biology as one of the Optional Subjects and a student shall be allowed to take Food Science and Quality Control at +3 level with Chemistry as the other subjects.

vi. The Provision on eligibility criteria and subject combination for Industrial Chemistry above shall also be applicable to Textile Science. However, no student shall be allowed to take more than one subject either as Pass or Honours from among the subjects like Chemistry, Industrial Chemistry and Textile Science.

vii. No student shall be allowed to take Computer Science or Computer Application if he/she has not passed +2/Higher Secondary Examination with Mathematics as the other subjects.

Elective Course

A Science student of both Honours and Pass has to choose ONE Minor Elective Paper carrying 100 marks and another ONE Major Elective Paper carrying 200 marks with two paper of 100 marks each.

Minor Elective

A student with Life Science (i.e. Botany/Zoology etc.) as Pass or Honours shall take the Minor Elective Paper on "Mathematics and Statistics for Biology Students" and a student of Physical Science stream shall take the Minor Elective of "Biology for Physical Science Students".

Major Elective

A B.Sc. student of both Honours and Pass shall choose one subject as Major Elective from among he following subjects, according to suitability nd availability of subjects in the College, carrying 200 marks with two papers of 100 marks each, without any Practical components.

1. Anthropology, 2. Bio-Technology, 3. Chemistry, 4. Conservation and Management of Natural Resources, 5. Disaster Management, 6. Life Science, 7. Material Science, 8. Mathematics, 9. Non-Conventional Energy Resources, 10. Pisciculture, 11. Polymer Science, 12. Remote Sensing, 13. Sustainable Agriculture Practices, 14. Geography, 15. Physics, 16. Industrial Chemistry, 17. Computer Science, 18. Psychology, 19. Statistics Provided that, as student (Honours or Pass) with any of he subject like Life Sciences, Physics, Chemistry, Mathematics, Statistics and Environmental Science etc. as Honours or Pass, shall not be allowed to offer corresponding subject as a Major elective course.

Table-I and Table-II given below gives a clear picture at a glance regarding course structure and Mark distribution for Three Year Degree Science (B.Sc.), Pass and Honours respectively.

3 YEARS DEGREE EXAMIANTION OF SCIENCE, SAMBALPUR UNIVERSITY
COURSE STRUCTURE
SCIENCE
Science Pass (1400 Marks)

FIRST YEAR		SECOND YEAR		FINAL YEAR	
English	050	Information Technology/ Indian Society & Culture	100	Environmental Studies	100
M.I.L./A.E.	100	Pass-A-3	100	Minor Elective	100
Pass-A-1	100	Pass-A-4	100	Major Elective-P-1	100
Pass-A-2	100	Pass-B-3	100	Major Elective-P-2	100
Pass-B-1	100	Pass-B-4	100		
Pass-B-2	100				
Total Marks	**500**		**500**		**400**

Distribution of Marks of Pass subject (400 + 400 marks)
Pass subject A & B (With A having practical component & Mathematics as B):

First Year		**Second Year**	
A-P-1 (Theory)	075	A-P-4 (Theory)	075
A-P-2 (Theory)	075	A-P-5 (Theory)	075
A-P-3 (Practical)	050	A-P-6 (Practical)	050
B-P-1 (Theory)	100	B-P-3 (Theory)	100
B-P-2 (Theory)	100	B-P-4 (Theory)	100

Pass subject A & B (Both having practical component):

First Year		**Second Year**	
A-P-1 (Theory)	075	A-P-4 (Theory)	075
A-P-2 (Theory)	075	A-P-5 (Theory)	075
A-P-3 (Practical)	050	A-P-6 (Practical)	050
B-P-1 (Theory)	075	B-P-4 (Theory)	075
B-P-2 (Theory)	075	B-P-5 (Theory)	075
B-P-3 (Practical)	050	B-P-6 (Practical)	050

Science Honours (1800 Marks)

FIRST YEAR		SECOND YEAR		FINAL YEAR	
English	050	Information Technology/ Indian Society & Culture	100	Environmental Studies	100
M.I.L./A.E.	050	Pass-P-3	100	Hons-P-5	100
Pass-P-1	100	Pass-P-4	100	Hons-P-6	100
Pass-P-2	100	Hons-P-3	100	Hons-P-7	100
Hons-P-1	100	Hons-P-4	100	Hons-P-8	100
Hons-P-2	100	Major Elective-P-1	100	Major Elective-P-2	100
Minor Elective	100				
Total Marks	**600**		**600**		**600**

Distribution of Marks of Pass subject (200 + 200 marks)
Pass Subject not having Practical Component.

First Year		**Second Year**	
Pass-1 (Theory)	100	Pass-3 (Theory)	100
Pass-2 (Theory)	100	Pass-4 (Theory)	100

Pass Subject having Practical component

First Year		**Second Year**	
Pass-1 (Theory)	075	Pass-4 (Theory)	075
Pass-2 (Theory)	075	Pass-5 (Theory)	075
Pass-3 (Practical)	050	Pass-6 (Practical)	050

Distribution of Marks having Honours subject (200 + 200 + 400 marks)

Honours Subject not having Practical Components

First Year		**Second Year**		Final Year	
Honours-1 (Theory)	100	Honours-3 (Theory)	100	Honours-5 (Theory)	100
Honours-2 (Theory)	100	Honours-4 (Theory)	100	Honours-6 (Theory)	100
				Honours-7 (Theory)	100
				Honours-8 (Theory)	100

Honours Subject having Practical Component.

First Year		**Second Year**		Final Year	
Honours-1 (Theory)	075	Honours-4 (Theory)	075	Honours-7 (Theory)	075
Honours-2 (Theory)	075	Honours-5 (Theory)	075	Honours-8 (Theory)	075
Honours-3 (Practical)	050	Honours-6 (Practical)	050	Honours-9 (Theory)	075
				Honours-10 (Theory)	075
				Honours-11 (Practical)	100

In order to clear an examination (First/Second/Final) a candidate is required to secure 30% marks in a subject and 40% in each practical paper. For passing out the Degree Examination, he/she has also to secure the minimum aggregate marks of 36%.The aggregate mark for passing the degree examination shall be the sum total of aggregate of First, Second and Final Examinations taken together.

In each of the above examinations for subjects having practical, a candidate, in order to secure Honours, must have secured a minimum of 45% marks in Theory paper(s) taken together and a minimum of 45% marks in Practical Paper(s) taken together in Honours subject.

Duration of Paper(s):The duration of examination for each Theory paper carrying 50 marks shall be two hours, and for each Theory Paper carrying 75 or 100 marks, shall be Three hours. Practical paper carrying 50 marks shall be 4 hours and practical paper carrying 100 marks shall be 6 hours durations.

(B) COMPULSORY COURSES:

FIRST UNIVERSITY EXAMINATION
ENGLISH

Full Marks – 50 Duration :2 hours

The Following novel shall be studied:

A Tapestry of short stories edited by Dr. Nanda Kishore Mishra and Dr. Sisir K. Swain (Authors Press, Delhi: 2009)

In addition, writing an expansion and pieces be taught.

Piece to be taught from A Tapestry of short stories:-

1. Boless by maxim Gorki
2. The Long Exile by Count les Nikolayevich Tolstoy
3. The Submerged Valley by Manoj Das
4. Revenge by Guy de Maupassant
5. The Cop and the Anthem by O Henry
6. A Cup of Tea by Katherine Mansfield

Division of Marks

The short answer type (50 words) questions of 5 marks each and one essay type question of 15 marks on the short stories. 10 marks for an expansion and 15 marks for the précis (within 150 words)

M.I.L. (ORIYA)

Full Marks – 50 Duration 2 hours

The Course shall comprise:

1.	(a)	Detailed Prose	15 Marks
	(b)	Explanation / Short Type	05 Marks
2.	(a)	Detailed Poetry	15 Marks
	(b)	Explanation/ Short Type	05 Marks
3.	Essay Writing		10 Marks

Detailed Course:

Book Prescribed:

1. Prose (Gadya) **Prabandh Suman**
   Ed.- Dr. Bairagy Charan Jena
   Publisher- Satyanarayan Book Store, Binod Bihari, Cuttack-2

Pieces to be Studied:

1. Mahasrota : Biswanath Kar
2. Khyama : Dr. Mayadhar Mansingh
3. Samuka O' Mukta : Professor Bhubaneswar Behera

Book Prescribed:

2. Poetry (Kavita) **Kavyadhara**
   Ed.- Dr. Ashok Kumar Dash

Publisher- Kalyan Prakashan, Gangadhar Meher College Road Sambalpur

Pieces to be Studied:

1. Shimuli Brukhyara Brutanta : Sarala Das
2. Prema Sudhanidhiku Chitau : Upendra Bhanja
3. Basantagame : Gangadhar Meher
4. Jadughara : Kalindi Charana Panigrahi
5. Pratima Nayak : Sachidananda Routray

Book Prescribed:

3. Essay Writing (Prabandha Rachana)

M.I.L. (HINDI)

Full Marks – 50 Duration 2 hours

The Course shall comprise:

Poetry Text	:	15 Marks
Non-details Short Stories	:	10 Marks
Grammer	:	10 Marks
Translation (English to Hindi)	:	05 Marks
Essay	:	10 Marks

Detailed Course:

Book Prescribed:

1. Kavya Manjusa **Ed.- Murari Lal Sharma**
Publisher- Sabnam Pustak Mahal, Cuttack-10

Pieces to be Studied:

1. Janatantra Ka Janma : Ramdhari Singh Dinkar
2. Nagarjuna : Kali Das
3. Agyenya : Deep Akela
4. Dusyanta Kumar : Gajlen (1, 2)

Book Prescribed:

2. Katha Rashmi **Ed. Chakradhar Prakasan, Elahabad**

Pieces to be Studied:

1. Sujan Bhagat : Premchand
2. Parda : Yaspal
3. Chief ke Dawat : Bhisma Sahani
4. Garmiyon Ke Din : Karmalswar

Book Prescribed:

3. Vyakaran Paryabachi Sabda, Bilom Sabda, Kahawaten Tatha Muhawaren.
4. Anubad Angreji Gadyanson ka Hindi Main Anuvad.
5. Nibandh (Lagbhag 240 Sabdon Main) Pradatta Bisayaon par Nibandh Likhan.

Pathaniya Pustaken:

1. **Dr. Basudeb nandan Prasad :** Adhunik Hindi Kavya Byakaran Aur Rachana, Bharati Bhawan, Patna-4
2. **Dr. Kanheya Singh, Dr. Kuver Mishra, Dr. Suresh Ch. Pandey:** Hindi Bhasa Bhag.

M.I.L. (BENGALI)

Full Marks – 50 Duration 2 hours

The Course content and the distribution of marks shall be as follows:

1. One non-fictional prose text for detailed study
2. One anthology of poems for detailed study
3. Essay.

Distribution of Marks:

1.	One essay type question on prose text		15 marks
2.	One essay type question on poetry text		15 marks
3.	Two passages of annotation one from each text	5x2	10 marks
4.	Essay		10 marks

Books Prescribed:

1. **Sanjib Chandra Chattopadhyaya**: Palaman
2. **Kalidas Roy**: Madhukari

   Pieces to be Read:

   Michel Madhsudan Dutta: Ravana O' Chitrangada

   Hemchandra Bandopadhyaya : Jiban Marichika

   Navin Chandra Sen : Krishnarjun

   Rabindra Nath Tagore: Swarga Haite Viday

   Karunanidhan Bandopadhyaya : Shrikhetra

M.I.L. (TELEGU)

Full Marks – 50 Duration 2 hours

There shall be one paper carrying 50 marks at the end of the First Year.

Distribution of Marks:

1. Poetry : 20 Marks
2. Prose : 20 Marks
3. General Essay : 10 Marks

Detailed Syllabus:

Unit-I

Poetry : Following pieces from the books prescribed by Andhra University for B.A./B.Sc./B.Com 1st Year – 2002.

1. Sakuntalopakyanam
2. Bejjamahadevi
3. Chirutondasnambikatha
4. Desabhakti
5. Prabodhamu
6. Kuinera Nadakalu

Unit-II

Prose: Following pieces from the prose book prescribed by A.U. for B.A/B.Sc./B.Com IInd Year-2003.

1. Swabhasha
2. Rayalanati Rasikata

Unit-III

General Essay

Books Available at:

Poetry Books – Degree Telutu First Year
Ravindra Publishing House, Kothapet, Guntur- 522001 (A.P.)

Prose Books:

VYASA KADAMBAMU – University Publishing House
Old CCB Road, Kothapet, Guntur – 522001 (A.P.)

M.I.L. (URDU)

Full Marks – 50 Duration 2 hours

Books Prescribed:-

There shall be one long question with an alternative carrying 10 marks. One short question with an alternative carrying 5 marks. There shall be one explanation from prose with an alternative carrying 5 marks.

Books Recommended:

Shawoor-e-Adab by Maktabe Jamia, New Delhi.

Pieces to be Studied:- Prose

1. Ek Khoda Parast Sahazadi, 2. Gulshane Umid Ki Bahar, 3. Achhi Kitab, 4. Khatoot-e-Ghalib, 5. Sir Sayed Marhoom Aur Urdu Literature, 6. Diyasilai, 7. Goutam Budh, 8. Quatil Ki Maa.

Poetry:

There shall be long question carrying 15 marks with an alternative

Nazm: Pieces to be Studied:-

1. Adminama, 2. Subha Shahodat, 3. Neshat-E-Umid, 4., Shaquee Nama, 5. Badli Ka Chand, 6. Ae Madare Hindustan.

Ghazalyat: Pieces to be Studied:-

1. Mir Taquee Mir, 2. Mir Dard, 3. Sauda, 4. Ghalib, 5. Hasrat, 6. Shad

There shall be one explanation from Poetry with an alternative carrying 5 marks. There shall be alternative topics for Essay carrying 10 marks.

M.I.L. (SANTALI)

Full Marks – 50 Duration 2 hours

The Course shall comprise:

1.	A.	Detailed Prose	15 Marks
	B.	Explanation/Short Type	05 Marks
2.	A.	Detailed Poetry	15 Marks
	B.	Explanation / Short Type	05 Marks
3.	Essay Writing		10 Marks

Detailed Course:

1. Prose: Santali Onolmal – By Babulal Murmu, "A Bibasi".
2. Poetry: Ororthen Mohak (Compilation of Poetry) – By all India Santali Writers Association.
3. Essay Writing.

M.I.L. (ALTERNATIVE ENGLISH)

Full Marks – 50 Duration 2 hours

The following novel shall be studied:

Graham Greene – Power and the Gloty (Penguin)

In addition, writing an expansion, and a pieces be taught.

Division of Marks:

One short answer type (50 words) question of 5 marks and one essay type question of 20 marks on the novel. 10 marks for an expansion, and 15 marks for the pieces (in 150 words).

INFORMATION TECHNOLOGY

Full Marks – 100 Duration 3 hours

1. **Information Concepts & Principle of Processing.**
   - i. Definition of data and information & differences.
   - ii. Need of Information
   - iii. Qualities of Information
   - iv. Value of Information
   - v. Level of Information

vi. Necessity of Information

2. **Data Processing**
   i. Storage retrieval and processing of data
   ii. Methods of data processing-general idea only.
   iii. On-line and batch processing
   iv. Word and text processing
   v. Storage of Data.

3. **Elements of Computer System**
   i. Basic blocks of a Computer and their fraction.
   ii. Development of Computer through generation
   iii. Computer Languages, high level and low level: Idea only.
   iv. Characteristics of Hardware and Software
   v. Data and Input & Output Devices.
   vi.

4. i. Ideas about Programming.
   ii. BASIC, COBOL, FORTRAN, C : General Characteristics only.
   iii. Binary digit, decimal to binary conversion and vice-versa.
   iv. Logical Operations.
   v. Principles and Operation of a Microprocessor.

5. **General Features of:**
   i. Personal Computer
   ii. Super Computer
   iii. Main Frame Computer
   iv. Computer Network
   v. Internet.

ENVIRONMENTAL STUDIES

(MAN AND ENVIRONMENT)

Full Marks – 100 Duration 3 hours

Unit-I Fundamental Concepts:

Earth as the only suitable habitat for man, Basic concepts on changes in the Environment caused by man.

Biosphere and Ecosystem, Structure of an Ecosystem (Producer, Consumer and Decomposer) Function of Ecosystem (Food Chain, Food web, Tropic level, Ecological Pyramid, Energy Flow, Nutrient Cycling and Homeostasis) Biodiversity.

Unit-II Environmental Pollution (Atmosphere and Hydrosphere)

Atmosphere:

Layers of Atmosphere, Composition of atmosphere, History Air Pollution and classification of air pollutants, Photochemical smog, global warming, Acid rain and Ozone layer depletion. Ambient Air Quality, AIR Pollution Control Methods.

Hydrosphere:

Water Cycle source and Distribution of water, Types of water pollution, Eutrophication, Biological Magnification, Ground Water Pollution, Treatment of Waste Water, Purification of water, Water Management and reuse: Noise Pollution and Radiation Pollution.

Unit-III Lithosphere and Energy Resources:

Lithosphere: Pre3liminary idea on soil, its composition and characteristics, Land Pollution, Is causes and consequences with reference to deforestation, overgrazing, mining activity, waste disposal and agriculture practices, Integrated Pest management, Energy Resources, Biogas, Solar, Tide, Hydropower and Coal Energy and their environmental impact

Unit-IV Public Health

Epidemiology, Transmission of communicable diseases, waterborne diseases, Air-borne Diseases, Food borne Diseases, Vector-borne Diseases, Diseases from animal to man, Eradication of vector-borne diseases through chemical, biological and Environmental management methods.

Unit-V Environment, Society and Law

Environment and Society : Population Growth in India, Urbanisation and its impact on Society, Concept of Sustainable Earth Society, Grassroot Environmental movements in Orissa and India, Environmental and Pollution Laws of India, Functions of State Pollution Control Board, Preliminary Idea on Environmental Impact, Assessment and Environmental audit.

Books Recommended:

Dash & Mishra: Man and Environment, Macmillan, Price-100/-

Mishra & Dash: Environmental and Society, Macmillan, Price- 70/-

Panigrahi & Sahu: Environmental Studies, Sadgrantha Mandir.

INDIAN SOCIETY AND CULTURE

Full Marks – 100 Duration 3 hours

Section-I INDIAN CULTURE

Unit-I Roots of Indian Culture

Concept of Bharatavarsa, Religious faith and belief.

Social Systems:

Characteristics of Indian Culture, Protestant Religious Movement during 6^{th} Century B.C., Cultural attainments with reference to the Gupta Period.

Unit-II Cultural Expansion:

Overseas trade and Commerce and its impact on South-East Asia.

External impact on Indian culture: Hellenistic impact on art and architecture, impact of Islam on Indian life, Socio Religious Reforms movement: Bhakti movement, Brahmo Samaj and Arya Samaj.

Unit-III Nationalism in India:

Freedom struggle and the role of Gandhi, Tagore, Nehru, Subhas and Jinna.

Section-II INDIAN SOCIETY

Unit-I Indian Society

Origin and composition, Formation of Castes and Tribes; Their Religion and tradition, Conflict and threats of unity; Steps for social integration.

Unit-II

Changes in Social – Cultural Pattern; impact of changes in different period of culture; Sanskritisation, secularization, impact of Western culture and modernization, changes due to democratization.

Unit-III

Liberalisation and Globalization and its impact on Indian Society; Conflict and adjustment to the emerging situation; the role of civil society.

Books for Indian Culture and Society:

1. **P.N. Chopra, B.N. Puri & M.N. Das :** A Social, Cultural and Economic History of India: (in 3 Volumes) Macmillan.
2. **Ed. R.C. Majumdar:** The History & Culture of Indian People, Vol.-III, IV, IX, XI
3. **Romila Thapar:** Social History of India.
4. **R.K. Mission** Series – Relevant Chapters- Vol.1,2,4,5.
5. **S.P. Nanda :** Economic and Social History of Modern India.
6. **K.M. Srinivas:** Social Changes in Modern India.
7. **B.K. Sarkar:** The Positive Background of Hindu Sociology.
8. **V.Goutam:** Aspects of Indian Society & Economy in the Nineteenth Century.
9. **Rekha Sharma:** A Hand Book of Sociology.

10. **Thapar:** Tribe, Caste & Religion.
11. **Varghese:** General Sociology.

(C) OPTIONAL COURSES:

BOTANY (PASS)

The First Year University Examination of the +3 Degree Pass consists of two Theory Papers each of three hours duration carrying 75 marks each and one Practical Paper of 4 hours duration carrying 50 marks. Each Theory Paper consists of Five Units. The Students have to attempt one question from each unit.

The Second Year University Examination of the +3 Degree Pass shall consist of two Theory Papers each of three hours duration carrying 75 marks each and one Practical Paper of 4 hours duration carrying 50 marks. Each Theory Paper consists of five Units. The students have to attempt one question from each Unit.

There will be no Theory or Practical paper in Botany Pass in +3 Final Year.

COURSE STRUCTURE:

FIRST UNIVERSITY EXAMINATION

PAPER-I (Theory) **75 Marks.**

Microbiology, Algae, Fungi, Bryophyta, Pteridophyta: Gymnosperms.

Unit-1	Microbiology, Fungi	**Unit-2**	Algae
Unit-3	Bryophyta	**Unit-4**	Pteridophyta
Unit-5	Gymnosperm		

PAPER-II (Theory) **75 Marks.**

Molecular Biology, Genetics, Evolution, Plant Bre4eding, Ecology & Biotechnology

Unit-1	Molecular Biology	**Unit-2**	Genetics
Unit-3	Evolution, Plant Breeding	**Unit-4**	Ecology
Unit-5	Biotechnology		

PAPER-III (Practical) **50 Marks.**

(Practical Relevant to Papers- I & II)

SECOND UNIVERSITY EXAMINATION

PAPER-IV (Theory) **75 Marks.**

Anatomy, Economic Botany, Taxonomy, Biochemistry & Enzymes

Unit-1	Anatomy	**Unit-2**	Economic Botany and Taxonomy
Unit-3	Taxonomy	**Unit-4**	Embryology
Unit-5	Biochemistry & Enzymes.		

PAPER-V (Theory) **75 Marks.**

Plant Physiology

Unit-1	Water Relation	**Unit-2**	Photosynthesis
Unit-3	Respiration	**Unit-4**	Nitrogen Assimilation
Unit-5	Plant Growth and Development		

PAPER-VI (Practical) **50 Marks.**

(Practical Relevant to Papers- IV & V)

DETAILED COURSE

FIRST UNIVERSITY EXAMINATION

PAPER-I (MICROBIOLOGY)

Full Marks – 75 Duration 3 hours

Unit-I

Scope & Development of Microbiology, Germ Theory of Disease, Protista and Domain concept, Life History, Affinity & economic importance of virus & Bacteria. Fungi: Life History, affinity & Economic importance of Penicillium, Puccinia & Agaricus.

Unit-II

Algae – Life History & Affinity & Economic importance of Nostoc, Volvox, Cedoganium, Chara, Fucus, Batrachospermum.

Unit-III

Bryophyta – Structure & Life Hisotry of Marchautia and Anthoceros.

Unit-IV

Pteridophyta – Structure and Life History of Bhynia, Selaginella, Equisetum.

Unit-V

Gymnosperm – Structure and Life History of Binus and Genetum.

PAPER-II
(MOLECULAR BIOLOGY, GENETICS, EVOLUTION, AND PLANT BREEDING, ECOLOGY)

Full Marks – 75 Duration 3 hours

Unit-I Molecular Biology:

Structure of DNA and RNA, Chemical nature of gene, Replication of DNA, Transcription of RNA, Genetic Code, Protein Synthesis.

Unit-II Genetics

Mendelism, Inheritance (Codominance, incomplete dominance) Non-Mendelian factors (Complementary and Supplementary), Numerical changes in chromosomes and structural aberratiof, in Chromosome.

Unit-III Evolution & Plant Breeding:

Origin of life, Evidences for organic evolution, Theories of organic evolution (Darwinism and neo-Darwinism) Principle and practices of plant breeding, Role of plant breeding in agriculture.

Unit-IV Ecology

Plant Community (Characters and Structure), Ecosystem (Structure, types) Energy flow in ecosystem, Food chain, Food-web, Ecological Pyramids, Plant succession (Hydrosere and Xerosere),, Environmental Pollution (Air, Water and Soil).

Unit-V Biotechnology:

Totipotency, Tissue culture – techniques and importance, Elementary idea on Genetic engineering (Recombinant DNA technology) Transgenic Plants.

PAPER-III (PRACTICAL)

(PRACTICAL RELEVANT TO PAPER-I & II)

Full Marks – 50 Duration 4 hours

1. Temporary Microscopic preparation of Algae, Fungi, Bryophyta, Pteriodophyta and Gymnosperm material with their identification.
2. Spot identification of slides/materials with classification.
3. Identification of cytological and embryological slides illustrating the various stages of development.
4. Identification of materials/slides of ecological adaptations.
5. Viva-voce
6. Practical Record.

SECOND UNIVERSITY EXAMINATION

PAPER-IV

(ANATOMY, ECONOMIC BOTANY, TAXONOMY, BIOCHEMISTRY & ENZYMES)

Full Marks – 75 Duration 3 hours

Unit-I Anatomy

Tissue System – (Meristermatic, Conducting and Mechanical) Anomalous secondary growth in stems, Secondary growth in monocot stems.

Unit-II Economic Botany and Principles of Taxonomy:

Economic Botany – Botany, cultivation and economic importance of Rice, Wheat, Sugarcane and Groundnut, economic values of Jute, Task, Opium, Tobacco, Wood apple, Sacred basil, Neem and Periwinkle(Vinca).

Taxonomy:

Principles of Classification of Plants, Systems of classification (Hutctrinson's System, Bentham and Hookers' system).

Unit-III Taxonomy – Study of the following families:

Dicots- Amaranthaceae, Euphorbiaceae, Cucurbitaceae, Rosaceae, Papaveraceae, Tiliaceae, Malvaceae, Rutaceae, Apocyanaceae, Convolvulaceae, Verbenaceae, Lamiaceae (Labiatae), Scrophulariaceae and Acanthaceae. Monocots – Poaceae (Gramineae), Cyperaceae

Unit-IV Embtyology:

Microsporogenesis, Megasporogenesis, Development of typical bisporic embryosac, Fertilization, Endosperm.

Unit-V Biochemistry and Enzymes:

Biochemistry – Structure and Properties of Carbohydrages, Lipids, Amino acids and Proteins.

Enzymes:

Classification, Nomenclatura and Properties, Mode and Mechanism of enzyme action, Factors affecting enzyme action.

PAPER-V (PLANT PHYSIOLOGY)

Full Marks – 75 Duration 3 hours

Unit-I Water Relations:

Properties of water, Diffusion, Osmosis and Imbibitions. Absorption and Translocation of water, Transpiration Absorption and Translocation of solutes.

Unit-II Photosynthesis:

Photosynthetic apparatus, Pigments, Mechanism of photosynthesis (Light reaction – absorption and transport of light energy, electron transport, cyclic and non-cyclic. Photophosphorylation: Dark reaction –C-3 and C4 pathway of Carbon fixation) Blackman's Law of limiting factors Photorespiration.

Unit-III Respiration

Structure of mitochondria, Anaerobic and aerobic respiration, Respiratory substrates, Respiratory quotient, Glycolysis, Fermentation, Krebs cycle, Electron transport system, Oxidative Phosphorylation.

Unit-IV Nitrogen assimilation:

Nitrogen cycle, Physical and chemical nitrogen fixation, Biological nitrogen fixing agents, Symbiotic nitrogen fixationnodule formation, Mechanism of nitrogen fixation, Ammonification, Nitrification and De-nitrification. Transamination and Reductive amination.

Unit-V Plant Growth and Development:

Types of growth, Sigmoid growth curve, Grand period of growth, Factors affecting growth. Chemical nature and physiological role of growth hormones – Auxins, Gibberellins, Cytokinins and Abscisic acid.

PAPER-VI (PRACTICAL)

(PRACTICAL RELEVANT TO PAPER-IV & V)

Full Marks – 50 Duration 4 hours

1. Description of commonly occurring plants belonging to the families included in the course and their identification.
2. Preparation of temporary slides for the study of normal and abnormal secondary growth.
3. Identification and comments of plants/plant parts/plant products with reference to their economic importance.
4. Identification of Embryological slides.
5. Experiments on Physiology
   a. Determination of Osmotic Pressure of cell sap by Plasmofytic method.
   b. Determination of Suction Pressure of stem tuber/root tuber/rhizome.
   c. Determination of resistance offered by cuticle to loss or water by Xerophyte.
   d. Determination of relation between Transpiration and Absorption by T/A apparatus.
   e. Effect of wavelength of light on the rate of Photosynthesis by Wilmott's bubbler.
   f. Determination of the rate of unbibition of starchy, Proteinaceous and oily seeds.
6. Experiments of Biochemistry
   a. Qualitative identification of carbohydrates, Proteins and Fats.
   b. Physical isolation of Photosynthetic pigments by Paper chromatography method.
   c. Quantitative estimation of Photosynthetic pigments.

BOTANY (HONS)

The +3 Degree Examination consists of three parts – First Second and Third. The examinations will be held at the end of each academic year.

The First Year Examination of the +3 Degree Honours shall consist of two Theory Papers each of three hours duration carrying 75 marks each and one Practical Paper of 4 hours duration carrying 50 marks. Each Theory Paper consists of Five Units. The students have to attempt one question from each Unit.

The Second Year University Examination of the +3 Degree Honours shall consist of two Theory Papers each of three hours duration carrying 75 marks each and one Practical Paper of 4 hours duration carrying 50 marks. Each Theory Paper consists of five units. The students have to attempt one question from each Unit.

The Third (Final) Year University Examination of +3 Degree Honours shall consist of four Theory papers, each of three hours duration carrying 75 marks and one Practical papers of six hours duration carrying 100 marks. Each theory pap0er consists of three units. The students have to attempt total five questions selecting atleast one question from each unit.

COURSE STRUCTURE:

FIRST UNIVERSITY EXAMINATION

PAPER-I (Theory) **75 Marks.** **3 Hours**

Microbiology, Algae, Fungi, Plant Pathology

Unit-1	Microbiology	**Unit-2**	Algae (A)
Unit-3	Algae (B)	**Unit-4**	Fungi
Unit-5	Plant Pathology		

PAPER-II (Theory) **75 Marks.** **3 Hours**

Cell Biology, Molecular Biology, Biotechnology, Genetic Engineering.

Unit-1	Cell Biology (A)	**Unit-2**	Cell Biology (B)
Unit-3	Molecular Biology	**Unit-4**	Biotechnology
Unit-5	Genetic Engineering		

PAPER-III (Practical) **50 Marks.** **4 Hours**

(Practical Relevant to Papers- I & II)

SECOND UNIVERSITY EXAMINATION

PAPER-IV (Theory) **75 Marks.** **3 Hours**

Bryophyta, Pteridophyta, Gymnosperms

Unit-1	Bryophyta	**Unit-2**	Pteridophyta (A)
Unit-3	Pteridophyta (B)	**Unit-4**	Gymnosperms (A)
Unit-5	Gymnosperms (B)		

PAPER-V (Theory) **75 Marks.** **3 Hours**

Genetics, Evolution, Plant breeding, Biostatistics, Economic Botany

Unit-1	Genetics (A)	**Unit-2**	Genetics (B)
Unit-3	Evolution & Plant Breeding	**Unit-4**	Biostatistics
Unit-5	Economic Botany		

PAPER-VI (Practical) **50 Marks.** **4 Hours**

(Practical Relevant to Papers- IV & V)

FINAL UNIVERSITY EXAMINATION

PAPER-VII (Theory) **75 Marks.** **3 Hours**

Anatomy and taxonomy

Unit-1	Anatomy	**Unit-2**	Taxonomy (A)
Unit-3	Taxonomy (B)		

PAPER-VIII (Theory) **75 Marks.** **3 Hours**

Embryology, Instrumental Technique & Environmental Biology

Unit-1	Embryology, Instrumental Technique		
Unit-2	Environmental Biology (A)	**Unit-3**	Environmental Biology (B)

PAPER-IX (Theory) **75 Marks.** **3 Hours**

Plant Physiology & Bio-Chemistry

Unit-1 Water relations, Mineral nutrition & Translocation of solutes.
Unit-2 Plant growth & Development **Unit-3** Bio-Chemistry

PAPER-X (Theory) **75 Marks.** **3 Hours**

Unit-1 Enzymes Respiration **Unit-2** Photosynthesis
Unit-3 Nitrogen assimilation, Fat metabolism

PAPER-XI (Practical) **100 Marks.** **6 Hours**

(Practical Relevant to Papers- VII & VIII)

DETAILED COURSE

FIRST UNIVERSITY EXAMINATION

PAPER-I

(MICROBIOLOGY, ALGAE, FUNGI, PLANT PATHOLOGY)

Full Marks – 75 Duration 3 hours

Unit-I Microbiology

Scope and development of Microbiology (spontaneous generation, biogenesis, germ theory of disease) Classification of micro organisms, Protista concept, General idea about occurrence, growth, metabolism, reproduction and economic importance of Virus and Bacteria.

Unit-II Algae (A)

Classification Pigmentation and economic importance of algae, Study of the following:

a. Cyanophyceae – Cell Structure, Pigmentation and economic importance with reference to oscillations, Nostoc and Rivularia.
b. Chlorophyceae – Thallus structure and sexual reproduction with refere4nce to Chlamydomonas, Volvox, Ulothris, Oedogonium, Coleochaete and Chara.

Unit-III Algae (B)

Study of the following:

a. Baccilariophyceae – Cell structure and economic importance of Diatoms.
b. Vaucheriaceae – Structure and reproduction of Vaucheria.
c. Phaeophyceae – Life- Cycle patterns with reference to Ectocarpus and Fucus.
d. Rhodophyceae – Life – Cycle patterns with reference to Batrachosperumum and Polysiphonia.
e. Origin and evolution of sex in algae.

Unit-IV Fungi:

Gneral characters and classification of Fungi:

Study the following:

a. Lower Fungi- Life history of Saprolegnia, Albugo, Pythium, Phytophthora, Peronospora, Rhizopus.
b. Ascomycetes – Life History of Aspergillus, Penicillium, Erysiphe and Claviceps, Development of fruiting body in Ascomycetes.
c. Basidiomycetes – life History of Ustilago, Puccinia and agaricus Development of Basidiocarp.
d. Fungi imperfect – Fusarium.
e. Degeneration of sex in Fungi.
f. Heterothallism in Fungi.

Unit-V Plant Pathology:

Mode of fungal infection, spore dissemination and control of plant diseases.

Study of symptoms, etiology, disease cycle and control measures of the following plant diseases:

Blast disease of rice (Pyricularia), Brown-spot disease of rice (Helminthosporium) Tikka disease of ground nut (Cercospora).

PAPER-II

(CELL BIOLOGY, MOLECULAR BIOLOGY, BIOTECHNOLOGY, GENETIC ENGINEERING)

Full Marks – 75 Duration 3 hours

Unit-I Cell Biology:

Protoplasm (Physical nature and properties), Cell membrane (Chemical composition, organization-Fluid-Mosaic model and Physiologycal importance, Structure and morphology of Eukaryotic chromosomes, Lampbrush and Polytene chromosomes.

Unit-II Cell Biology:

Cell division, Mitotic Cell Cycle(G.S., M.D.), Meiosisphases and significance. Nucleic acids – Structure of DNA, forms of DNA, DNA replication, Different types of RNA.

Unit-III Molecular Biology:

Development of Gene concept, identification of the genetic material (DNA & RNA) Central dogma, Transcription, Genetic code, Gene function (Protein Synthesis), Generegulation (Lac Operon).

Unit-IV Biotechnology:

Tissue culture – Totipotency, techniques of tissue culture, application of tissue culture (Ovary culture, pollen culture and embryo culture) Proteplast fusion.

Unit-V Genetic Engineering:

Elementary idea on genetic engineering, Recombinant DNA technology, Restriction enzymes, Plasmids, Cloning Vectors, Development of transgenic plants, Potential benefits and hazards of genetic engineering.

PAPER-III (PRACTICAL)

(PRACTICAL RELEVANT TO PAPER-I & II)

Full Marks – 50 Duration 4 hours

1. Study & identification with the help of suitable microscopic preparations of the specimen belonging to bacteria, Algae and Fungi with their identification included in the course.
2. Spot identification of slides/ materials with reasons and classification.
3. Study of cell division by squashing technique and identification of stages.
4. Preparation of media for bacterial/fungi culture.
5. Submission of prepared slides.
6. Viva-voce
7. Practical Record.

SECOND UNIVERSITY EXAMINATION

PAPER-IV

(BRYOPHYTA, PTERIDOPHYTA, GYMNOSPERMS)

Full Marks – 75 Duration 3 hours

Unit-I Bryophyta

General characters, classification, Origin and affinities of Bryophyta.

Morphology, Anatomy, Life history and phylogeny of the following:

Riccia, Marchantia, Porella, Anthoceros and Funaria, Progressive sterilization of sporogenous tissue.

Unit-II Pteridophyta (A):

General characters and classification of Pteridophytes, Morphology, Anatomy, Life history and Phylogeny of the following:

Rhynia, Psilotum, Lycopodium, Selaginella and Lepidodendron, Heterospory and seed habbit.

Unit-III Pteridophyta (B):

Morphology, Anatomy, Life History and Phylogeny of Equisetum, Ophioglossum and Marsilea, Stelal evolution in Pteridophytes, Apospory and Apogamy.

Unit-IV Gymnosperms (A):

General characters, Origin and Classification of Gymnosperms, Geological time-scale, Process of fossilization. Study of the following and their affinities: Lyginodendron, Cycadeoidea.

Unit-V Gymnosperms (B):

Morphology, Anatomy, Life History of Phylogeny of : Cycas, Ginkgo, Pinus and Gnetum.

PAPER-V

(GENETICS, EVOLUTION, PLANT BREEDING, BIOSTATISTICS, ECONOMIC BOTANY)

Full Marks – 75 Duration 3 hours

Unit-I Genetics (A)

Heredity, Deviations of Mendelian ratios, Linkage and Crossingover, Elementary idea on Sex-Linkage, gene mapping, Cytoplasmic inheritance.

Unit-II Genetics (B)

Numerical changes in chromosomes, Structur-al changes in chromosomes, Population genetics (Hardy – Lienberg Law) Mutation and its role in evolution.

Unit-III Evolution and Plant Breeding:

Origin of life, Evidence of Organic evolution, Isolation and Origin of species Plant breeding – Objectives of plant breeding, general principles and techniques, Application of plant breeding in crop improvement.

Unit-IV Biostatistics:

Idea on Sample and Population, Sampling, Classification and arrangement of biological data, Presentation of data (Tables, diagrams, graphs and charts), Frequency (Frequency polygon, frequency curves and cumulative frequency), Frequency distribution, Measures of central tendencies – Mean, Mode and Median, Measures of dispersion Variance (Standard deviation, Standard error of the mean), Comparison of two means (Null hypothesis, confidence limit, test of significance, Chi-square test and Students' t-test).

Unit-V Economic Botany

Cultivation of Rice, Jute, Sugarcane, Groundnut and their economic importance, Botany and economic values of the following: Thea, Coftea, Cin-chona, Strychnous, Rauwolfia, Papaver, Cannabis, Nicotiana, Azadirachta, Vinca, Madhuca indica and Tectona grandis.

PAPER-VI (PRACTICAL)

(PRACTICAL RELEVANT TO PAPER-IV & V)

Full Marks – 50 Duration 4 hours

1. Study and identification with the help of suitable temporary preparations of the specimen belonging to Bryophyta, Pteridophyta and Gymnosperms included in the course.
2. Study of fossil materials/slides.
3. Spot identification of slides/materials with reasons and classification.
4. Experiments on Biostatistics
   a. Determination of Central tendency by sampling method in plant materials (leaf, fruit, seed etc.)
   b. Comparison of mec:Ins of two samples by Students t-test.
   c. Chi-square analysis relating to goodness of fit.
5. Identification and comments on plants/Plants materials Plant products with reference to their economic use.
6. Viva-voce
7. Practical Record
8. Students are required to submit microscopic preparations at the time of examination.

PAPER-VII
(ANATOMY & TAXONOMY)

Full Marks – 75 Duration 3 hours

Unit-I Anatomy:

Meristematic tissue (Classification, theories of tissue differentiation, Organisation of root and shoot apices), Vascular tissues (ontogeny and development), Mechanical tissues: Origin and lateral roots.

Anomalous secoridary growth in stems – Adaptive (Aristolochia, Bignonia, Tecema and Leptadaenia type), Nonadaptive (Amarnath us, Chenopodium and Boerhaavia type), Secondary growth in monocot stem (Dracaena).

Unit-II Taxonomy (A):

Aims, approaches and principles of International code of Botanical Nomenclature (ICBN), Logic of classification, Principles of nomenclature, Units of classification, typification rules of priority, Classification-Historical development types of classification, systems of classification proposed by Bentham and Hooker, Engler and Prenteleand Hutchinson. Distinguishing Characters of the following orders with special reference to the families mentioned.

Monocotyledons: Glumiflorae – Gramineae (Poaaae), (Gramineae) and Cyperaceae. Spathiflorae – Arecaceae (Palmaceae). Uliflorae – Liliaceae and Amaryllidaceae. Scitamineae – Musaceae and Zingiberaceae. Microspermae – Orchidaceae.

Unit-III Taxonomy (B):

Distinguishing characters of the following order with special references to the families mentioned.

Decotyledons:

Orders: Ranales; Ranunculaceae, Nymphaeaceae, Announaceae and Magnoliaceae; Rhoeadales – Papaveraceae and Capoaridaceae; Malvales – Tiliaceae and Sterculaceae; Geraniales – Euphorbiaceae; Rosales – Rosaceae; Myrtiflorae – Myrtaceae; Umbelliflorae- Umbilliferae; Contortae – Apocyan Ficeae and Asclepiadaceae; Convolvulales – Convolvulaceae; Tubiflorae – Verbenaceae, Scrophulariaceae and Labiatae (Lamiaceae); Rubiales – Rubiaceae; Campanulales – Asteraceae.

PAPER-VIII
(INSTRUMENTAL TECHNIQUES, EMBRYOLOGY AND ENVIRONMENTAL BIOLOGY)

Full Marks – 75 Duration 3 hours

Unit-I Instrumental Techniques:

General Principles and uses of ElectronMicroscopy Centrifugation, Paper Chromatography and Spectrophotometry.

Embryology:

Microsporogenesis, Megasporogenesis, Male gametophyte, Female gametophyte, Fertilisation, Embryo and endosperm development, Polymbryony, Parthenogenesis.

Unit-II Environmental Biology (A):

Population concept, Natality, Mortality, Communalism, Parasitism and Symbiosis, Plant communities, Community dynamics (Hydrosere and Xerosere) Ecosystem (types, structure and components), Energy flow in ecosystem (Food chain, food-web, ecological pyramids, energy flow models), Bioremediation (need and scope), Environmental application of bioremediation. Biological resources and their conservation, Conservation and Bioethics and Biodiversity.

Unit-III Environmental Biology (B):

Environmental pollution (Air, Water and Soil), Eutrophication, Biological Oxygen Demand (BOD) and Chemical Oxygen Demand(COD), Control of air, water and soil pollution, Phytogeography of India, Forests of Orissa in general, Social forestry, Environmental education-Goals.

PAPER-IX

(PLANT PHYSIOLOGY & BIOCHEMISTRY)

Full Marks – 75 Duration 3 hours

Unit-I Water Relations

Colloidal system and its properties, diffusion, Imbibition, Osmosis and Plasmolysis, Absorption of Water – (Water absorbing system, Mechanism of absorption and factors affecting absorption), Ascent of sap (Mechanism and theories, factors) Transpiration (Mechanism and factors, wilting and Guttation).

Mineral nutrition and Translocation of solutes – Mneral nutrition Essential elements – Their source and role, Role of trace elements, Study of mineral deficiency, Mechanism of absorption and translocation of inorganic solutes. Translocationof Organic solutes.

Unit-II Growth and Growth hormones:

Types of plant growth, Phases and mechanism of growth factors affecting growth, Growth regulators – Discovery, chemical rlature, bio-a say and physiological roles of Auxins, Gibberellins, Cytokinins, Ethylene and Abscisic acid, Grwoth and Development – Germination, Dormancy (Causes of seed and bud dormancy, methods of breaking dormancy) Photoperiodism and vernalization. Senescence – Types of senescence, symptoms, and factors regulating senescence.

Unit-III Biochemistry:

Structure and properties of water, pH and buffers, Biological molecules, Intra and inter molecular forces, Concept of Free energy and calculation of AG Classification, Structure, properties and biological importance of Carbohydrates, Proteins and Lipids.

PAPER-X
(ENZYMES AND PLANT METABOLISM)

Full Marks – 75 Duration 3 hours

Unit-I Enzymes:

Classification, Nomenclature and properties of enzymes, Mode and mechanism of enzyme action, Inhibition of enzyme activity, Factors affecting enzyme action. Enzyme kinetics – MichaelisMenton equation and the Km value. Respiration- Structure of mitochondria, Types of respiration, Respiratory substrate and respiratory quotient (RQ), Glycolysis, Fermentation, Krebs cycle, Electron transport and terminal oxidation, Oxidative Phosphorylation.

Unit-II Photosynthesis:

Structure of chloroplast of Photosynthetic pigments, Redrop. Emerson effect and the two pigment systems, Organisation of thylakoid membrane, Mechanism of Photosynthesis- Light reaction – Absorption and transport of light energy, Cyclic and non-cyclic electron transport (Z-Scheme) Oxygen evolution and photophosphorylation. Dark reaction – Carbon fixation by C_3 and C_4 plants and CAM plants. Photorespiration, Blackman's Law of limiting factors, Elementary idea on Bacterial photosynthesis and Chemosynthesis.

Unit-III Nitrogen assimilation:

Nitrogen cycle, Sources of nitrogen, Nitrogen fixation- Physical and chemical nitrogen fixation, Biological nitrogen fixation (Nitrogen fixing agents, Root nodule bacteria and mechanism of nitrogen fixation) Ammonification, Nitrification and Denitrification, Nitrate assimilation, Amination (Reductive amination, transamination) Fat Metabolism – Degradation of fats, and oxidation of fatty acids, Energeetics of Oxidation, Synthesis of fatty acids (Mitochondrial and extra-mitochondrial system), Synthesis of glycerol and biosynthesis of triglycerides.

PAPER-XI (PRACTICAL)

Full Marks – 100 Duration 6 hours

A. Practical Relevant to Paper VII & VIII

1. Description of commonly occurring plants belonging to the families included in the course and the identification with help of a Flora Book.
2. Preparation of temporary slides for the study of abnormal secondary growth.
3. Identification and comments on the prepared embryological slides.
4. Preparation of atleast 30 herbaria of commonly occurring wild plants.

5. Ecological experiments.
6. Viva-voce related to relevant theory papers.
7. Students are required to submit microscopic preparations and laboratory note books duly certified by the concerned teachers.

N.B.: Students should be taken in study-tour to study flora at different places and sample specimens collected from these places should be presented for assessment at the time of practical examination.

B. Practical Relevant to Paper – IX & X

Experiment on Physiology:

a. Determination of Osmotic Pressure of cell sap by Plasmolytic method.
b. Determination of Suction Pressure to stem tuber/root tuber/rhizome.
c. Determination of resistance offered by cuticle to loss of water by Xerophyte.
d. Determination of relation between Transpiration and Absorption by T/A apparatus.

Experiments on Biochemistry:

a. Qualitative identification of Carbohydrates, Proteins and Fats.
b. Chromatographic separation of photosynthetic pigments.
c. Comparison of chlorophyll content of young and old leaves.
d. Determination of PKa value of acetic acid by plotting titration curve.
e. Effect of substrate concentration on the rate of enzyme activity and determination of Km value.
f. Effect of enzyme concentration on the rate of enzyme activity.
g. Estimation of total sugar content of plant tissue by Anthrone's method.
h. Quantitative estimation of starch.
i. Quantitative estimation of casein from nulk.
j. Effect of substrate concentration of diastase activity.
k. Effect of enzyme concentration of disaster activity.
l. Identification of biochemical compounds (starch, Protein, Vitamin-C)- Qualitative.

CHEMISTRY (PASS)

COURSE STRUCTURE:

FIRST UNIVERSITY EXAMINATION

There shall be two theory papers each carrying 75 marks and each of 3 hours duration and one practical paper carrying 50 marks of 4 hours duration.

Paper-I (Theory)	Physical Chemistry	75 Marks.
Paper-II (Theory)	Inorganic Chemistry	75 Marks
Paper-III (Practical)		50 Marks
a. Experiment-1	25 Marks	
b. Experiment-2	15 Marks	
c. Viva-Voce	05 Marks	
d. Record	05 Marks	

SECOND UNIVERSITY EXAMINATION

There shall be two theory papers each carrying 75 marks and each of 3 hours duration and one practical paper carrying 50 marks of 4 hours duration.

Paper-IV (Theory)	Organic Chemistry	75 Marks.
Paper-V (Theory)	General Chemistry	75 Marks
Paper-VI (Practical)		50 Marks
a. Experiment-1	25 Marks	

b. Experiment-2	15 Marks
c. Viva-Voce	05 Marks
d. Record	05 Marks

DETAILED COURSE

FIRST UNIVERSITY EXAMINATION

PAPER-I (PHYSICAL CHEMISTRY)

Full Marks – 75 Duration 3 hours

Unit-I

Kinetic Theory of Gases: Maxwell-Boltzmann distribution of molecular velocities (Mathematical derivation excluded), Calculation of Root Mean Square (R.M.S.), Most probable and Average velocities and the relation between them, Mean free path, Collision frequency, Derivation of gas laws from ideal behavior, Vanderwall's equation of state, Critical Phenomena and Critical constants, Law of corresponding states of reduced equation of state, Liquefaction of gases.

Unit-II

Chemical Kinetics : Order and Molecularity, Kinetics of 1^{st} and 2^{nd} order reactions, Determination of order of a reaction, Simple opposing (A&B) reaction, Consecutive or Sequential (A-B-C) reaction, Chain reaction (H_2+Br_2), Effect of temperature on reaction rate Qualitative treatment of Transition state theory.

Unit-III

a. Thermodynamic Concepts: Heat Content and Heat capacity, Isothermal and Adiabatic changes, Work done for Ideal and Vanderwaal's gases.
b. Thermo Chemistry: Heat changes in chemical reaction, Hess's Law of constant heat summation, Kirchoffs equation.
c. Second law of thermodynamics: Spontaneous process, Carnot's theorem and Cannot's cycle, Efficienty of ehat engines, Entropy changes in reversible and irreversible processes, Free energy and work function, Conditions of equilibrium, Claypeyeron and Classisus equation, Gibb's Helmholtz equation.

Unit-IV Homogneous gaseous equilibrium:

Law of Mass Action and the Thermodynamic derivation of the expenssion for the equilibrium constants, Different forms of equilibrium constants, Le-Chatelier's principles, illustration with some gaseous reations, Effect of temperature on equilibrium, Vant-hoff's equations and its integration.

Unit-V Dilute Solutions:

Vapor pressure, Roult's Law, Thermo Dynaimc derivation of laws telating to elevation of Boiling point, Depression of Freezing point and Osmotic pressure, Ideal and Non-Ideal solution, Association and Dissociation.

Book Recommended:

1. **Bahi and Tuli:** Essential of Physical Chemistry, S. Chand & Com. Ltd.
2. **Puri, Sharma & Pathania:** Principle of Physical Chemistry, Vishal Publishing Co.
3. **K.L. Kapur:** A Text Book of Physical Chemistry, Vol.-1-4, Macmillan Publisher.
4. **Poni and Dharmarha:** Text Book of Physical Chemistry, S.Chand & Sons.

PAPER-II (INORGANIC CHEMISTRY)

Full Marks – 75 Duration 3 hours

Unit-I Structure of Atoms:

De-Broglie matter waves, Heisenberg's uncertainty principle and its verification, Schrodinger's wave equation, Significance of wave equation, Schrodingers equation for the hydrogen atom (Solution of the equation for hydrogen atom is not required), Theta, Phi-and R equation, Quantum numbers and their significance, Concept of redial and angular wave functions, Spherical harmonics (Mathematical derivation not required), Redial and

Angular distribution curves, Shape of S.P.D. orbitals L.S. Coupling Scheme, Derivation of ground term symbols of d' to d" systems.

Unit-II Chemical Bonding:

a. Ionic Bond: General characteristics, Born equation and its application, Polarixability, Fajan's rule, percentage of ionic character from dipole-moment and electro-negativity difference, Sovation energy.
b. Covalent Bond: Valence Bond approach, Heitler – London treatment of H_2 molecule (mathematical treatment excluded), Concept of resonance and Resonance energy, Directional characteristics of covalent bond, Concept of hybridization, Deduction of geometry of the following type of ions, Molecules from hybridization, AB_2, AB_3, AB_2E, AB_4, AB_3E, AB_2E_2, AB_4E, AB_3E_2, AB_2E_3, AB_6, AB_5E, AB_4E_2 (where 'E' represents lone pair of electron).
c. Qualitative treatment of Molecular orbital theory: Bonding, Antibonding, Nonbonding Molecular orbitals, Molecular orbitals, MO configuration of H_2, N_2, O_2, CO, NO, HS and their ions.

Unit-III Compounds of p-Block Elements (Preparation & Structure)

a. Boron Family: Boric Acid, Hydrides of Boron and Borazole.
b. Carbon Family: Carbides, Silanes, Silicates and Silicones.
c. Nitrogen Family: Hydrides of Nitrogen
d. Oxygen Family: Oxygen Fluorides, Peracids of Sulphur.
e. Halogen Family: Oxides & Oxy acids of chlorides Inter halogen compounds.

Unit-IV Chemistry of d-Block Elements:

Electronic configuration and cComparative Studies of 1st row, 2nd row and 3rd row transition series with special reference to atomic and ionic radii, ionization potential, redox potential, oxidation state, metallic nature and captaiytic activity, Principle of Extractions and Chemistry of Silver Chromium & Manganese.

Unit-V Co-ordination Compounds:

Ligands, Co-ordination Number, Co-ordinations sphere, Nomencalture, Wener's co-ordination theory, Effective Atomic Number (EAN) concepts, Chelates, Isomerism in co-ordination compounds, Valance bond theory of transition metal complexes with special reference to octahedral, tetrahedral & square planner complexes.

Books Recommends:

1. **Satya Prakash, G.D. Tuli, S.K. Basu & R.D. Madan:** Advance Inorganic Chemistry : Vol-1, S. Chand Co. Pvt. Ltd.
2. **B.R. Puri, L.R. Sharma & K.C. Kala:** Principle of Inorganic Chemistry, S. Chand Co. Pvt. Ltd.
3. **K.D. Sharma:** Modern College Chemistry, Kalyani Publisher
4. **P.L. Soni:** Text Book of Inorganic Chemistry, S. Chand Co. Pvt. Ltd.

PAPER-III (INORGANIC PRACTICAL)

(PRACTICAL RELEVANT TO PAPER-I & II)

Full Marks – 50 Duration 4 hours

a. Experiment-1

Qualitative Analysis of mixtures of inorganic substances containing not more than six radicals (Interfeaing Acid radicals like PO_4^{-3}, F and mixture of acid radicals like CO_3^{-2}, SO_3^{-2}, $S^{-2}, NO_2^{-1}, Cl^{-1}, PO_4^{-3}$ AsO_4^{-3}, NO_3^{-}, SO_4^{-2} (one insoluble substance such as *$BaSO_4$*, *Al_2O_3*, *$SrSO_4$* or *SnO_2* May be given)

b. Experiment-2

1. Standardization of $KMnO_4$ solution with standard sodium oxalate solution.
2. Estimation of Ferrous and Ferric ion using
   a. Standard $KMnO_4$ Solution.
   b. Standard $K_2Cr_2O_7$ solution.
3. Estimation of Calcium by $KMnO_4$ Solution.
4. Standardization of thiosulphate solution with $K_2Cr_2O_7$ solution.
5. Estimation of Copper Iodometrically.

Books Recommended:

1. **Revised by G. Svehla:** Vogel's Qualitative Analysis, Orient Longman
2. **W.G. Palmer:** Experimental Inorganic Chemistry, Cambridge
3. **A.K. De & A.K. De:** Inorganic Chemistry and Analysis, New Age International.

SECOND UNIVERSITY EXAMINATION

PAPER-IV (INORGANIC CHEMISTRY)

Full Marks – 75 Duration 3 hours

Unit-I

a. **Distribution of electrons in organic molecules:**
Inductive effect, Resonance & Hyperconjugation (Conditions, effect of electron withdrawing and donating groups, steric effect, influence on acidity, basicity and dipole moment)

b. Reaction Intermediates (Formation, Stability and Structur): (i) Carbocation, (ii) Carbanion

c. Reactions in Organic Compounds:

(i) Classification of reactions: Substitution, Addition, Elimination, Electron Transfer Reactions, Molecularity, Order of reactions, Transition state and Intermediate, Nucleophiles and Electrophiles.

(ii) Reaction Mechanisms: SN_1, SN_2, EL, E_2, AdE and and (Full forms, Explanation with examples, details not required).

Unit-II

a. Configurational isomerism:
   (i) Optical Isomerism: Introduction, Condition for optical activity, Optical rotation, Specific rotation, D&L Convention, R&S notations, Optical isomers of lactic, threonic and tartaric acids, Enantionmers and Disastereomers, Threo and Erythro nomenclature, Meso compounds, Racemic modification, Methods of resolution.
   (ii) Geometrical Isomerism: Introduction, Strucutural requirement (cis & trans, syn & anti) E.Z. convention, configuration of oximes.

b. ConformationalIsomerism: Introduction, conformations of Ethane & n-Butane.

Unit-III

a. Grinard's Reagent: Preparation, Structure, Synthetic uses.

b. Esters containing active methylene group:
   (i) Acetoacetic Estr: Synthesis, Synthetic uses, Structure, Keto-enol tautomerism.
   (ii) Malonic ester: Preparation and Synthetic uses.

Unit-IV

a. **Carbonhydrate:** Classification, Configuration of sugars, Glucose and Fruetose (Occurrence, Reaction: Osazone formation with Fehiling's solution, Mutarotation, Elucidation of the structure of D-glucose (Open chain and ring structural), Inter-conversion of sugars.

b. **Heterocyclic Compounds:**
Five membered heterocycles: Pyrrole, Thiophene and Furun: Synthesis (from Sugar, Dicarbonyl compound), Properties (Aromaticity, Electrophilic substitution reactions).

c. Alicyclic compounds: Preparations, Reactions & Stability.

Unit-V

a. Aryl Nitrogen Compounds:
   (i) Nitro hydrocarbons, Preparations, Properties, Reduction of nitrobenzene, TNT.
   (ii) Amines: Preparations (Reduction of notro compounds), Properties (dia oreaction, alkylation, basicity), Structure and synthetic uses of benezenediazonium salt, Comparison with aliphatic amines.

b. Aryl Oxygen compounds:

(i) Phenols: Preparation (diazo reaction and fusion), Properties (acidity, reactions with alkyl and aryl halides, esterfication, electro philic substitution, Kolbe synthesis Diazonium coupling) Comparison with alcohols.

(ii) Aryl Aldehydes and Ketones: Preparation (Etards reactions, Friedal Craft reaction), Properties (Addition reactions, Cannizoro's Benzoin, Perkin and Indoform reactions.

(iii) Aryl Carboxylic Acid: Preparation (Oxidation, Hydrolysis of nitrilies, Gringnard's reaction), Properties (Acidity, Reactions with PCL_5, $SOC1_2$ alcohol, NH_3 and Electrophilic substitution reactions).

Book Recommended:

1. **B.S. Bhal & A. Bhal:** Advanced Organic Chemistry, S. Chand Co. Ltd.
2. **S.M. Mukherjee, S.P. Singh and K.P.Kapoor:** Organic Chemistry- Vol-I & II, Wiley Easter Ltd., New Age International.
3. **P.L. Soni & S.M.Chawla:** Text Book of Organic Chemistry, S. Chand Co. Ltd.
4. **P.P. Klasi:** Stereochemistry, New Age International.
5. **O.D. Tyagi & M. Yadav:** A Text Book of Organic Reaction Mechanism, Anmol Publication

PAPER-V (GENERAL CHEMISTRY)

Full Marks – 75 Duration 3 hours

Unit-I Nuclear Chemistry

Fundamental particles, Size and Stability of nucleus, Nature and Artificial Radioactivity, Radioactivity decay kinetics, Unit of Radioactivity, Dist-integration series, Nuclear transmutation, Nuclear fission and fusion, Nuclear reactions, Hydrogen bomb, Radioactive isotopes and their applications in Industry, Agriculture and Medicine.

Unit-II Biochemistry:

a. Classification, Structure and Stereochemistry of amino acids, Acid-base behaviours, Isoselectric point and Electrophoresis, Preparation and reactions of a Amino acids.
b. Structure and nomenclature of Peptides and Proteins, Classification of proteins, Peptide structure determination, End group analysis, selective hydrolysis, Classical peptide synthesis, Solid phase peptide synthesis, Structure of peptide and proteins, Proteins denaturation and renaturation.
c. Nuleic Acids: Introduction, Constitution of Nulceic Acids, Double helical structure of DNA.

Unit-III Environmental Chemistry:

The natural cycles of the Environment (The Hydrological, Oxygen, Nitrogen, Phosphate and Sulphur cycles), Environmental segments (Atmosphere, Hydrosphere and Lithosphere).

Unit-IV Industrial Chemistry:

Processes, Cement (Types and their composition, Nanufacture, Setting, Uses), Glass (Introduction, Physical and Chemical properties, Manufacture and some special glasses), Chemical Fertilizers: Introduction, Classification, Nitrogenous fertilizers: Ammonium Nitrate, Ammonium Sulphate and Urea).

Unit-V Polymer Chemistry:

Introduction, Chain Polymerization (Free radical, Ionic and Co-ordination Polymerization), Step polymerization (Polycondensation, Polyaddition, ring opening), Electrochemical polymerization, Meta Thettical Polymerization and group transfer polymerization, Co-polymerization (introduction, free radical and ionic co-polymerization).

Books Recommends:

For Unit-I

1. **B.R.Puri, L.R. Sharma & K.C. Kala:** Principle of Inorganic Chemistry, S. Chand Co. Pvt. Ltd.
2. **K.D. Sharma:** Modern College Chemistry, Kalyani Publisher

For Unit-II

3. **B.S. Bhal & A. Bhal:** Advanced Organic Chemistry, S. Chand Co. Ltd., pp. 1-79.

For Unit-III

4. **A.K.De:** Environmental Chemistry – 4th Ed., New Age International.

For Unit-IV

5. **M.G. Arora & M. Singh:** Industrial Chemistry, Anmol Publisher, pp. 214-226 & 296-339.

For Unit-V

6. **V.R. Gowrikar, N.V. Viswanathan & J. Sreedhar:** Polymer Science, New Age International, pp. 1-85 & 193-212.

PAPER-VI

Full Marks – 50 Duration 4 hours

Experiment-1

Systematic identification of simple organic compounds (mono functional) C.,H.,O and C.,H.,O, N systems.

Experiment-2

(a) Preparation of buffer solution of

1. Ch_3COONa & CH_3COOH
2. NH_4Cl & NH_4OH
3. NaH_2PO_4 & Na_2HPO_4

Measurement of their pH by pH meter.

(b) Determination of rate of reaction of acid hydrolysis of an ester.

Books Recommended:

1. **N.K. Vishnoi:** Advanced Practical Organic Chemistry, Vikash
2. **R.C. Das & B. Behera:** Experements in Physical Chemistry, Tata McGraw Hill

CHEMISTRY (HONS)

COURSE STRUCTURE:

FIRST UNIVERSITY EXAMINATION

There shall be two theory papers each carrying 75 marks and each of 3 hours duration and one practical paper carrying 50 marks of 4 hours duration.

Paper-I (Theory)	Physical Chemistry-I	75 Marks.
Paper-II (Thory)	Inorganic Chemistry-I	75 Marks
Paper-III (Practical)	Inorganic Qualitative Anaylsis	50 Marks
a. Experiment	35 Marks	
b. Viva-Voce	10 Marks	
c. Record	05 Marks	

SECOND UNIVERSITY EXAMINATION

There shall be two theory papers each carrying 75 marks and each of 3 hours duration and one practical paper carrying 50 marks of 4 hours duration.

Paper-IV (Theory)	Organic Chemistry-I	75 Marks.
Paper-V (Theory)	General Chemistry	75 Marks
Paper-VI (Practical)	Inorganic Qualitative Anaylsis	50 Marks
a. Experiment	35 Marks	
b. Viva-Voce	10 Marks	
c. Record	05 Marks	

FINAL UNIVERSITY EXAMINATION

There shall be four theory papers each carrying 75 marks and each of 3 hours duration and one practical paper carrying 100 marks of 6 hours duration.

Paper-VII (Theory)	Physical Chemistry-II	75 Marks.
Paper-VIII (Theory)	Inorganic Chemistry-II	75 Marks
Paper-IX (Theory)	Organic Chemistry-II	75 Marks
Paper-X (Theory)	Analytical Chemistry (Instrumentation Method)	75 Marks
Paper-XI (Practical)		100 Marks

DETAILED COURSE

FIRST UNIVERSITY EXAMINATION

PAPER-I (PHYSICAL CHEMISTRY-I)

Full Marks – 75 Duration 3 hours

Unit-I

Kinetic Theory of Gases: Maxwell-Boltzmann distribution of molecular velocities (Mathematical derivation excluded), Calculation of Root Mean Square (R.M.S.),Most probable and Average velocities and the relation between them, Mean free path, Collision frequency, Derivation of gas laws from ideal behavior, Vanderwall' sequation of state, Critical phenomena and Critical constants, Law of corresponding states and reduced equation of state, Liquefaction of gases.

Unit-II

Chemical Kinetics: Order and Molecularity, Kinetics of 1^{st} and 2^{nd} order reactions, Determination of order of a reaction, Simple opposing (A&B) reaction, Consecutive or Sequential (A-B-C) reaction, Chain reaction (H_2 + Br_2), Effect of temperature on reaction rate, Collision theory of reaction rate Qualitative treatment of Transition state theory.

Unit-III

a. Thermodynamic Concepts: Heat Content and Heat capacity, Isotehrmal and Adiabatic changes, Work done for ideal and Vanderwaal's gases.
b. Thermo Chemistry: Heat changes in chemical reaction, Hess's Law of constant heat summation, Kirchoffs equation.
c. Second law of thermodynamics: Spontaneous process, Carnot's theorem and Cannot's cycle, Efficienty of heat engines, Entropy changes in reversible and irreversible processes, Free energy and work function, Conditions of equilibrium, Claypeyeron and Classisus equation, Gibbs' Helmholtz equation.

Unit-IV Homogeneous gaseous equilibrium:

Law of Mass Action and the Thermodynamic derivation of the expression for the equilibrium constants, Different forms of equilibrium constants, Le-Chatelier's principles,Illustration with some gaseous reactions, Effect of temperature on equilibrium, Vant-hoff's equation and its integration.

Unit-V Dilute Solutions:

Vapor pressure, Roult's Law, Thermo Dynamic derivation of laws telating to elevation of Boiling point, depression of Freezing point and Osmotic Pressure, Ideal and Non-Ideal solution, Association and Dissociation.

Books Recommends:

1. **Bhal and Tuli:** Essential of Physical Chemistry, S. Chand Co. Pvt. Ltd.
2. **Puri, Sharma and Pathania:** Principle of Physical Chemistry, Vishal Publishing Co.
3. **K.L.Kapur:** A Text Book of Physical Chemistry- Vol.-1-4, Macmillan Publisher
4. **Poni & Dharmarha:** Text Book of Physical Chemistry, S. Chand & Sons.
5. **P.W. Atkins:** Physical Chemistry, Oxford Publication.

PAPER-II (INORGANIC CHEMISTRY-I)

Full Marks – 50 Duration 4 hours

Unit-I Structure of Atoms:

De-Broglie matter waves, Heisenberg's uncertainty principle and its verification, Schrodinger's wave equation, Significance of wave equation, Schrodingers equation for the hydrogen atom (Solution of the equation for hydrogen atom is not required), Theta-, Phi- and R equation, Quantum numbers and their significance, Concept of redial and angular wave functions, spherical harmonics (Mathematical derivation not required), Radial and Angular distribution curves, Shape of S.P.D. orbitals L.S. coupling scheme, Derivation of ground term symbols for d' and d" systems.

Unit-II Chemical Bonding:

a. Ionic Bond: General characteristics, Born equation and its application, Polarixability, Fajan's rule, percentage of ionic character from dipolemoment and electro-negativity difference, Solvation energy.
b. Covalent Bond: Valence Bond approach, Heitler – London treatment of H^2 molecule (Mathematical treatment excluded), Concept of resonance and Resonance energy, Directional characteristics of covalent bond, Concept of hybridization, Deduction of geometry of the following type of ions, molecules from hybridization, AB_2, AB_3, AB_2E, AB_4, AB_3E, AB_2E_2, AB_4E, AB_3E_2, AB_2E_3, AB_6, AB_5E, AB_4E_2 (Where 'E' represents lone pair of electron).
c. Qualitative treatment of Molecular orbital theory: Bonding, Antibonding, Nonbonding Molecular orbitals, Molecular orbitals, Mo configuration of H_2, N_2, O_2, CO, NO, HS and their ions.

Unit-III Compound of p-Block Elements: (Preparation & Structure)

a. Boron Family: Boric Acid, Hydrides of boron and Borazole.
b. Carbon Family: Carbides, Silanes, Silicates and Silicones.
c. Nitrogen Family: Hydrides of Nitrogen
d. Oxygen Family: Oxygen Fluorides, Peracids of sulphur.
e. Halogen Family: Oxides & Oxy acids of Chlorides Inter Halogen compounds.

Unit-IV Chemistry of d-Block Elements:

Electronic configuration and Comparative studies of 1st Row, 2nd Row and 3rd Row transition series with special reference to atomic and ionic radii, ionization potential, redox potential, oxidation state, metallic nature and captalytic activity, Principle of Extractions and Chemistry of Silver, Chromium & Manganese.

Unit-V Co-ordination Compounds:

Ligands, Co-ordination Number, Co-ordination sphere, Nomenclature, Wener's co-ordination theory, Effective Atomic Number (EAN) concepts, Chelates, Isomerism in co-ordination compounds, Valance bond theory of transition metal complexes with special reference to octahedral, tetrahedral & square planner complexes.

Books Recommends:

1. **Satya Prakash, G.D. Tuli, S.K. Basu & R.D. Madan:** Advance Inorganic Chemistry. Vol-1, S. Chand Co. Pvt. Ltd.
2. **B.R. Puri, L.R.Shrama & K.C. Kala:** Principle of Inorganic Chemistry, S. Chand Co. Pvt. Ltd.
3. **K.D. Sharma:** Modern College Chemistry, Kalyani Publisher
4. **P.L.Soni:** Text Book of Inorganic Chemistry, S. Chand Co. Pvt. Ltd.

PAPER-III (INORGANIC PRACTICAL)

Full Marks – 50 Duration 4 hours

Experiment-1

Qualitative Analysis of mixtures of inorganic substances containing not more than six radicals (Interfering Acid Radicals like PO_4^{-3} , F and mixture of acid radicals like CO_3^{-2}, SO_3^{-2}, $S^{-2}, NO_2^{-1}, Cl^{-1}, Br^{-1}$, PO_4^{-3}. AsO_4^{-3}, NO_3^{-}, | SO_4^{-2} (one insoluble substance such as *$BaSO_4$, Al_2O_3, $SrSO_4$* or *SnO_2* May be given)

Books Recommends:

1. **G.Svehla: (Revised)** Vogel's Qualitative Analysis, Orient Longman.
2. **W.G. Palmer:** Experimental Inorganic Chemistry, Cambridge
3. **A.K. De & A.K. De:** Inorganic Chemistry and Analysis, New Age International.

SECOND UNIVERSITY EXAMINATION

PAPER-IV (ORGANIC CHEMISTRY-I)

Full Marks – 75 Duration 3 hours

Unit-I

a. **Distribution of electrons in organic molecules:**
Inductive effect, Resonance & Hyperconjugation (Conditions, effect of electron withdrawing and donating groups, steric effect, influence on acidity, basicity and dipole moment)

b. Reaction Intermediates (Formation, Stability and Structure): (i) Carbocation, (ii) Carbanion

c. Reactions in Organic Compounds:
   (i) Classification of Reactions: Substitution, Addition, Elimination, Electron transfer reactions, Molecularity, Order of reactions, Transition state and Intermediate, Nucleophiles and Electrophiles.
   (ii) Reaction Mechanisms, SN_1, SN_2, E_1, E_2, AdE and and (Full forms, Explanation with examples, details not required).

Unit-II **Stereo Chemistry:**

a. Configurational isomerism:

i. Optical Isomerism: Introduction, Conditions for optical activity, Optical rotation, Specificrotation, D&L convention, R&S notations, Optical isomers of lactic, threonic and tartaric acids, Enantiomers and Diastereomers, Threo and Erythro nomenclature, Meso compounds, Racemic modification, Methods of resolution.

ii. Geometrical isomerism: Introduction, Structural requirement (cis & trans, syn & anti) E.Z. convention, configuration of oximes.

b. Conformational Isomerism: Introduction, Conformations of Ethane & n-Butane.

Unit-III

a. Grignard's Reagent: Preparation, Strucuture, Synthetic uses.

b. Esters containing active methylene group:
   (i) Acetoacetic Estr: Synthesis, Synthetic uses, Structure, Keto-enol tautomerism.
   (ii) Malonic ester: Preparation and Synthetic uses.

Unit-IV

a. **Carbonhydrate:** Classification, Configuration of sugars, Glucose and Fruetose
(Occurrence, Reaction : Osazone formation, with Fhling's solution, Mutarotation, Elucidation of the structure of D-glucose (Open chain and ring structural), Interconversion of sugars.

b. **Heterocyclic Compounds:**
Five membered heterocycles: Pyrrole, Thiophene and Furun: Synthesis (from sugar dicarbonyl compound), Properties (Aromaticity, Electrophilic substitution reactions).

c. **Alicyclic Compounds:** Preparations, Reactions and Stability.

Unit-V

a. Aryl Nitrogen Compounds:

1. Nitro hydrocarbons, Preparations, Properties, Reduction of Nitrobenzene, TNT
2. Amines: Preparation (Reduction of notro compounds), Properties, (dia oreaction, alkylation, basicity), Structure and synthetic uses of benezenediazonium salt, Comparison with alphatic amines.

b. **Aryl Oxygen Compounds:**

1. Phenols: Preparation (diazo reaction and fusion), Properties (acidity, reactions with alkyl and aryl halides, esterfication, electrophilic substitution, Kolbe synthesis Diazonium coupling), Comparison with alcohols.
2. Aryl Aldehydes and Ketones: Preparation (Etards reactions, Friedal Craft reaction), Properties (Addition reactions, Cannizoro's, Benzoin, Perkin and Indoform reactions.
3. Aryl Carboxylic Acid: Preparation (Oxidation, Hydrolysis of nitries, Grignard's reaction), Properties (Acidity, Reactions with PCL_5, $SOCl_2$ alcohol, NH_3 and Electrophilic substitution reactions).

Books Recommends:

1. **B.S. Bhal & A. Bhal:** Advanced Organic Chemistry, S. Chand Co. Pvt. Ltd.
6. **S.M. Mukherjee, S.P. Singh and K.P.Kapoor:** Organic Chemistry- Vol-I & II, Wiley Easter Ltd., New Age International.
7. **P.L. Soni & S.M.Chawla:** Text Book of Organic Chemistry, S. Chand Co. Ltd.
8. **P.P. Klasi:** Stereochemistry, New Age International.
9. **O.D. Tyagi & M. Yadav:** A Text Book of Organic Reaction Mechanism, Anmol Publication

PAPER-V (GENERAL CHEMISTRY)

Full Marks – 75 Duration 3 hours

Unit-I Nuclear Chemistry

Fundamental particles, Size and Stability of nucleus, Nature and Artificial Radioactivity, Radioactivity decay kinetics, Unit of Radioactivity, Dist-integration series, Nuclear transmutation, Nuclear fission and fusion, Nuclear reactions, Hydrogen bomb, Radioactive isotopes and their applications in Industry, Agriculture and Medicine.

Unit-II Biochemistry:

a. Classification, Structure and Stereochemistry of amino acids, Acid-base behaviours, Isoselectric point and Electrophoresis, Preparation and reactions of a Amino acids.
b. Structure and nomenclature of Peptides and Proteins, Classification of proteins, Peptide structure determination, End group analysis, selective hydrolysis, Classical peptide synthesis, Solid phase peptide synthesis, Structure of peptide and proteins, Proteins denaturation and renaturation.
c. Nuleic Acids: Introduction, Constitution of Nulceic Acids, Double helical structure of DNA.

Unit-III Environmental Chemistry:

The natural cycles of the Environment (The Hydrological, Oxygen, Nitrogen, Phosphate and Sulphur cycles), Environmental segments (Atmosphere, Hydrosphere and Lithosphere).

Unit-IV Industrial Chemistry:

Processes, Cement (Types and their composition, Nanufacture, Setting, Uses), Glass (Introduction, Physical and Chemical properties, Manufacture and some special glasses), Chemical Fertilizers: Introduction, Classification, Nitrogenous fertilizers: Ammonium Nitrate, Ammonium Sulphate and Urea).

Unit-V Polymer Chemistry:

Introduction, Chain Polymerization (Free radical, Ionic and Co-ordination Polymerization), Step polymerization (Polycondensation, Polyaddition, ring opening), Electrochemical polymerization, Meta Thettical Polymerization and group transfer polymerization, Co-polymerization (introduction, free radical and ionic co-polymerization).

Books Recommends:

For Unit-I

1. **B.R.Puri, L.R. Sharma & K.C. Kala:** Principle of Inorganic Chemistry, S. Chand Co. Pvt. Ltd.
2. **K.D. Sharma:** Modern College Chemistry, Kalyani Publisher

For Unit-II

3. **B.S. Bhal & A. Bhal:** Advanced Organic Chemistry, S. Chand Co. Ltd., pp. 1-79.

For Unit-III

4. **A.K.De:** Environmental Chemistry – 4th Ed., New Age International.

For Unit-IV

5. **M.G. Arora & M. Singh:** Industrial Chemistry, Anmol Publisher, pp. 214-226 & 296-339.

For Unit-V

6. **V.R. Gowrikar, N.V. Viswanathan & J. Sreedhar:** Polymer Science, New Age International, pp. 1-85 & 193-212.

PAPER-VI (PRACTICAL)

Full Marks – 50 Duration 4 hours

1. Estimation of Calcium by precipitation of oxalate & standardization of $KMnO_4$ using Sodium oxalate.
2. Estimation of Ferrous and Ferric ion in a mixture using standard $K_2Cr_2O_7$.
3. Estimation of Copper Iodometrically and Standardization of thiosulphate with $K_2Cr_2O_7$ solution.
4. Estimation of Chloride using Volhard's method (Ferric alum indicator).
5. Gravimetric estimation of
   (a) Barium as $BaSO_4$
   (b) Nickel as Dimethylglycoxime.

Books Recommends:

1. **J. Bassell, R.C. Denny, G.H. Jeffery & J. Mendharm: (Revised)** Vogel's Qualitative Analysis, ELBS Publication.
2. **A.K. De & A.K. De:** Inorganic Chemistry and Analysis, New Age International.

FINAL UNIVERSITY EXAMINATION

PAPER-VII (PHYSICAL CHEMISTRY-II)

Full Marks – 75 Duration 3 hours

Unit-I

a. Law of independent migration of ions, ionic velocities and mobilities, Weak and Strong electrolytes, Arrhenius theory, Debye-Huckel theory (Qualitative idea only).
b. Application of conductance, Measurement for determination of Solubility and Solubility product, Degree of ionization, Ionic product of water, Hydrolysis constant.
c. Transference number and its determination by Hittorfs method and moving boundary method, Conductometric titrations.

Unit-II Electromotive Force:

Galvanic cell, Cell reactions, Reversible electrode, Thermodynamic parameters of reversible cell, Nernest equation and expression for single electrode potential, Reference electrode (calomel, Hydrogen, Silver chlorides) Redox potential, Concentration cells with and without transference, Liquid junction potential, Determination of solubility product, ionic product of water, and mean ionic activity Coefficient of electrolyte.

Unit-III

1. Equilibrium in electrolytes: Acids and bases, Bronsted and Lowry theory, Determination of pH by EMF method, Hydrogen, Quinohydrone and glass electrodes.
2. Hammett acidity function: Buffer solution, Henderson equation, Acid-Base indicators and indicator constants, Neutralization curves.

Unit-IV Surface Chemistry:

a. Colloid and Surface Chemistry: Physiorption and Chemisorptions, Adsorption isotherm derivation of Froundlich and Longmuir absorption isotherms, Gibbs adsorption isotherms, BET equation and their significance, Soaps and detergents, Micelle formation, Critical Micellar concentration (CMC).
b. Heterogenous Equilibrium: Phase, component, degree of freedom, Phase Rule, Phase Diagram of one and two component systems.

Unit-V Photochemistry:

Beer's Lambert's Law, Gretthus Draper law, Stark Einstein law of photochemical equivalence, Quantum yield, Comparison between thermal and photochemical reactions, Decomposition of Hl and HBr, Elementary ideas about photosensitized reaction and photosynthesis, Joblensky diagram, Fluroscence, Chemoluminiscence, Biolumini scence.

Books Recommends:

1. **Bhal, Bhal & Tuli:** Essential of Physical Chemistry, S. Chand Co. Pvt. Ltd.
2. **Puri, Sharma & Pathania:** Principle of Physical Chemistry, Vishal Publishing Co.
3. **K.L. Kapoor:** A Text Book of Physical Chemistry, Vol.-1-4, Macmillan Publisher.
4. **Soni & Dharmrha:** Text Book of Physical Chemistry, S. Chand & Sons.
5. **P.W. Atkins:** Physical Chemistry, Oxford Publication.

PAPER-VIII (INORGANIC CHEMISTRY-II)

Full Marks – 75 Duration 3 hours

Unit-I

Metal-ligand bonding in metal complexes: Crystal field theory, Qualitative idea about d-orbital splitting in octahedral and square planner field, Calculation of crystal field stabilization energy, explanation of magnetism, geometry and colour of the co-ordination compounds on the basis of the above theory, Jhon-teller effect in octahedral complex.

Unit-II

Thermodynamic, Kinetic and magnetic aspects of metal complexes:

a. A brief outline of thermodynamic stability of metal complexes and factors affecting the stability, Substitution reactions of square planner complexes.
b. Types of magnetic behavior, methods of determining magnetic suspetibility, spin-only furmule, u_{eff} and u_{L+5} values, Orbital contribution to magnetic moments application of magnetic moment data for 3d-Metal complexes.

Unit-III Chemistry of f-block elements:

a. Lanthanides: General study, Electronic configurations, Oxidation states, Magnetic, Spectral and Complex forming properties, Lanthanides contraction, Its causes and consequences, Separation of Lanthanides by ion exchange methods Chemistry of Cerium.
b. Actinides: Electronic Structure, Comparision with lanthanides, ionic radii, Oxidation states and Stereochemistry, Chemistry of Uranium and Thorium.

Unit-IV Organometallic Chemistry:

Definition, Nomenclature and Classification, Preparation, Properties, bonding and applications of alkyls and aryls of Li, Al, Hg, Sn and Ti. A brief account of metal ethylenic complexes and homogeneous hydrogenation. Preparation, Structures and bonding of Carbonyls of Cr, Mn, Fe, Co, Ni, Effective atomic number rule.

Unit-V Inorganic Polymers and non-aqueous solvents:

a. Inorganic polymer: Types of Inorganic polymer, Comparision with organic polymer, Structure, Aspects and applications of silicones, Phosphonitrillic halides and condensed phosphates.
b. Non-aqueous solvents: Classification of solvents and their general characteristics, Solubility and Reaction in non-aqueous solvents (liq. NH_3 and liq. SO_2).

Books Recommends:

1. **R.D. Madan:** Modern inorganic Chemistry, S. Chand Co. Pvt. Ltd.
2. **F.A. Cotton, GMilllkinson & P.L. Gaus:** Basic Inorganic Chemistry, Wiley Publisher
3. **K.D. Sharma:** Modern College Chemistry, Kalyani Publisher
4. **B.R. Puri, L.R. Sharma & K.C. Kala:** Principle of Inorganic Chemistry, S. Chand & Co. Pvt. Ltd.

PAPER-IX (ORGANIC CHEMISTRY-II)

Full Marks – 75 Duration 3 hours

Unit-I

a. Reaction Intermediates: (Formation, Stability and Structure)
   (i) Free radicals
   (ii) Carbene
b. Aliphatic substitution reactions: SN_1, SN_2 and SN_i reactions (Kinetics, Stereochemistry, Structural and environmental aspects) Neighbouring group par ticipation reactions.
c. Conformational Isomerism: Introduction, Conformation of Cyclohexane, Conformational analysi of mono-and disubstituted cyclohexanes.

Unit-II

a. Heterocyclic compounds:
i. Six membered heterocycles: Pyridine and Quinoline (Preparation and reactions).
ii. Fused heterocycles: Urides and Purines, elucidation of the structure of Uric acid.
iii. Indigo: Structure and use.
b. Polynuclear Hydrocarbons: Maphthalene and Anthracene (addition and electrophilic substitution reactions, elucidation of their structures).

Unit-III

a. Alkaloids: Introduction, Isoprene Rule, Elucidation of the structure of Nicotine and papaverine.
b. Terpenes: Introduction, Isoprene Rule, Elucidation of the structure of Camphor
c. Vitamines: Introduction, Elucidation of the structure of Vitamin-C

Unit-IV

a. Molecular Rearrangement: Pinacole – Pinacolone, Demzenov, Dienone-phenol, Beckmann and Bezidine (Mechanism and applications).
b. Name reactions: Disel-Alder, Fries, Michael, Mannich, Reformatsky, Clasisen and Dickman (Principle, Mechanism and application).
c. Regent: $LiAl_4$, $NaBH_4HIO_4$, $Ph(OAc)_4$ PCC and DCC.

Unit-V

a. Dyes: Colour and Constitution, Classification, Chemistry and Synthesis of Methyl orgage, Bismarck Brown.
b. Drugs: Introduction, Synthesis and uses of Sulphanamides, Plasmoquin, Meprazine, Chlorop phenicol, Aspirin and Paracetamol.

Books Recommends:

1. **Jerry March:** Advanced Organic Chemistry, Jhon Wiley Publication.
2. **O.D. Tyagi & M. Yadav:** A Text Book of Organic Reaction Mechanism, Anmol Publication.
3. **P.S. Klasi:** Streochemistry, New Age International.
4. **I.L. Finar:** Organic Chemistry- Vol.-I & II, Orient Longman Publiction.
5. **Morison & Byod:** Organic Chemistry, Prentice Hall
6. **Agrwal:** Chemistry of Organic Natural Products, Vol.-I& II, Goel Publishers.
7. **G.Chatwal:** Chemistry of Organic Natural Products – Vol.-I & II, Himalayan Publication).
8. **G. Raj & K. Prakash:** Organic Name Reaction & Rearrangements, Media Pvt. Ltd.
9. **H.O. House:** Modern Organic Reactions, Benjamin.

PAPER-X (ANALYTICAL CHEMISTRY)

(INSTRUMENTAL METHODS)

Full Marks – 75 Duration 3 hours

Unit-I

UV- Visible Spectroscopy: Origin of molecular spectra, Absorption law, Instrumentation, Theory of electronic spectroscopy, Empirical calculation of absorption maxima for Dienes and Enones Woodward- Fisher rules, Other Applications, Problems involved.

Unit-II

IR Spectroscopy: Introduction, Range of IR radiation, Requirements of IR absorption, Modes of Vibration of atom in polytomic molecules, single beam and Double beam Spectrophotometer, Applications to organic and in organic compounds, Miscelleneous examples, Problems involved.

Unit-III

Nuclear Magnetic Resonance (NMR) Spectroscopy: Principle of NMR, Quantum description of NMR, Instrumentation, Chemical shift, Spin-Spin coupling, Application of NMR spectroscopy to simple organic compounds, problems involved.

Unit-IV

a. Mass Spectroscopy: Basic principles, Instrumentation, Types of ions produced in a mass spectrometer, Determination of molecular formula, Fragmentation Identification of the mass spectra of simple organic compounds.
b. Simple problems involving IR, NMR and Mass Spectra.

Unit-V

Chromatography: Principles, Classification, RF value, column chromatographs (Introduction, Adsorbents, Classification of adsorbents, Eluents, Preparation, Separation of components and application), paper chromatography (Introduction, Stationary phase, solvents, mechanism, types, Separation of components), Radial paper chromatography, Thin layer chromatograph (Introduction, preparation and application), Gas-Liquid chromatography and High performance liquid chromatographs (Preliminary idea).

Books Recommends:

1. **Y.R. Sharma:** Elementary Organic Spectroscopy, S. Chand Co. Pvt. Ltd.
2. **P.S. Kalsi:** Spectroscopy of Organic Compounds, New Age International

For Unit-V

1. **Y.R. Sharma & R.C. Acharya:** Analytical Methods in Chemistry, Kalyani Publisher, pp. 152-171.
2. **B.S.Furniss, A.J. Hanafold, P.W.G. Smith & A.R. Tatchel:** Vogels Text Book of Practical Organic Chemistry, Pearson Edn. Isn. Saurabh Printer Pvt. Ltd., pp. 197-234.

PAPER-XI (PRACTICAL)

Full Marks – 100 Duration 6 hours

A. Organic Chemistry Practical

Experiment-I

a. Detection of elements in organic compounds (C,N,S and Halogens)
b. Identification of Organic compounds containing C,H, and Halogens.

Experiment-II

a. Estimation of glucose, estimation of aniline and phenol.
b. Preparation of organic substance like Ethyl benzoate, acetamide, p-tolyisothiocyanate, picric acid, p-nitroaniline. required).

Books Recommends:

1. **B.S.Furniss, A.J. Hanafold, P.W.G. Smith & A.R. Tatchel:** Vogels Text Book of Practical Organic Chemistry, Pearson Edn. Isn. Saurabh Printer Pvt. Ltd., pp. 197-234.
2. **R.K. Bansal:** Laboratory Manual in Organic Chemistry
3. **N.K. Vishnoi:** Advanced Practical Organic Chemistry, Vikash Publishing House.

B. Analysitcal & Physical Chemistry Practical

Experiment-I

a. Study of the distribution equilibrium of iodine in water/benzene or water/ carbon tetrachloride or water/ chloroform medium at room temperature.
b. Determination of the pseudo first order hydrolysis rate constant of methyl acetate at room temperature in 0.5M H_2SO_4 and 0.5M HCl.
c. Determination of molecular mass of volatile liquid by Victor Mayers Methods..

Experiment-II

a. Estimation of calcium and magnesium in mixture by EDTA titration.

b. Estimation of total manganese in pyrolusite by Volhard's titration.
c. Estimation of manganese in mild steel.

Books Recommends:

1. **R.C. Dash & B. Behera:** Experiment in Physical Chemistry, Tata McGrawhill
2. **J.B. Yadav:** Advanced Practical Physical Chemistry, Goel Publisher
3. **J.C. Ghosh:** Experiment in Physical Chemistry
4. Vogel's Text Book of Quantitative Analysis **(ELBS)**

COMPUTER SCIENCE AND DATA PROCESSING (PASS)

COURSE STRUCTURE:

FIRST UNIVERSITY EXAMINATION

There shall be two theory papers each carrying 75 marks and each of 3 hours duration and one practical paper carrying 50 marks of 4 hours duration.

Paper-I (Theory)	C Programming and Data Structure	75 Marks.
Paper-II (Theory)	Operating System (DOS & UNIX)	75 Marks
Paper-III (Practical)	(C, DOS & UNIX)	50 Marks

SECOND UNIVERSITY EXAMINATION

There shall be two theory papers each carrying 75 marks and each of 3 hours duration and one practical paper carrying 50 marks of 4 hours duration.

Paper-IV (Theory)	Object Oriented Programming with C++	75 Marks.
Paper-V (Theory)	Database Management System (DBMS)	75 Marks
Paper-VI (Practical)	(C++ & FOXPRO)	50 Marks

DETAILED COURSE

FIRST UNIVERSITY EXAMINATION

PAPER-I (C-PROGRAMMING & DATA STRUCTURE)

Full Marks – 75 Duration 3 hours

Overview of C, constants, variables & data type operators and expressions, Managing I/O operators, Decision making and branching, looping, arrays, character strings, user defined functions, structure and union, pointers, Filemanagement in C, dynamic memory allocation and linked list, stacks, Lists and Tree.

Books Recommends:

1. **E. Balguruswamy:** Progamming in ANSI-C, Chapter-1-13.
2. **V. Rajaraman:** Computer Programming in C, Chapter – 15, 18.

PAPER-II (OPERATING SYSTEM (DOS & UNIX))

Full Marks – 75 Duration 3 hours

1. Introduction to DOS: Operating System Concept, Introduction to DOS, Booting, DOS files & File names, coiled cards, file extension, DOS internal and external commands.
2. Basic DOS commands: CLS, VER,REN,DEL, LABLE, CHKDSK, VOL, BOKP, DISKCOMP, DISKCOPY, PROMPT.
3. DOS files & Subdirectories: Directory, Sub-Directory, Root Directory MKDIR, CHDIR, RM DIR, TREE, PATH, APPEND
4. Input, Output, Redirection: Standard I/O, Redirection commands, Piping filters, DOS I?O, MORE, FIND, SORT.
5. Batch Processing: Batch files and process, Batch commands, Parameters, AUTOEXECBAT files.
6. EDLIN DOS Editor
7. Disk BACKUP & Restore
8. DOS common messages

9. Advanced DOS commands: ASSIGN, ATTRIB, EXIT, JOIN, EXIT, RECOVER, SYS, XCOPY, REPLACE, SET, SUBSET, CTTY ETC.
10. Working of DOS.

Books Recommends:

1. **Subas Mehta:** DOS made Simple, Galgotia Pub.
   UNIX – Files in UNIX System, Directory, hierarchy, creating, removing, changing and keeping track of directories, file access permissions, sending mail,copying, printing, renaming deleting and editing files, VI editor commands.
2. **Mohammad Azam:** UNIX in easy steps, Chapter 1 to 7.

PAPER-III (PRACTICAL (C. DOS & UNIX))

Full Marks – 50 Duration 4 hours

SECOND UNIVERSITY EXAMINATION

PAPER-IV (OBJECT ORIENTED C-PROGRAMMING WITH C++)

Full Marks – 75 Duration 3 hours

Principles of Objected Oriented Programming, Beginning with C++, Tokens, Expressions and control structures, functions in C++, classes and objects, constructors and destructors, operator overloading and type conversions, Inheritance,pointers, Virtual functions and polymorphism, Managing console I/O operations, working with files.

Books Recommends:

1. **E. Balguruswamy:** Object Oriented Programming with C++, Chapter-1-11

PAPER-V (DATABASE MANAGEMENT SYSTEM (DBMS))

Full Marks – 75 Duration 3 hours

Database Management Systems :Categorization of DBMS

Network Model: Typical structure, Explanation of DBTG set, links, owner, member, virtual fields, chains, DDL, Statements, Navigation in database for retrieval, insertion, updating and deletion.

Rational Model: Explanation of domain, Tubbs, Attributes, Relations Normalisation keys, Primary, Alternate candidate, Integrity rules, Navigation in database for retrieval, insertion, updating and deletion.

Hierarchical Model: Explanation of root segment, dependent segment, level of dependent segment, links, pointers, navigation in database for retrieval, insertion updating and deletion.

RDE\1S Package – FOXPRO – creation and maintenance of database file, Editing, browsing, listing, searching of records of dbf. Custom built screen report generation, printing reports, sorting and indexing a dbf. Creating prg files.

Books Recommends:

1. **D. Desai:** Database Management System, FOXPRO 2.5, Taxali.

PAPER-VI (PRACTICAL (C++ AND FOXPRO))

Full Marks – 50 Duration 4 hours

COMPUTER SCIENCE AND DATA PROCESSING (HONS

COURSE STRUCTURE:

FIRST UNIVERSITY EXAMINATION

There shall be two theory papers each carrying 75 marks and each of 3 hours duration and one practical paper carrying 50 marks of 4 hours duration.

Paper-I (Theory)	Digital Circuit & Computer Organization	75 Marks.
Paper-II (Theory)	Operating System	75 Marks
Paper-III (Practical)	a. Digital Circuit, b. Learning DOS	50 Marks

SECOND UNIVERSITY EXAMINATION

There shall be two theory papers each carrying 75 marks and each of 3 hours duration and one practical paper carrying 50 marks of 4 hours duration.

Paper-IV (Theory)	Computer Architecture & Microprocessor	75 Marks.
Paper-V (Theory)	Programming in C and Data Structure	75 Marks
Paper-VI (Practical)	a. Experiments with Microprocessor, b. Programming with C	50 Marks

FINAL UNIVERSITY EXAMINATION

There shall be four theory papers each carrying 75 marks and each of 3 hours duration and one practical paper carrying 100 marks of 6 hours duration.

Paper-VII (Theory)	File Organisation and Database Management System	75 Marks.
Paper-VIII (Theory)	Object Oriented Programming with C++	75 Marks
Paper-IX (Theory)	Data Communication & Computer Network	75 Marks.
Paper-X (Theory)	Elements of Java and Computer Graphics	75 Marks
Paper-XI (Practical)	a. DBMS Practical b. Project Work	100 Marks

DETAILED COURSE

FIRST UNIVERSITY EXAMINATION

PAPER-I (DIGITAL CIRCUIT AND COMPUTER ORGANISATION)

Full Marks – 75 Duration 3 hours

Unit-I **15 Marks**

Logic gates, Map simplification (sum ofproducts equation, product of sum equation, Kamaugh map) Boolean Algebra, Half Adder and Full Adder SR, D, JK (Master slave) and T flip-flaps, Decoders (using AND and NAND gates). Decoderexpansion, Multiplexer, Register with paralled load. Bidirectional shift register. 2-bit and 4-bit binary counters.

Unit-II **30 Marks**

Binary, Octal and Hexadecimal number systems and conversion from one to other. Binary coded Octal (BCO), Binary Coded Hexadecimal (BCH) and Binary Coded Decimal (BCD) representation ASCII code, {r-i}'s and r's complements. Fixed point representation., Subtraction of signed and Unsigned binary numbers. Overflow, Floating point representation, Gray code, Error deletion code.

Register transfer language, BUS and memory transfer, Arithmetic micro-operations and arithmetic circuit, Logic microoperations and the Logic circuit, Shift micro operations.

Unit-III **30 Marks**

Instruction code, Basic Computer registers connected to a common bus. Memory reference, Register reference and Input-output instruction sets. Timing signals and Control unit. Instruction cycle and its flow chart Register reference and Memory reference instructions with their control functions Input-output and program interrupt.

Memory Hierarchy RAM and ROM chips and their interconnection to CPU. Memory Address Map, Direct Memory Access and Input-Output processor.

Text Book

1. **M. Morris Man:** Computer System Architecture, PHI

Reference Books:

1. **A.S. Tannenbaum:** Structural Computer Organisation, PHI
2. **William Stallings:** Computer Organisation and Architecture: Principle of Structure and Function, Me MUlan Publishing.

PAPER-II (OPERATING SYSTEMS)

Full Marks – 75 Duration 3 hours

Unit-I **45 Marks**

Operating Systems objectives and functions, Operating system as resource manager, evolution of OS, types of OS, Architecture of UNIX Process description and control, Examples of UNIX process.

Memory management: Requirements, Partitioning, simple paging, simple segmentation, virtual memory, page table structure, page size, 70m bined paging and segmentation, page replacement algorithms, cache memory.

Processor management, Types of scheduling, scheduling algorithms, concurrency, Deadlock and starvation.

I/O management and Disk scheduling, Direct memory Access, Buffering, Disk scheduling algorithms, File management, File allocation methods.

Unit-II **30 Marks**

Learning MS-DOS Directory commands dir (along with attribute and order options), cd (chdir), mkdir(md), rd (or rmdir). Concept of path, parent directory and directory tree.

Naming of DOS files, del, erase, copy, move, type, more, rename, print, tree, date, time, CLS commands, Creating/editing a file by edit. Changing attribute. Wild card notation, Batch files, Formatting a floppy.

Learning UNIX (or LINUX): Brief idea about dev, bin, lib, etc, tmp, usr (or home) directories in root, ordinary file, directory file and special file, Login, logout, shutdown procedures, changing password.

General UNIX commands such as tty, sleep n, clear, echo, cal, data, man, who, who am I, pwd. Message sending through write and mail commands and wall commands for running high level programs, Creating files by vi text editors and the vi commands. Commands relating to files, such as, cat, more, pg, grap, sort, comm., cmp, rm, mv, cp, Redirection through and Printing files (I(pstat, cancel, Ip-w and Ip-m commands). Change of access permission by chmod. Pipes and pipelines. Background process (pi and kill commands) Alloting user name and password to a user.

Elements of UNIX shell programming – Assigning value to shell variable and displaying value assigned to shell variable. Exporting variables, Creating shell scripts through read command and positional parameters. Set command, changing shed prompt.

Learning Windows: Desktop icons such as My Computer, Recycle Bin, Network neighbourhood etc, start menu, task bar and application box. Title bar, minimize, maximize and close buttons, Scroll Bar, Scroll button and thumb. Menu bar, Menu and its options, opening a menu and selecting an option, Selecting a menu option by shortcut key. Special indicators in a menu such as toggle, triangle, ellipsis, Dialog box and its command and option buttons. Context Menu. Folder: Important features of Word pad and MS-Word.

Books Recommended:

Text Book:

1. **William Stallings:** Operating Systems, PHI

Reference Books:

1. **A. Silberchatz & Galvin:** Operating Systems, Addison Wesley
2. **Madnik & Donovon:** Operating System, McGraw Hill
3. **A.S. Tanenbaum:** Modern Operating System, Prentice Hall

PAPER-III (PRACTICAL)

Full Marks – 50 Duration 4 hours

a. Digital Circuit: Study of truth tables of Logic gates (AND, OR, NAND, NOR, INVERTER, XOR & XNOR), Verification of Boolean expressions and Qe Morgan's Theorem, Construction of Half Adder and Full Adder. Study of the characteristics of decoders and Multiplexers. Study of the characteristics of flip-flops, counters and converters (Decimal to binary)

b. Learning DOS commands, Creating a directory tree state with districts as subdirectories, each district having subdivisions as subdirectories and each subdivision having important towns as subdirectories. Creating a Bio-data file and a text file using edit (inside one of the towns subdirect of the above directory tree). Copying & moving the above two files to different subdirectories/directories of the above tree.

Repeating the aboye assignments using UNIX (and the vi text editor). Learning important UNIX commands, Learning Windows: Typing biodata using Wordpad and using MS-Excel (salary bill preparation; admission merit list preparation using formula).

SECOND UNIVERSITY EXAMINATION

PAPER-IV (COMPUTER ARCHITECTURE AND MICROPROCESSOR)

Full Marks – 75 Duration 3 hours

Unit-I **45 Marks**

Programming the basic computers Machine Language, Assembly language and its rules, The Assembler (First and Second pass), Program loops, Programing arithmetic and logic operations, Subroutines.

Central Processing Unit- Register and memory stack, Three address, two address, one address and zero address instruction, Addressing model, Data transfer and Data manipulation instruction. Arithmetic and shift instructions, Logical and bit manipulation instructions.

Input-Output Organisation: Input-Output Interface Asynchronous data Transfer, Storbe control, handshaking, First-In First-Out (FIFO) buffer, Direct memory access, DMA controller and DMA transfer.

Unit-II **15 Marks**

Evolution of Microprocessors, Architecture of 8085 microprocessor, Instruction Sets, Assembly Language Programming, Interfacing I/O devices with 8085, Keyboards, LED display unit, Memory interfacing and Address decoder concept.

Unit-III **15 Marks**

Architecture of 8086 microprocessor, Addressing model, Instruction sets, Assembler directives, Assembly language programming using 8086, Interrupts and interrupt service Procedures, Elementary idea of 32 bit microprocessor.

Text Book

1. **Douglas V. Hall:** Microprocessor and Interfacing, TH
2. **R.L. Goankar:** Microprocessor
3. **M. Morris Mano:** Computer System Architecture, PHI

Reference Books:

1. **A.P. Mathur:** Introduction to Microprocessor, TMH
2. **T. Luce:** Computer Hardware, System Software and Architecture, McGraw Hill
3. **M.Mano:** Digital Logic and Computer Design.

PAPER-V (PROGRAMMING IN C AND DATA STRUCTURE)

Full Marks – 75 Duration 3 hours

Unit-I **45 Marks**

C character set, identifiers and keywords, Data types, constants, variables, arrays, declarations, expressions, statements, symbolic constants.

Arithmetic, unary, relational, logical, assignment and conditional operators, Library functions.

Getchar, putchar, scanf, printf, gets and puts functions. Interactive (Conversational) programming, Preparation and running a complete C program.

If-else, while, do-while, for statements, Nested control structures, Switch, break, continue, gotot statements, comma operator.

Defining and accessing a function, Function prototypes passing arguments to a function, Recursion, Storage classes, Automatic, External (Global) and Static variables, Multifile programs and more about library functions.

Defining and processing an array. Passing arrays to functions. Multidimensional arrays, Arrays and strings.

Unit-II **30 Marks**

Pointer declaration, Passing pointers to functions. Pointers and one dimensional and multidimensional arrays. Dynamic memory allocation. Operations on pointers, Passing functions to other functions.

Defining and processing a structure, Typedef structures and pointers, Passing structures to functions, Self referential structures, Unions.

Creating opening, closing and processing a data file, Unformatted data files, Resistor variables, bitwise operations and bit fields, C processor.

Text Book:

1. **C Gottfreid:** Programming in C, Schaum Series

Reference Books:

1. **Let us C**
2. **E. Balguruswami:** Programming in C

PAPER-VI (PRACTICAL)

Full Marks – 50 Duration 4 hours

A. Experiments with Microprocessors:

Familiarity with 8085 and 8086 MP- Architecture and interfacing, Addressing models, Assembly language and machine language programming, writing of simple proram such as addition of integers in arithmetic progression, finding largest number among a given set of numbers, Interfacing 8086 with Keyboard and 7 segment display units.

B. Programming with C

Exercise to study various features of the C language, Writing of well structured modular programs, case studies of use of various data structures: stack, queue, list, binary tree using arrary and pointers and their applications in sorting, searching, string manipulation and list manipulations.

FINAL UNIVERSITY EXAMINATION

PAPER-VII (FILE ORGANISATION & DATA BASE MANAGEMENT SYSTEM)

Full Marks – 75 Duration 3 hours

Unit-I **45 Marks**

Basic concepts of data base system, Architecture, Storage structures, general indexing techniques, Data structures and corresponding operators – Relational, hierarchical and network approaches, Relational data structures – relations, domains, Keys, Architecture of System 'R' – system R data structures, data manipulations, embedded, SOL, external and internal levels of system 'R' query by examples.

Relational algebra, calculus, functional dependence, normalization (1NF, 2NF, 3NF, 4NF and 5NF).

Unit-II **30 Marks**

Hierarchical approach – data manipulation of an IMS system. The network approach- architecture of a DBTG system, DBTG data structure, External level of DBTG, data manipulation, unified database language.

Comparison of relational and network approaches, Protection of data base- integrity, security.

RDBMS packages – command structure of FOXPRO and its program application, Concept of MS-ACCESS, ORACLE.

Text Book:

1. **C.J. Date:** An Introduction to Database System (Vol.-I & II)

Reference Books:

1. **Silberscatz & Korth:** Database System Concepts
2. **Jeffery D. Ullman:** Principles of Database System, Golgotia Publication Pvt. Ltd.
3. **Bipin C. Desai:** Introduction of Data Base, Golgotia Publication Pvt. Ltd.

PAPER-VIII (OBJECT ORIENTED PROGRAMMING WITH C++)

Full Marks – 75 Duration 3 hours

Unit-I **15 Marks**

Principles of object oriented programming, Object Oriented Programming paradigm, basic concept of OOP, Benefits of OOP, applications of OOP, Structure of a C++ programme- creating a source file, compiling and linking a C++ programme.

Tokens, expressions and control structures – Key words, identifiers, data types, user defined data types, derived data types, symbolic constant, variables, operations in C++.

Unit-II **30 Marks**

Functions in C++ - functions prototyping, call by reference, return by reference, inline function, default argument, virtual function, function overloading.

Classes and objects – Defining class and member function, structure of a C++ programme with class, nesting of member function, memory allocation for objects, static data member, static member function, friend function, pointers to data members.

Constructors and destructors - default constructor and parameterized constructor, copy constructor, dynamic constructor, Constructor with default arguments, dynamic initialization of objects, constructor overloading destructors and its functions.

Unit-III **30 Marks**

Operator overloading and type conversions – defining operator overloading, overloading unary and binary operators, overloading binary operator using friend function, manipulation of strings using operators, rules for overloading operators, type Conversions.

Inheritance: Extending classes- defining derived classes, single inheritance, making a private member inheritable multiple in heritance, hierarchical inheritance, hybrid inheritance, virtual base class, abstract classes, constructors in derived class, nesting of classes.

Pointers, virtual functions and polymorphism – pointers to objects. This pointer, pointer to derive classes, virtual functions, pure virtual function.

Text Book:

1. **E. Balguruswami:** Object Oriented Programming with C++ (Ch. 1 to 9).

Reference Books:

1. **Rbert Lafore:** Object Oriented Programming in Turbo C++
2. **Venugopal:** Mastering C++
3. **Robert Lafora:** Object Oriented Programming in Turbo C++

PAPER-IX (DATA COMMUNICATION AND COMPUTER NETWORK)

Full Marks – 75 Duration 3 hours

Unit-I

Introduction to data communication and computer networks, concepts and terminologies, Network goals, motivation, application of computer networks, analog and digital data transmission, concept of noise, attenuation, delay Elementary idea about packet radio networks, broadcast network, satellite networks, LAN, WAN and MAN.

Transmission terminology – Simplex, half duplex, full duplex, Elementary idea about optical fibers, coaxial cable & twisted pair, wireless transmission.

Unit-II

Data encoding, modulation and demodulation techniques – AM, FM, Pulse Amplitude modulation and pulse code modulation, Modes of transmission (asynchronous and synchronous). Line Configuration and interfacing, Frequency division multiplexing, synchronous time division multiplexing and statistical time division multiplexing.

Unit-III

Error detection nd control (parity check, CRC), Flaw control, High level data link control, Circuit switching, message switching, packet switching, Routing and congestion control in packet switched networks, X.25, Rs232 Introduction to frame relay, ATM-ATM protocol, architecture ATM Cells.

Unit-IV

LAN architecture – BUS tree, ring, star, wireless LAN, Token ring, Routers, bridges, gateways – Principle of bridge operation, FOOL OSI reference model, TCPIP, ALOHA, slotted ALOHA, CSMA/CO principles of internet working, Internet protocols, IPV6, Transport protocols.

Unit-V

Network security and management, privacy message authentication, public key encryption, digital signature, IPV4 and IPV6 security.

Concept of e_mail, URL, HTTP, Concept of ISOM.

Text Books:

1. **William Stalling:** Data and Communication, PHI
2. **A.S. Tannenbaum:** Computer Networks, PHI

Reference Book:

1. **U. Black:** Computer Networks – Protocols, Standards and Interface, PHI

PAPER-X (ELEMENTS OF JAVA AND COMPUTER GRAPHICS)

Full Marks – 75 Duration 3 hours

Unit-I **30 Marks**

Elements of JAVA:

Basic Java features, difference…. C++, writing simple JAVA application program, Applet creation and working with HTML for wave page designing.

Unit-II **45 Marks**

Computer Graphics:

Desplay devices – language and point plotting system, Raster, vector, pixel and point plotters, Continual refresh and storage displays, digital frame buffer, plasma panel displays, Very high resolution devices, colour display techniques (shadowmask and penetration CRT, colour look up tables, analog false colours, hard copy colour printers).

Display description – Screen Co-ordinates, user co-ordinate Graphical data structures (compressed incremental list, vector list, use of homogeneous co-ordinates), Display code generation, Graphical functions. The view algorithm, two dimensional transformation.

Interactive Graphics – Pointing and positioning devices (cursor, lightpen, digitizing tablet, the mouse, track balls) interactive graphical techniques, positioning elastic lines, inking, zooming, panning, clipping windowing, scissoring.

Text Book:

1. **D.Hem & M. Pall:** Computer Graphics, Line Baker
2. **E. Balguruswamy:** Elements of JAVA, TMH

Reference Books:

1. JAVA & Complete Reference**, PHI**
2. **William M. Newman & Robert F. Spor UII:** Principles of Interactive Computer Graphics

PAPER-XI (PRACTICAL)

Full Marks – 100 Duration 6 hours

A. DBMS Practical

i. Familiarity with MS: ACCESS, FOXPRO
ii. File creation, manipulations, sorting, indexing, report writing.
iii. Creation of simple database applications with use of SQL queries.
iv. Use of forms and reports.
v. Sample applications such as:
   a. Examination marks database
   b. Hostel accounting
   c. Employee database

d. Library database.

B. Project Works

Each student has to submit a project work carrying 50 marks. This has to be examined by an external examiner.

ELECTRONICS (PASS)

COURSE STRUCTURE:

FIRST UNIVERSITY EXAMINATION

There shall be two theory papers each carrying 75 marks and each of 3 hours duration and one practical paper carrying 50 marks of 4 hours duration.

Paper-I (Theory)	Electrical Circuits	75 Marks.
Paper-II (Thory)	Semiconductor Devices	75 Marks
Paper-III (Practical)		50 Marks

SECOND UNIVERSITY EXAMINATION

There shall be two theory papers each carrying 75 marks and each of 3 hours duration and one practical paper carrying 50 marks of 4 hours duration.

Paper-IV (Theory)	Electronics Circuits-I	75 Marks.
Paper-V (Thory)	Electronics Circuits-II	75 Marks
Paper-VI (Practical)	Electronics Circuits Experiments	50 Marks

DETAILED COURSE

FIRST UNIVERSITY EXAMINATION

PAPER-I (ELECTRICAL CIRCUITS)

Full Marks – 75 Duration 3 hours

Circuits Fundamentals:

Concept of grounding, open circulating and short circuiting, different types of resistors, capacitors and inductors.

Electrical Networks:

Mesh and node analysis of network, network, theorems, statements and applications (without proof) of super position theorem, reciprocity theorem, The Venin's theorem, Norton's theorem and maximum power transfer theorem.

Transient Response:

Growth and decay of currents in R.C. and L in R-L and R.C. circuits time constants, pulse and square wave response of R.C. circuits.

AC Response:

AC Fundamentals, AC through R, Land C, AC through R-L, R.C. and L-C-R circuits, Q factor of a coil, series and parallel resonance in, L-C-R- circuits, sharpness of responance, tunning, tuned circuits, tuned transformer, double tuned transformer, coupled circuits, coefficient of coupling.

Filter network:

Filters, their types, ladder network as constant K-type simple low pass, high pass, band pass and band elimination filters.

PAPER-II (SEMICONDUCTOR DEVICES)

Full Marks – 75 Duration 3 hours

Semiconductor Fundamentals:

Concept of bonding and energy bands in Semiconductors, electrons and holes, Intrinsic and extrinsic Semiconductors, drift current in Semiconductors.

The P-N Junction:

Depletion layer, barrier voltage, forward and reverse biasing of P-N Junction, Junction break down, junction capacitance, fabrication of P-N junction diode, zener diode-voltage regulation, tunnel diode, varactor diode, schottky diode, steprecovery diode, thermistors, light emitting diode, photo diodes.

The Bipolar Junction Transistor:

Transistor currents, transistor circuit configurations, CS, CE & CC leakage current in transistor, transistor static characteristics in CS, CE & CC configurations and related formulae, transistor biasing, stability factor and beta sensitivity, different method of biasing, DC & AC load line, Q-point, Transistor equivalent circuits (DC & AC) equivalent circuits for CB, CE and CC amplifiers, small signal low frequency models for transistors in CB, CE and CC configuration (T model) and related formulae, the h-parapater, h-parameter for CB, CE configurations, h-parameter equivalent circuits and formulae for transistor amplifiers.

The Field Effect Transistors:

Junction FET, characteristics, small signal parameters, biasing and lond line, MOSFET – type and characteristics, applications.

Thyristors:

Principles, characteristics and applications of SCR, UJT, Disc, Triac and SCB.

PAPER-III (PRACTICAL)

Full Marks – 50 Duration 4 hours

A. Electrical Experiments:

Experiments relating to

1. Growth and decay of current in-a chapacitor.
2. R-C circuits
3. R-L circuits
4. Series resonance in L-C-R circuits
5. Parallel resonance in L-C-R circuits

B. Device Experiments:

Experiments relating to:

1. Characteristics of p-n-junction diode
2. Characteristics of BJT
3. Characteristics of JFET
4. Characteristics MOSFET
5. Chracteristics of Zenor diode

SECOND UNIVERSITY EXAMINATION

PAPER-IV (ELECTRICAL CIRCUITS-I)

Full Marks – 75 Duration 3 hours

Half wave and full wave rectifiers-ripple factor and efficiency, bridge rectifier; filters-series inductor, shunt capacitor, L-Section and II section filters, voltage regulation zener diode and transistor regulators, voltage divider, voltage doubler, tripler and quadrupler circuits controlled rectification circuits wave forms and applications.

Amplifiers:

Performance of Transistor amplifiers in CB, CE and CC configurations; RC coupled/CE potential amplifiers – frequency response, Miller effect, effect of cascading, alpha & beta cut off, frequency, gain band with product;

power amplifiers – Class A, B and C type Power amplifiers, Power relations and efficiency, the push-pull class 3 amplifiers, distortions in power amplifiers; feedback in amplifiers effect of negative feedback on gain, band with, stability and harmonic distortion analysis of current and voltage and shunt feedback circuits.

PAPER-V (ELECTRICAL CIRCUITS-II)

Full Marks – 75 Duration 3 hours

Oscillators:

Feedback and circuit requirements for oscillators tuned bass and tuner collector oscillators, Hartley and Colpitt oscillators, phase shift and wein bridge oscillators; crystal oscillators and Multivibrators.

Communication circuits:

Basic Principles of communication, modulation, amplitude modulation (AM) sidebands, power relations, percentage modulation, analysis of AM wave, SSB generation, circuits or AM, block diagram of an AM transmitter, frequency modulation (FM), modulation index, sidebands analysis of FM waves, demodulation, essentials of AM demodulation, diode detectors for AM AM signals, transistor detectors for AM signals, FM detection – the quadrature detectors, frequency conversion and the superheterodyne AM receiver (block diagram), FM receiver (block diagram).

PAPER-VI (PRACTICAL)

ELECTRONICS CIRCUITS EXPERIMENTS

Full Marks – 50 Duration 4 hours

Experiments relating to:

1. Half wave and full wave rectifiers with filters;
2. CE single stage and double stage transistors amplifiers.
3. Current & voltage feedback in transistors amplifiers.
4. Harley oscillator;
5. Colpitt oscillator;
6. Phase shift oscillator;
7. A stable multivibrator;
8. FST amplifiers;
9. Amplitude modulation and
10. Frequency modulation

Books Recommended:

1. **D. Raychoudhury,** Networks and Systems.
2. **Chopra and Shehgal,** Electricity and Magnetism.
3. **B.L. Theraja,** Basic Electronics
4. **B.C. Streetman,** Solid State Electronics Devices
5. **Millman and Halkias,** Electronic devices and circuits.
6. **J.D. Ryder,** Electronic Fundamentals and Applications.

ELECTRONICS (HONS)

COURSE STRUCTURE:

FIRST UNIVERSITY EXAMINATION

There shall be two theory papers each carrying 75 marks and each of 3 hours duration and one practical paper carrying 50 marks of 4 hours duration.

Paper-I (Theory)	Electrical Circuits	75 Marks.
Paper-II (Thory)	Semiconductor Devices	75 Marks
Paper-III (Practical)	Experiments on Electrical Circuits	50 Marks

SECOND UNIVERSITY EXAMINATION

There shall be two theory papers each carrying 75 marks and each of 3 hours duration and one practical paper carrying 50 marks of 4 hours duration.

Paper-IV (Theory)	Basic Electronic Circuits	75 Marks.
Paper-V (Thory)	Special Electronic Circuit	75 Marks
Paper-VI (Practical)	Device Experiments	50 Marks

FINAL UNIVERSITY EXAMINATION

There shall be four theory papers each carrying 75 marks and each of 3 hours duration and one practical paper carrying 100 marks of 6 hours duration.

Paper-VII (Theory)	Measurements, signals and Microprocessors	75 marks
	A. Electronic measurements and Instrumentation	40 Marks
	B. Elements of Microprocessors	35 Marks
Paper-VIII (Theory)	Signal and System	75 Marks
Paper-IX (Theory)	Computer Fundamentals	75 Marks
Paper-X (Theory)	Computer Programming	75 Marks
Paper-XI (Practical)	Practical Electronic circuit & Computer Programming Experiment.	100 Marks

DETAILED COURSE

FIRST UNIVERSITY EXAMINATION

PAPER-I (ELECTRICAL CIRCUITS)

Full Marks – 75 Duration 3 hours

Circuits Fundamentals:

Concept of grounding, open circuiting and short circuiting, different types of resistors, capacitors and indicators.

Electrical Networks:

Mesh and node analysis of network, network, theorem statement and application (without proof) of super position theorem, reciprocity theorem, the Venin's theorem, Norton's theorem and maximum power transfer theorem.

Transient Response:

Growth and decay of circuits in R.C. and L, in R-L and R-C. circuits time constants, pulse and square wave response of R0C circuits.

RC Response:

AC fundamentals, AC through R L and C, AC through R-L, R-C and L.C.R circuits, Q factors of coil, series and parallel response in L-C-R- circuits, sharpness of resonance, tunning, tuned circuits, tuned transformers, double tuned transformers, coupled circuits, coefficient of coupling.

Filter Networks:

Filters, their types, ladder network as constant K-type simple low pass, high pass, band pass and band elimination filters.

PAPER-II (SEMICONDUCTOR DEVICES)

Full Marks – 75 Duration 3 hours

Semiconductor Fundamentals:

Concept of binding of energy bands of Semiconductors, electrons and holes, Intrinsic and extrinsic semiconductors, drift circuits in Semiconductors.

The P-N Junction:

Depletion layer, barriers, voltage, forward and reverse biasing of p-n junction, Junction break down, junction capacitance, fabrication of p-n junction diode, zener diode-voltage regulation, fabrication of p-n junction.

The Bipolar Junction Transistor:

Transistor circuits, transistor circuit configurations, CB, CE & CC leakage current in transistor, transistor static characteristics in CB, CE & CC configuration and related formulae, transistor biasing, stability factor and beta sensitivity, different methods of biasing, DC & AC loading, Q-point, Transistor equivalent circuits (DC and AC) equivalent circuits for CB, CE and CC amplifiers, small signal, low frequency model for transistors in CB, CE and CC configuration (T model) and related formulae, the h-parameter, h-parameters for CB, CE configuration, h-parameter equivalent circuits and formulae fortransistor amplifiers.

The Field Effect Transistors:

Junction FET, characteristics, small signals parameters, biasing and loading, MOFSET – type and characteristics, applications.

Thyristors:

Principles, characteristics, and application of SCR, UJT, Disc, Triac and SCS.

PAPER-III (PRACTICAL)

ELECTRICAL CIRCUITS EXPERIMENTS

Full Marks – 50 Duration 4 hours

Experiments relating to:

1. Growth and decay of current in capacitor
2. R-C circuits
3. R-L Circuits
4. Series response in L-C-R circuits
5. Parallel resonance in L-C-R circuits
6. Verification of Thevenin's theorem
7. Verification of Super Position theory
8. Verification of Norton's Theorem
9. Low-Pass and high-pass filter and
10. Band pass and Band stop filter.

SECOND UNIVERSITY EXAMINATION

PAPER-IV (BASIC ELECTRONIC CIRCUITS)

Full Marks – 75 Duration 3 hours

Half wave and full wave rectifiers – ripple factor and efficiency, bridge rectifier; filter-series indicator, shunt capacitor, L- Section and II Section filters, voltage regulation-zoner diode and transistor regulators, voltage divider, voltage doubler, tripler and quadrupler, circuits; controlled rectification-circuits wave from and applications.

Amplifiers:

Performance of Transostor amplifiers in CB, CE and CC configurations; RC coupled and CE potential amplifiers frequency response, Miller effect, effect oc cascading, alpha & beta cut off frequency, gain band with product; power amplifiers – Class A, Band C type Power amplifiers, Power relation and efficiency, the push-pull class B amplifiers, distortion in power amplifiers; feedback in amplifiers – effect of negative feedback on gain, bandwith stability and harmonic distortion, analysis of current and voltage series and shunt feedback circuits.

Oscillators:

Feedback and circuits requirements for oscillators, tuned base and tuned collector oscillators, Harley and Colpitt oscillators, phase shift and Wien bridge oscillators, crystal oscillators and multivibrators.

PAPER-V (SPECIAL ELECTRONIC CIRCUITS)

Full Marks – 75 Duration 3 hours

Integrated Circuits:

Advantage and drawabacks, monolithic and hybrid ICs, Linear and digital ICs. Process type and IC fabrication, linear IC the differential amplifiers, the operational amplifiers (OP-AMP) OP-AMP amplification s adder, subtractor, multiplier, integrator and differentiater, solution of simultaneous linear equation and differential equations using OP-AMP.

Digital Circuits:

Binary number system, binary to decimal and binary conversion, binary arithmetic, addition, subtraction, multiplication and division, Octal and hexadecimal number system and their interconversion, with binary and decimal numbers, Boolean algebra, Laws of Boolean algebra and D'Morgan theorem, Logic gates, AND or NOT gates circuits and truth tables, the XOR gates, implementation of simple Boolean functions using logic gates adder and subtractors-half adder, full adder, half subtractors and full subtractors logic families- main families, RTL, DTL and TL circuits, ECL and T^2L circuits, NOs families, PMOS, NMOS COSM circuits.

Communication Circuits:

Basic principles of communication, modulation, amplitude modulation (AM) side band power relations, perecentage, modulation, analysis of AM wave and SSB generation, circuits for AM, block diagram of an AM Transistors, frequency modulation (FM), modulation Index, sideband analysis of FM waves, demodulation, essential of demodulation of AM. Diode detectors for AM signal, FM detection-the quadrature detectors, frequency conversion, and the super theoterodyne AM receiver (Block Diagram), FM receiver (Block Diagram).

PAPER-VI (PRACTICAL)

DECIVE EXPERIMENTS

Full Marks – 50 Duration 4 hours

Experiments relating to:

1. Characteristics of p-n-junction diode
2. Characteristics of BJT
3. Characteristics of JFET
4. Characteristics MOSFET
5. Characteristics of Zenor diode
6. Characteristics of SCR
7. Characteristics of UJT
8. Characteristics of Photo diode
9. Characteristics of Diac
10. Characteristics of Triac.

FINAL UNIVERSITY EXAMINATION

PAPER-VII (MEASUREMENTS, SIGNALS AND MICROPROCESSORS)

Full Marks – 75 Duration 3 hours

A. Electrical Measurements and Instrumentation: 40 Marks

Transistors in measurement, classification of transistors, pressure transducers, piezo electric transducer, temperature transducers, photo electric transducers, electric measuring instruments, analog and digital, essential of instruments, measurement standard basic meter, AC meters; rectifier type, electronic voltmeter, VTVM, FET voltmeter and the digitial voltmeter, the Q-meter.

Cathode Ray Oscilloscope:

The cathode ray tube, vertical and horizontal deflection systems, measurement with CRO-current, voltage frequency and phase, special CRO-dual trace, dual beam, storage and sampling CRO.

B. Elements of Microprocessors (8085): 35 Marks

Introduction of microprocessors, evaluation and organization, architecture and operation, instruction and timing, instruction and classification, data transfer, Arithmetic and logic operations, writing simple assembly language programme.

PAPER-VIII (SIGNAL AND SYSTEMS)

Full Marks – 75 Duration 3 hours

Signal transformation of Independent variables, basic continuous-time and discrete time signals, systems-preparation, discrete time, linear time Invarient (L TI) system convolution sum, continuous time systems – convolution integral properties of L TI systems, systems (described by differential and different equations block diagram representation of LTI system, Fourier analysis of continuous time signal and system response of continuous time LTI system to complex expotential, representation of periodic signals, using fourier series, approximation of periodic signals using fourier series, convergence of fourier series, representation of a periodic signals, to the continuous fourier transform, properties of (CT) Fourier Transform convolution properties, modulation properties, frequency response of systems, characteristics, linear constant coefficient, differential equation, first and second order systems.

PAPER-IX (COMPUTER FUNDAMENTALS)

Full Marks – 75 Duration 3 hours

Introductions:

Basic components of a digital computer, types of digital computers, types of application, idea on different operating systems, the arithmetic logic unit (ALU), construction of the ALU, integer representation, a parallel binary adder, positive and negative number addition in 1's and 2's compliments systems, addition and subtraction in a parallel arithmetic elements, shift operation, basic operation, binary multiplication, division, logic operations.

Memory:

RAM, linear, select memory, organization, decoder, memory access, dimension, connection of memory chips to computer bus, Semiconductor, RAM, static RAM, dynamic RAM, RCM Magnetic disk, floppy disk, magnetic tape, cassettes and catridges.

I/O Devices:

Punched typed and cards, tape and ccard readers, alpha numeric codes, character recognition, printers, CRT, Key boards and terminals.

The Control Units:

Constructing the instruction words, Instruction cycle and execution cycle, organization of control registers, sequence of operation of control register, controlling arithmetic operations, typical sequence of operations, BRANCH, SKIP and JUMP instructions, SHIFT instruction, register transfer language, microprogramming.

PAPER-X (COMPUTER PROGRAMMING)

Full Marks – 75 Duration 3 hours

Fundamental Concepts:

Problem analysis, algorithm and flow-chart, Programming Languages – assembly and high-level, interpretation and compilers.

Programming with BASIC:

Constants and Variables, data types, Operators and expressions, library functions, I/O statements transfer of control –branching and looping, functions and subroutines, arrays, matrices and vectors, file organization – sequential and random, enhanced features of BASIC, graphic and sound features in BASIC and their applications.

PAPER-XI (PRACTICAL)

Full Marks – 100 Duration 6 hours

A. Electronic circuit Experiments 50 Marks

Experiments relating to:

1. Half wave and full wave ractifiers with filtering.
2. CE single stage and double stage transistor amplifier.
3. Current and voltage feedback in transistors.
4. Harley oscillators
5. Colpitt Oscillators
6. Phase shift oscillators
7. Stable ande multi vibrators
8. FET amplifier
9. Amplitude
10. Frequency modulation

B. Computer Programming Experiments: 50 Marks

Programming experiments in BASIC relating to (formula to be provided for numerical solution)

1. Determination of the sine and cosine functions from series demolitions;
2. Solution of quadratic equations
3. Sorting of array of numbers
4. Integration by Simpson's rule
5. Determination of value of a function at a point by interpolation;
6. Sequential file organization
7. Random file organization
8. Plotting of graphs
9. Designing various graphic arts and
10. Composing various sound features and music.

Books Recommended:

1. **D. Raychoudhury:** Networks and Systems
2. **Shehgal, Chopra & Shehgal: Electricity and Magnetism**
3. **B.L. Theraja:** Basic Electronics
4. **B.G. Streetman:** Solid State Electronic Devices
5. **Millan & Halklas:** Electronic Devices and Circuits.
6. **A. Mottershed:** Electronic Devices and Circuits
7. **J.D. Rycor:** Electronic Fundamental and Application.
8. **Cooper and Halfrick:** Electronic Instrumentation and Measurement Techniques
9. **Oppenheim, Willsky and Young:** Signals and Systems.
10. **R.S. Gaonkar:** Microprocessor Architecture Programming and Application.
11. **T.C. Bart:** Digital Computer Fundamentals
12. **Bayeers Gottfried:** Programming with BASIC (Schaum Series)

ENVIRONMENTAL SCIENCE (PASS)

COURSE STRUCTURE:

FIRST UNIVERSITY EXAMINATION

There shall be two theory papers each carrying 75 marks and each of 3 hours duration and one practical paper carrying 50 marks of 4 hours duration.

Paper-I (Theory)	Fundamental of Ecology	75 Marks.
Paper-II (Thory)	Resource Conservation & Management	75 Marks
Paper-III (Practical)	Practical relating to Paper-I & II	50 Marks

SECOND UNIVERSITY EXAMINATION

There shall be two theory papers each carrying 75 marks and each of 3 hours duration and one practical paper carrying 50 marks of 4 hours duration.

Paper-IV (Theory)	Environmental Pollution & Toxicology	75 Marks.
Paper-V (Thory)	Environmental Law & Society	75 Marks
Paper-VI (Practical)	Practical relating to Paper-IV & V	50 Marks

DETAILED COURSE

FIRST UNIVERSITY EXAMINATION

PAPER-I (FUNDAMENTALS OF ECOLOGY)

Full Marks – 75 Duration 3 hours

Unit-I Concept of Hydrosphere, Atomosphere, Lithosphere and Biosphere, Ecological factors: Water, Light and temperature, Bio-Geo Chemical cycles: water cycle, carbon cycle, Nitrogen cycle, Phosphorous cycle and Sulphur cycle.

Unit-II Concept of Ecology and Ecosystem, Component parts of Ecosystem, Enumeration of natural and man-made Eco Systems (Pond, space, craft etc.). Food chain, Food web, Ecological pyramides.

Unit-III Concept of productivity, Primary production and secondary production, Ecological Efficiencies, Energy flow in ecosystem.

Unit-IV Concept of Population, Population attributes, Natality, Mortality, Biotic potential, Environmental resistance, growth Curves and Survivorship curve, Population Oscillations, population interactions: Pray-Predator relationship, parasitism, commencialism, Symbiosis, density dependent and density independent, factors regulating population.

Unit-V Human population growth in developed, developing and under developed countries, problems of population explosions and methods to tackle it. Concept of Ecological niche and Biotic community. Community Dynamics (Primary and Secondary Succession).

PAPER-II (RESOURCE CONSERVATION & MANAGEMENT)

Full Marks – 75 Duration 3 hours

Unit-I Concept of Resources: Renewable, non-renewable and perpetual resources and their conservation in general. Land Resources: Wild life, Forests and Rang lands, Improtance and Management, How species become endangered and extinct, Protecting wild species from extinction, Wild Life Management, Biodiversity & Environment.

Unit-II Non-renewable Mineral Resources: Mineral deposits, grouping of ores minerals, uses of common metals and their recycling, Radio-active minerals. Environmental impact of mining and processing mineral resources conservation of mineral resources.

Unit-III Non renewable Energy resources: Fossil fuels, their classification – Coal, oil, natural gas and other gaseous fuels derived from fossil fuels. Environmental Impact of Fossil Fuels use.

Unit-IV Perpetual and non-renewable energy source: Geothermal energy: Source, Principles of harnessing energy and its operation, Nuclear Energy: Source, fission and fusion reactions, broad idea of reactor, its operation, management and safety measures.

Unit-V Perpetual and Renewable energy sources: Solar Energy: its secret, devices based on solar energy, their advantages and drawbacks, Wind energy: Wind mills and applications, aerogenerators, their advantages and disadvantages, Water energy: Hydroelectricity, wave and tidal energy, tidal power plant, Energy from biomass: Biomass as fuel, Biogas plants and generation, uses of biogas.

PAPER-III (PRACTICAL)

Full Marks – 50 Duration 4 hours

1. **Major Experiment:** **15 Marks**
   - i. Simulation of an Ecosystem in the laboratory.
   - ii. Measurement of frequency and relative abundance of species on a grassland and forest.
   - iii. Measurement of dissolved oxygen content, chloride content, Alkalinity in water.
   - iv. Estimation of Phytoplankton and Zooplanktons abundance in fresh water or any other suitable experiment to be designed by the teacher concerned.
2. **Minor Experiment:** **5 Marks**
   - i. Identification of autotrophs and heterotrophs (according to trophy level) of a grassland and pond ecosystem.
   - ii. Measurement of pH in water and soil samples.
   - iii. Identification of animal association mainly symbiosis, commencialism and Parasitism or any other suitable experiment to be designed by the teacher concerned.
3. **Identification of slides of phyto-and zooplankton** **5 Marks**
4. **Class Record, Field collection, Slide Preparation** **12.5 Marks**
5. **Viva-Voce** **7.5 Marks**

SECOND UNIVERSITY EXAMINATION

PAPER-IV (ENVIRONMENTAL POLLUTION & TOXICOLOGY)

Full Marks – 75 Duration 3 hours

Unit-I Concept of Environmental pollution, Classification of pollutants and sources of pollutants. All pollution and pollutants in the atmosphere, Green House effect, Ozone layer, Depletion, Acid rain, Effect of pollution on health.

Unit-II Water pollution and pollutants in the hydrospheres, pollution due to sewages, Eutrophication, Ecological magnification, water borne diseases associated with water pollution..

Unit-III Soil Pollution by fertilizers and pesticides, Pollution due to solid wastes, noise pollution and radiation pollution..

Unit-IV Concept of Toxicology, toxicity, hazards. Risks, Benefit to Risk ratio, tolerance limits, Aceeptable daily intake, Dose, Effect & Response, Doe-response curve, cute & chronic toxicity, Thresh hold value. Factors affecting toxicity: Host factors: Age, species, Sex, feeding, interaction of chemicals and Environmental factors.

Unit-V Toxicity of pesticides (DOT), Malathion, carbofuran and heavy metals (Mercury Lead).

PAPER-V (ENVIRONMENTAL LAW & SOCIETY)

Full Marks – 75 Duration 3 hours

Unit-I Human impact on the Earth, Hunting and Gathering Society, Agriculture Society, Industrial Society, Sustainable Earth Society: Concept of throw-away and sustainable Earth Society.

Unit-II Economics and Environment: Economic growth, Gross National product and the quality of life, Sustainable-earth economy, Economic and Pollution control, Discount factor, cost-benefit and cost effectiveness analysis.

Unit-III Environmental Law: Salient features of Air act, Water Act. and Environment (protection) Act. Pollution prevention and control Boards, Constitution and power.

Unit-IV Environmental movement and people's participation with special references to Gandhamardan, Chilika, Narmada Bachao Andolan, Women and Environmental Protection..

Unit-V Environmental Ethics: Ethics and moral, Throw-away society ethics, Sustainable – Earth Society ethics, Ethical Guidelines.

i. Estimation of Biological Oxygen Demand and Chemical Oxygen Demand of waste.

PAPER-VI (PRACTICAL)

COVERING COURSES OF PAPER-IV & V

Full Marks – 50 Duration 4 hours

1. **Major Experiment: 15 Marks**

i. Estimation of Biological Oxygen Demand and Chemical Oxygen Demand of waste.

ii. Analysis of soil Carbon, Organic matter, Nitrogen, Sodium and Potassium content.

iii. Measurement of Oxygen uptake by Fish/Earthworm exposed to different stress

iv. Measurement of carbon dioxide evolution from soil sprayed with different dose of pesticides.

OR

v. Any other experiment to be asked by the examiner.

2. **Minor Experiment: 10 Marks**

i. Identification of phyto and zooplankton from oligotrophic and Eutrophic water bodies.

OR

3. **Class record & Field collection, Field report. 17.5 Marks**
4. **Viva-Voce 7.5 Marks**

Books Recommended:

1. **Dash:** Fundamental of Ecology, Tata McGraw Hill.
2. **Kormundy:** Concept of Ecology, Prentice Hall, New Delhi
3. **Odum:** Fundamental of Ecology, Sounders
4. **Allen:** Principles of Animal Ecology
5. **Anant Krishnan:** Bio-resource Ecology, Oxford & IBH Publication.
6. **Ashish Mishra:** Fundamentals of Air & Water Pollution
7. **Kakate:** Environmental Pollution
8. **Agrawal:** Environmental Biology
9. **Dash & Mishra:** Man and Environment, Macmillan.

ENVIRONMENTAL SCIENCE (HONS)

COURSE STRUCTURE:

FIRST UNIVERSITY EXAMINATION

There shall be two theory papers each carrying 75 marks and each of 3 hours duration and one practical paper carrying 50 marks of 4 hours duration.

Paper-I (Theory)	Abiotic Environment & System Ecology	75 Marks.
Paper-II (Theory)	Population & Community Ecology	75 Marks
Paper-III (Practical)	Practical relating to Paper-I & II	50 Marks

SECOND UNIVERSITY EXAMINATION

There shall be two theory papers each carrying 75 marks and each of 3 hours duration and one practical paper carrying 50 marks of 4 hours duration.

Paper-IV (Theory)	Resource Conservation & Management	75 Marks.
Paper-V (Theory)	Environmental Pollution	75 Marks
Paper-VI (Practical)	Practical relating to Paper-IV & V	50 Marks

FINAL UNIVERSITY EXAMINATION

There shall be four theory papers each carrying 75 marks and each of 3 hours duration and one practical paper carrying 100 marks of 6 hours duration.

Paper-VII (Theory)	Environmental Microbiology and Environmenal Biotechnology	75 Marks.
Paper-VIII (Theory)	Environmental Law and Society	75 Marks
Paper-IX (Theory)	Pollution Control & Management	75 Marks
Paper-X (Theory)	Environmental Toxicology	75 Marks
Paper-XI (Practical)	Practical relating to Paper-IX & X And Seminar & Term Paper	100 Marks

DETAILED COURSE

FIRST UNIVERSITY EXAMINATION

PAPER-I (ABIOTIC ENVIRONMENT AND SYSTEM ECOLOGY)

Full Marks – 75 Duration 3 hours

Unit-I Hydrosphere and Hydrology cycle, Distribution of water in Hydrosphere Atmosphere: Major regions and chemical elements present in atmosphere, Meteorology of Atmosphere. Lithosphere: Soil formation and soil development, Physico-Chemical characteristics of soil Organism present in soil.

Unit-II Ecology and Ecosystems: Scope and subdivisions of Ecology, system concept in Ecology, Component parts of an ecosystem, Classification of ecosystems, major ecosystem of the world, Ecological factors: Water, Temperature, Light, Bio-geo-chemical cycle: Carbon cycle, nitrogen, sulphur cycle, phosphorus cycle.

Unit-III Food Chain, Trophic levels & Ecological pyramid concept: Types of food chain & Significance of food chain, pyramid of number, biomass & energy Concept of Primary Production, Factors affecting primary production, methods for measuring primary production, Relationship between GPP, NPP and autotrophic respiration, primary productivity of different world sites:

Unit-IV Secondary Production, Concept of secondary production and secondary productivity, Maintenance cost, production assimilation efficiency and secondary productivity. Relationship of secondary production to net primary production.

Unit-V Energy flow in Ecosystems: Concept of Energy, Energy source in Ecosystem, Laws governing energy transformation, Energy flow in producers and consumers, Lindeman's Trophic-Dyanamic concept Energy flow models.

PAPER-II (POPULATION AND COMMUNITY ECOLOGY)

Full Marks – 75 Duration 3 hours

Unit-I Populationa nd Population attributes, concept of population, attributes of population. Biotic potentiality and natality, mortality, survivorship curves, life table, age, structure, population growth forms concept of carrying capacity and environmental resistance. Life history strategies, r and k selection.

Unit-II Population fluctuation and population interaction: Extrinsic and intrinsic factors associated with population fluctuation, parasitism, predation, competition, social behavior in animals.

Unit-III Human Population: Factors affecting change in change in size of human population: death rateand net population change, migration, fertility age structure, Human population control; family planning, Method of birth control, socio-economic method of controlling population growth.

Unit-IV Community: Concept of habitat and niche, types of niches; spatial, trophic and hypervolume niche; ecological equivalents, community organization, types of communities, community structure (analytic and synthetic), qualitative feature of community (Composition, stratification, Physigonomy dispersion, socioability, vitality etc.) quantitative characteristics of community (Frequency, density, cover dominance and diversity, important value index), Ecotone and edge effect.

Unit-V Community dynamics and succession: Ecological succession and kind of succession. Succession process, concept of climax, monoclimax and polyclimax theories, examples of succession (hydrosere, lithosere and seroser)

PAPER-III (PRACTICAL)

COVERING COURSES OF PAPER-I & II

Full Marks – 50 Duration 4 hours

SECOND UNIVERSITY EXAMINATION

PAPER-IV (RESOURCE CONSERVATION AND MANAGEMENT)

Full Marks – 75 Duration 3 hours

Unit-I Concept of Resources: Renewable, non-renewable and perpetual resources and their conservation in general, land Resources: Wild Life, Forests and Range lands, Importance and Management, How species become endangered and extinct, Protecting wild species, from extinctions, Wild life Management, Biodiversity & Environment.

Unit-II Non-renewable Mineral Resources: Mineral deposits, grouping or ores minerals, uses of common metals and their recycling, Radioactive minerals, Environmental impact of mining and processing mineral resources, conservation of mineral resources.

Unit-III Non0renewable Energy resources: Fossil fuels, Their classification: Coal, oil, natural gas and other gaseous fuels derived from fossil fuels, Environmental Impact of Fossil Fuels Use.

Unit-IV Perpetual & non-renewable energy source: Geothermal energy: Source, Principles and harnessing energy and its operation, Nuclear Energy: Source, fission and fusion reactions, broad idea of reactor, its operation, management and safety measures.

Unit-V Perpetual and Renewable energy sources: Solar energy: its secret, devices based on solar energy, their advantages and drawbacks, Wind energy: Wind mills and applications, aerogenerators, their advantages and disadvantages, Water energy: Hydroelectricity, wave and tidal energy, tidal power plant, Energy from biomass: biomass as fuel, Biogas plants and generation, uses of biogas.

PAPER-V (ENVIRONMENTAL POLLUTION)

Full Marks – 75 Duration 3 hours

Unit-I Concept and Definition of Environmental Pollution, types and classification of pollution, pollution and source of pollution. History of major pollution episodes. Air Pollution: Concept of Atmosphere and its Pollution, Major and Minor Pollutants in atmosphere (Sox, Nox, CO_2, Fluoride, Hydrocarbon).

Unit-II Water pollution: Classification and types of water pollution: Industrial wastes, Municipal waste, Agriculture Chemicals, Oil population, Heavy metals (mercury, lead, arsenic), ground water pollution..

Unit-III Acid rain photochemical smog, Green House effect and ozone layer depletion, Eutrophication, Ecological magnification..

Unit-IV Soil Pollution: Sources of soil pollution, Pollution effect of pesticides and fertilizer in soil, types of solid wastes and their effect on environment.

Unit-V Pollution by radiation: Sources of radioactive pollution, effect of radiation protection and control from radiation, disposal of radio active waste. Pollution due to noise: Sources of noise, noise levels in decibel scale, effect of noise on human health, prevention and control of noise.

PAPER-VI (PRACTICAL)

COVERING COURSES OF PAPER-IV & V

Full Marks – 50 Duration 4 hours

FINAL UNIVERSITY EXAMINATION

PAPER-VII (ENVIRONMENTAL MICROBIOLOGY AND ENVIRONMENTAL BIOTECHNOLOGY)

Full Marks – 75 Duration 3 hours

Unit-I Microbes and heir specific roles in ecosystem, Microbial classification based on nutrition. Cactors affecting microbial community. Biogeochemical cycles and microbial biodiversity in soils. Factors affecting microbial community in soil.

Unit-II Soil Microbiology: Organic matter decomposition by soil microbes, organic composting, waste management, Biotechnology of microbes in mine reclamation and wasteland development, Application of microbes in agriculture and afforestation, biofertiliser.

Unit-III Aquatic Microbiology: Micro-organisms in water and waste water, Biofilms, Remediation of water pollutants using biofilms, Algal toxins, Methane producing microbes in aquatic environment, Microbes in sewage treatment.

Unit-IV Biotechnology I: Terminology, Development and scope, Techniques of gene sequencing, gene cloning, genetic manipulation through tissue culture techniques, basic concept of gene transfer, recombinant DNA technology and its application, Trangenic plants and animals and their importance..

Unit-V Biotechnology II: Degradation of genetic compounds, Microbial biodegradation of simple aromatic compounds, chlorinated hydrocarbons, polyaromatic hydrocarbons, Aerobic and anaerobic treatment of waste water and role of microbes. Methanogenesis, fermenting bacteria.

PAPER-VIII (ENVIRONMENTAL LAW & SOCIETY)

Full Marks – 75 Duration 3 hours

Unit-I Human impact on the Earth, Hunting and Gathering Society, Agriculture Society, Industrial Society, Sustainable Earth Society: Concept of throw-away and sustainable – Earth Society.

Unit-II **Economics and Environment:** Economic growth, Gross National Product and the quality of life, Sustainable earth economy, Economics and Pollution control Discount factor, Cost-benefit and cost effectiveness analysis.

Unit-III Environmental Law: Salient features of Air act, Water Act and Environment (protection) Act. Pollution prevention and control Boards, Constitution and power..

Unit-IV Environmental movement and people's participation with special references to Gandhamardan, Chilika, Narmada Bachao Andolan, Women and Environmental Protection..

Unit-V Environmental Ethics: Ethics and moral, Throw-away society ethics, Sustainable – Earth Society ethics, Ethical guidelines.

PAPER-IX (POLLUTION CONTROL AND MANGEMENT)

Full Marks – 75 Duration 3 hours

Unit-I Characterization of municipal waste water, Physico-chemical characteristics of waste water of Sugar and Paper Industries, Water quality standard.

Unit-II Conventional methods of treatment of waste water. Primary treatment, secondary treatment and tertiary treatment.

Unit-III Nonconventional waste water treatment methods: Land treatment, oxidation pond. Use of macrophytes and Blue green algae.

Unit-IV Characterization of gaseous emission from Thermal power plant & Iron and Steel Industries, Permissible limit and ambient air quality. Methods for control of air pollution: Particulate and gaseous.

Unit-V Waste Management: Source and nature of waste, their characteristic and classification, different methods of disposal of wastes. Management of wastes (utilization, recovery, reuse, recycling). Biomas conversion of water through microbial inoculation and vermitechnology. Alternate methods of pest control: Biological control, Hormonal control, Integrated pest management.

PAPER-X (ENVIRONMENTAL TOXICOLOGY)

Full Marks – 75 Duration 3 hours

Unit-I Introducing Toxicology: History, types of toxicology, Toxicity, Hazards, Risks, Benefit-to-risk ratio, tolerance limits, Acceptable daily intake, Threshold value, Effect and response, Dose response curves & Dose effect relationship (Graded and Quantal response) Statistical concept of toxicity (Acute toxicity, margin of safety).

Unit-II Natural Laws Concerning toxicology: Factors affecting toxicity: Host factor: Age species and strain, sex, feed and feeding, Interaction between chemicals: synergism, antagonism, Experimental factors, Physico chemical properties of toxic substance, route and rate of administration Dose.

Unit-III Absorption, Distribution and Excertion of toxic substance, Absorption: Membrane permeability, mechanism of chemical transfer, absorption (Gastrointestinal, skin, lungs). Distribution: tissue affecting distributions and tissues retention. Excretion: Reneal excretion, Biliary excretion and Gastrointestinal.

Unit-IV Toxicity of Pesticides: Organo-Chlorine (DDT), Organo phospahate (malathion) and carbarnate (Carbaryl) and Herbicides, Impact of pesticides on Ecosystem.

Unit-V Metal toxicity: Arsenic, mercury, lead and cadmium (Source, Environmental metabolism, toxicity).

Books Recommended:

1. **M.C. Dash:** Fundamental of Ecology, McGraw Hills.
2. **E.J. Kormundy:** Concept of Ecology, Oxford
3. **P.C. Mishra:** Fundamental of Air and Water Pollution, Ashish
4. **A.K. Dey:** Fundamental Chemistry, Wiley Eastern
5. **Katyal & Satake:** Environmental Pollution, Anmol
6. **Odum:** Ecology
7. **Tivecly & Raj Akashdeep:** Environmental Energy Resources, New Delhi
8. **Saxena:** Applied Environmental Biology
9. **Michael:** Ecological Methods for Field Laboratory Investigation, Tata McGraw Hill
10. **R. Mishra:** Ecologi Work Book, Oxford & IBHS
11. **Trivedy and Goel:** Practical Methods of Ecology and Environmental Science, Env. Publication
12. **Khulbe Papyrus:** Prospective in aquatic Biology, New Delhi
13. **Schwoerber:** Hand Book of Limnology, Scientific Publication, Jodhpur
14. **Kudesia:** Air Pollution, Pragati
15. **Gupta:** Toxicology, Vol-I, II and III, Metropolitan Book Co.

16. **Krishna Murthy:** Forest and Wildlife of India, '60Sred' Publication
17. **The Wild Life Of India**
18. **S.K. Agrwal:** Fundamentals of Ecology, IUCN, Ashish House, New Delhi
19. **Trivedi & Raj:** Solid Wate Pollution, Akashdeep Publication.
20. **Ray Choudhury & Gupta:** Environmental Pollution and Toxicology, Today & Tomorrow.
21. **Dash & Mishra:** Man and Environment, Macmilan
22. **Agrawal:** Environmental Biotechnology
23. **Lynch:** Soil Biotechnology

PAPER-XI (PRACTICAL)

Full Marks – 100 Duration 6 hours

A. Seminar & Term Paper 25+25 Marks

a. Each student shall deliver a seminar talk before the teachers and students of the Department and the Seminar will be evaluated by the teachers present in the seminar.

b. Each student has to submit a term paper, which will be evaluated by one of the teachers of the Department nominated by the Head of the Department.

B. Practical Relating to Paper IX & X 50 Marks

GEOLOGY (PASS)

COURSE STRUCTURE:

FIRST UNIVERSITY EXAMINATION

There shall be two theory papers each carrying 75 marks and each of 3 hours duration and one practical paper carrying 50 marks of 4 hours duration.

Paper-I (Theory)	75 Marks.
Paper-II (Theory)	75 Marks
Paper-III (Practical)	50 Marks

SECOND UNIVERSITY EXAMINATION

There shall be two theory papers each carrying 75 marks and each of 3 hours duration and one practical paper carrying 50 marks of 4 hours duration.

Paper-IV (Theory)	75 Marks.
Paper-V (Theory)	75 Marks
Paper-VI (Practical)	50 Marks

DETAILED COURSE

FIRST UNIVERSITY EXAMINATION

PAPER-I (GENERAL GEOLOGY)

Full Marks – 75 Duration 3 hours

Unit-I Scope and sub-division of Geology, Geology and Man, Age and origin of the earth, Seismology and interior of Earth, Geological time scale, Earthquake causes, effects; volcanoes.

Unit-II **Geomorphology:** Weathering & Erosion, Geological work of river, glacier wind; Karst topography.

Unit-III **Crystallography:** Crystalline and non-crystalline substance, symmetry elements, parameter and indices, Classification of crystals into six normal class, study of normal classes with respect to axes, symmetry elements and forms.

Unit-IV **Mineralogy:** Physical properties of minerals; Silicate structures, Study of important rock forming mineral groups with respect to physical, chemical and optical properties:- Olivine, Pyroxene, Amphibole and Feldspar.

Unit-V **Optical Mineralogy:** Nature of light rays, polarization, double refraction, Nicol prism, Refractive Index, Isotropism, Anisotropism, Extinction, Pleochroism, Interference color.

PAPER-II (IGNEOURS PETROLOGY)

Full Marks – 75 Duration 3 hours

Unit-I Introduction, form, texture, structure and classification of igneous rocks. Bowen's reaction series, Differentiation and Assimilation.

Unit-II **Sedimentary Petrology:** Introduction, General characters of sedimentary rocks, Piagenesis, Texture, classification of sedimentary rocks. Heavy minerals and their significance.

Unit-III **Metamorphic Petrology:** Introduction, Agents, Types of Metamorphism, Texture, structure and classification of metamorphic rocks, zone, grade, facies of metamorphism.

Unit-IV **Stratigraphy:** Stratigraphic co-relation, code of stratigraphic nomenclature, stratigraphy of type of area of Archean, cuddapah, Vindhyan, Gondwana, Decan traps.

Unit-V **Palaeonotology:** Modes of preservation and Uses of fossils, Morphology and geological history of Trilobita, Prachiopoda, Pelecypoda, Oephalopoda, Gastropode, Gondwana Flora.

PAPER-III (PRACTICAL)

Full Marks – 50 Duration 4 hours

1.	Study of Orystal model as given in theory	06
2.	Topographic map & drawing of profile	04
3.	Megascopic identification of Minerals as Given in theory	05
4.	Microscopic identification of Minerals	05
5.	Megascopic identification of imp. Rocks	06
6.	Microscopic identification of imp. Rocks	06
7.	Identification of fossils (as given in Theory)	06
8.	Drawing of stratigraphic units in outline map of Orissa and Indian	02
9.	Geological Field training and report	05
10.	Lab record	03
11.	Viva	02

SECOND UNIVERSITY EXAMINATION

PAPER-IV

Full Marks – 75 Duration 3 hours

Unit-I **Structural Geology (A):** Strike and Dip, Classification of fold, fault, joints, criteria for recognition of fold and fault.

Unit-II **Structural Geology (B):** Definition, Types of recognition of unconformity, geological significance of unconformity, Foliation, Lineation, Top and bottom criteria.

Unit-III **Geotectonics:** Plate tectonics concepts, Sea floor spreading, continental drift, Geosynclines, Isostasy.

Unit-IV **Ground Water:** Hydrological cycle, vertical distribution of sub-surface water, porosity, Permeability, Sy, Sr, Storage co-efficient, Aquifertypes, Dercy's Law, Surface methods of Ground water exploration.

Unit-V **Engineering Geology:** Engineering properties of soils and rocks, Geology of Dam and reservoir sites, Tunnel sites, Earth quake resistant structure.

PAPER-V

Full Marks – 75 Duration 3 hours

Unit-I **Origin of Ores:** Ore, Tenor, Gengue minerals, Processes of formation of mineral deposits – Magnetic, Hydrothermal, Mechanical and Residual concentration, Sedimentation, Oxidetion and Supergene enrichment, Processes.

Unit-II **Prospecting:** Geological, Geophysical, Geochemical methods, controls of ore localization, Metallogenic epoch and provinces.

Unit-III **Mining Geology:** Opencast and underground mining methods (Cut and fill, Board and Piller), Impact of mining activities on environment, Sampling methods.

Unit-IV **Mineral Resources of India:** Mineralogy, Mode of occurrence, Indian distribution of Iron ores, Mn, Cu,Pb, Zn, Mica, Limestone, Origin, occurance, Indian distribution of Coal Petroleum.

Unit-V **Geology of Orissa:** Geomorphology, petrology, Stratigraphy and Structure, Mineral Resources, Ground Water Potential, Mineral based Industries of Orissa.

PAPER-VI (PRACTICAL)

Full Marks – 50 Duration 4 hours

A	**Structural Geology:**	
- Prawing and interpretation of profile section across the geological map.		10 Marks
- Completion of out crops		05 Marks
B	**Ground Water**	
- Interpretation of Ground Water maps		05 Marks
C	**Engineering Geology**	
- Interpretation of Problems with Engineering Structures		05 Marks
- Identification of building stones and their uses		05 Marks
D	**Economic Geology**	
- Identification of ores and their uses		05 Marks
- Problems related to ore reserve estimation		05 Marks
E	**Geological Field Training and Report**	05 Marks
F	**Lab Record**	03 Marks
G	**Viva**	02 Marks

GEOLOGY (HONS)

COURSE STRUCTURE:

FIRST UNIVERSITY EXAMINATION

There shall be two theory papers each carrying 75 marks and each of 3 hours duration and one practical paper carrying 50 marks of 4 hours duration.

Paper-I (Theory)	75 Marks.
Paper-II (Thory)	75 Marks
Paper-III (Practical)	50 Marks

SECOND UNIVERSITY EXAMINATION

There shall be two theory papers each carrying 75 marks and each of 3 hours duration and one practical paper carrying 50 marks of 4 hours duration.

Paper-IV (Theory)	75 Marks.
Paper-V (Theory)	75 Marks

Paper-VI (Practical) 50 Marks

FINAL UNIVERSITY EXAMINATION

There shall be four theory papers each carrying 75 marks and each of 3 hours duration and one practical paper carrying 100 marks of 6 hours duration.

Paper-VII (Theory) 75 Marks.
Paper-VIII (Theory) 75 Marks
Paper-IX (Theory) 75 Marks
Paper-X (Theory) 75 Marks
Paper-XI (Practical) 100 Marks

DETAILED COURSE

FIRST UNIVERSITY EXAMINATION

PAPER-I

Full Marks – 75 Duration 3 hours

Unit-I **General Geology:** Scope and sub-divisions of Geology, Age, Origin of the Earth, Geological Time-scale, Geology and Man.

Unit-II **Geomorphology:** Weathering & Erosion, Geological work of river, Glacier wind, Volcanism, Earth quake, Karst topography, Geomorphic cycle (Davis), Applied geomorphology.

Unit-III **Geotectonics (A):** Scigmology and Interior to Earth, Concept of Plate tectonics, Mid-oceanic ridge, Island arc, Sub-duction zone, Hot spots, Benioff Zones Island areas.

Unit-IV **Geotectonics (B):** Continental drift, Sea floor spreading & Palaeomagnetism, Tectonic design and evolution of Himalayas, Indus suture zone, Narmada rift Valle, Geosyndines.

Unit-V **Geotectonics (A):** Orogeny and Epiorogeny, Isostasy and gravity anomaly, Neotectonic movements in India – active baults, geomorphological indicators, drainage changes, recurrent scisricity.

PAPER-II

Full Marks – 75 Duration 3 hours

Unit-I **Crystallography:** Crystalline and Non-crystalline substance, Symmetry elements, Parameter and Indices, Symmetry peration, HMS, Classification of XIs into 6-system, study of six normal class w.r.t. axes, symmetry elements and forms present, Zonal equation, Twinning, stereographic projection of crystals.

Unit-II **Mineralogy (A):** Physical properties of minerals, classification of silicate structures, Isomorphism, Polymorphism, Psendomorphism, Atomic substitution and solid solution.

Unit-III **Mineralogy (B):** Study of structure, Chemistry, Physical, Optical Properties and occurrence of the following groups – Olivine, garnet, Pyroxene, Amphilbole, Feldspar, Quartz, Mica, Fieldspathoid, Physical, Optical proportion of other important rock forming minerals.

Unit-IV **Optical Mineralogy (A):** Nature of light rays and atheir propagation, polarization, Double refraction, Nicol prison, Refracting microscope, preparation of their section and polished samples.

Unit-V **Optical Mineralogy (B):** Isotropism, Anisotropism, Behaviour of light in this section, Pleochroism, R.I., Birefriengence, Extinction, Inerference, Color, Anoutline study of optical Characters of minerals in their sections.

PAPER-III (PRACTICAL)

Full Marks – 50 Duration 4 hours

1. Study of topographic Maps and Construction of topographic profiles 04
2. Identification of crystal models given in theory 08
3. Stereographic Projection of Crystal models 04

4. Magascopic identification of Minerals 10
5. Microscopic identification of Minerals 10
6. Geological Field training & report (7 days) 05
7. Lab. Record 04
8. Viva 05

SECOND UNIVERSITY EXAMINATION

PAPER-IV

Full Marks – 75 Duration 3 hours

Unit-I **Igneous Petrology (A):** Introduction, Forms of Igneous rocks, Texture, structure, Bowen's reaction series, Differentiation, Assimilation, classification of igneous rocks.

Unit-II **Igneous Petrology (B):** Crystallisation behavior of unicomponent magma, Bicomponent magma showing solid solution eutectic relation, incongruent melting, Temary system Petrographic notes on Basalt, Dolerite, Gabbro, Granite, Pegmatite, Synite, Dunite Diorite, Peridotite, Carbonatite, Anorthosite, Kimbertite. Tectonics and Magmatism.

Unit-III **Metamorphic Petrology (A):** Introduction, Agents, Types of Metamorphism, texture, structures, classification of metamorphic rocks, zone, grade and facies of metamorphism.

Unit-IV **Metamorphic Petrology (B):** Metasomatism,Metamorphic differentiation, Paired Metamorphic belts, AcF, AKF diagram, Lunar-Petrology, Metamorphism and Tectonics, Petrographic notes on important rock tyesshist, gnesis, mable, Quartzites, Slat, Phyllites.

Unit-V **Geo-Chemistry:** Cosmic abundance of elements, Composition of planets and meteorites, structure and composition of Earth, Geo-Chemical Class elements, Distribution of Major and trace elements in Igneous, sedimentary and metamorphic rocks.

PAPER-V

Full Marks – 75 Duration 3 hours

Unit-I **Sedimentary Petrology (A):** Introduction, Texture, Structure, Diagenasis, Classification of sedimentary rocks, sedimentary environments.

Unit-II **Sedimentary Petrology (B):** Heavy minerals & their significance, sedimentation and rectonics, sedimentary basins of India, Petrographic notes on sand stone, Conglomerate, shale, Limestone, Breceia.

Unit-III **Stratigraphy (A):** Principal of stratigraphy, Stratigraphic co-relation, code of stratigraphic Class and nomenclature, Tectonic divisions of India.

Unit-IV **Stratigraphy (B):** Stratigraphy of type area of Archeans, Cuddapah, Vindhyan, Gondwana, Solar group with spl. Emphasis of fossils, climate, economic importances.

Unit-V **Stratigraphy (C):** Decan traps, Triassic of spiti, Jurassic of Kutch and Mesozoic rocks of the Himalayas, Siwalik deposits, Tertiary of Assams.

PAPER-VI (PRACTICAL)

Full Marks – 50 Duration 4 hours

1. Megascopic identification of rocks 12
2. Microscopic identification of rocks 15
3. Drawing of stratigraphic Units of Outline map of India & Orissa 06
4. Geological Field training (10 days) 07
5. Lab Record 05
6. Viva 05
7.

FINAL UNIVERSITY EXAMINATION

PAPER-VII

Full Marks – 75 Duration 3 hours

Unit-I **Structural Geology (A):** Concept of Stress & Strain, Stress and Strain in materials, Determination of strain in rocks, V's Rule, Attitude of beds, Fold-Geometry, Classification, Recognition in field, Effects of erosion on folded strata, salt dome & Diapirs, Geological structures & Plate tectonics, Fold mountains – Origin, Characteristics and related structures.

Unit-II **Structural Geology (B):** Fault-Classification, mechanism, significance, Recognition in the field, General effects of faulting, Joints – Geometry, Classification, Significance Shear Zones, Top and bottom criteria.

Unit-III **Structural Geology (C):** Unconformity – Types, significance, Recognition in field overlap, offlap outlier, Inlier.

Foliation – Type & Its relation to major structures. Lincation – Types & its relation to major structures Petrofabric analysis.

Unit-IV **Engineering Geology (A):** Introduction, Engineering Properties of rocks and soils, Dam and reservoir – Geological consideration and environmental impact, landslides – causes and prevention.

Unit-V **Engineering Geology (B):** Tunnel – Geological consideration in Bridge site, Grouting, Back-filling, Soil-stabilisation, Earth-quake resistant structures.

PAPER-VIII

Full Marks – 75 Duration 3 hours

Unit-I **Palaeontology (A):** Mode of preservation of fossils, geological significance of fossils, A brief idea of evolution of Man and Horse, Foraminifera morphology, Distribution, significance.

Unit-II **Palaeontology (B):** Morphology, evolution and Geological history of the following groups – Trilobite, Brachiopoda, Pelecypoda, Cephalopoda, Echinoidea, Gastropod, Corals, Graptolite.

Unit-III **Quartemary Geology:** Climate changes, sea level fluctuation and other geological activities during quarternary, Landforms and deposits during Quarternary, An elementary idea about Geoarchaeology.

Unit-IV **Marine – Geology:** Relief of ocean floor, Marine –Sentiments & their classification, Marine resources, Pollution of marine environment, Man and Ocean.

Unit-V **Geology of Odisha:** Geomorphology, Stratigrphy of Odisha, Structure of important belts (eastern Ghat, IOG & Gangpur belts) mineral resources, ground water potential, mineral bassed industries of Odisha, Gemstone Occurrences of Odisha, Description of important rock types of Odisha – Khondalite, basic Granulite, Charnockite, Carbonatite, Nepheline Syenete Sandstones, Lime stones.

PAPER-IX

Full Marks – 75 Duration 3 hours

Unit-I **Ground Water (A):** Hydorological cycle, occurrence of Ground water, Porosity, Permeability, Sy, Sr, Safe yield, Storativity, Aquiefer – Types, Aquitard, Aquifuse, Aquiclude, Darcy's Law, Quality of ground water and its use in domestic, agriculture and industries, Ground water pollution.

Unit-II **Ground Water (B):** Ground water explanation – Geological, Geophysical, Hydrogeological methods, Ground water management, Ground water provinces of India, sea-water intrusion.

Unit-III **Photogeology & Remote Sensing:** Principle of Photogeology & Remote Sensing, Application of aerial photography and remote sensing in mineral exploration, Ground water exploration, structural mapping and geomorphology.

Unit-IV **Mining and Surveying:** Terminology in mining, Open cast mining, under ground mining methods (Board & Pillar, Longwall) Cut and fill method, shrinkage stopping methods, ore-dressing, sampling, drilling, chain and compass survey, Plane table survey.

Unit-V **Environmental Geology:** Natural hazards & their management (Earth quake, Landslides). Impact of mining activities on environment, Role of geologist in environmental planning and management.

PAPER-X

Full Marks – 75 Duration 3 hours

Unit-I **Origin or Ores:** Processes of formation of ore bodies, (Magmatic concentration, Hydrothermal, Mechanical & residual concentration, Oxidation and Supergene enrichant, sedimentation) Geothermometry, wace rock alteration, paragension, Zoning.

Unit-II **Prospecting:** Geological, Geophysical, Geochemical methods, Controls of ore localization, Metallorgenic epochs & Provinces, Ore-reserve estimation.

Unit-III **Mineral Resources (A):** Mineralogy, Mode of occurrence, distribution & Uses of Fe-ores, Mn, Cr, Pb, Zn, Cu, Bauxite.

Unit-IV **Mineral Resources (B):** Mineralogy, Mode of occurrence, distribution and use of mica, Asbestos, Limestone, Diamond, Kynite, Diamond, Gold, Grphite, Magnesite.

Unit-V **Energy resources(O):** Origin, Occurrence, distribution and use of Coal, Petroleum, Geothermal energy resources of India, Atomic minerals, Conservation of mineral resources.

PAPER-XI (PRACTICAL)

Full Marks – 100 Duration 6 hours

Practical-A 20 Marks

- Structural Geology
- Drawing & The interpretation of profile sections across the geological Maps
- Outcrop completion
- Stereographic Projection of structural data
- Exercises of structural GI problems.
- Three Points Problem

2. Engineering Geology: 06 Marks
   Study and identification of building staines and uses. Interpretation of Problem with engineering Structures.
3. Palaeontology 06 Marks
   Identification of fossils as given in theory
4. Geology of Odisha 03 Marks
   Drawing of mineral map of Odisha.
5. Geological Field Training 09 Marks
   10 days of actual geological mapping of structurally complex area, around dam sites, collection of fossils during field tour.
6. Lab Record. 03 Marks
7. Viva 03 Marks

Practical (B) 50 Marks

1. Ground water – Quality analysis, quality diagram 10 Marks
   Simple Problem related to Darcy's Law, Interpretation of ground water map, Drawing of country Map.
2. Photogeology – Interpretation of Photo-Pairs. 05 Marks
3. Surveying – Chain & Compass, Plane table. 08 Marks
4. Mineral resources – Identification of ores 11 Marks
   Problems related to ore reserve estimation.
5. Geological field training (7 days) 10 Marks

- Visit of economic mineral deposits
- Visit to opencast and underground mining Case Studies of environmental problem.

6. Lab Records: 03 Marks

7. Viva 03 Marks

MATHEMATICS

Note:-

1. Mathematics (Pass) in Three Year Degree course shall be without any practical component.
2. But there shall be two sets of three year Degree Mathematics (Honours) Course having either of the components.
   i. With Practical component and
   ii. Without Practical component

   Colleges having infrastructure facilities for Computer practical may introduce the Honours Course with practical components, and Colleges having no infrastructure facilities for Computer practical may go for the Honours course without practical components.

MATHEMATIC (PASS)
(BOTH FOR SCIENCE AND ARTS. STUDENTS)

COURSE STRUCTURE:

FIRST UNIVERSITY EXAMINATION

Paper-I				100 Marks
	i.	Calculus	50 Marks	
	ii.	Linear Algebra	50 Marks	
Paper-II				100 Marks
	i.	Differential Equation	50 Marks	
	ii.	Programming in C	50 Marks	

SECOND UNIVERSITY EXAMINATION

Paper-III				100 Marks
	i.	Analysis	50 Marks	
	ii.	Vector Calculus	50 Marks	
Paper-IV				100 Marks
	i.	Algebra	50 Marks	
	ii.	Numerical Analysis	50 Marks	

FINAL UNIVERSITY EXAMINATION

There shall be no examination in Mathematics (Pass) in the Final University Examination.

N.B. i. Each paper consists of five units
ii. Numbers in the right hand side indicates marks in the respective topics.

DETAILED SYLLABUS

FIRST UNIVERSITY EXAMINATION

PAPER-I

Full Marks – 100 **Duration -3 hours**

a. Calculus **50 Marks**

Unit-I

i. Asympotes,Curvature, Singular Points, Curve Tracing.

ii. Partial Differentiation, Maxima Minima of functions of two or more real variables.

Unit-II

Definite Integral, Riemann integral,Length of a curve, Area bounded by curves, Volume and surface of solid of revolution, multiple integrals,Beta function & Gamma Function.

Unit-III

Sphere, Cone, Cylinder, Central conicoids,

Books Prescribed:

i. Gorakh Prasad: Text Book of Differential Calculus, Pothisala Pvt. Ltd., Allahabad, Ch. 9 10,11 (11.1-11.2), 12,14.

ii. Gorakh Prasad: Text Book of Integral Calculus, Pothisala Pvt. Ltd., Allhabad, Ch 5 Ch.-6 (6.1-6.3), Ch.-7(7.1-7.2), Ch.-8(8.1-8.3),Ch 9 ,Ch.-10(10.1-10.6).Ch11

iii. R.N. Das: An Introduction to the Theory of Quadratic Surfaces, Kalyani Publishers. Ch.-I(1.1-1.6, 1.8), Ch.-II(2.1-2.9),Ch.-III(3.1-3.3), Ch.-IV(4.1-4.8), Ch.-V(5.1-5.4).

Reference Books:

i. J. Edward: A Treatise of Differential Calculus

ii. Das & Mukjherjee: Differential Calculus, U.N. Dhar & Sons., Pvt. Ltd., Calcutta.

iii. Das & Mukjherjee: Integral Calculus, U.N. Dhar & Sons., Pvt. Ltd., Calcutta.

iv. David Wider: Advanced Calculus, PHI.

v. P.K. Jain & Khalil Ahmad: Text Book of Analytical Geometry of Three Dimensions, Wiley Eastern Ltd. (New Age International Ltd.), New Delhi.

vi. R.J.T. Bell: An Elementary Treaties on Co-ordinate Geometry of Three Dimensions ,Macmillan

vii. Shanti Narayan: Analytical Solid Geometry, S.Chand & Co.

viii. N.Sharan & L. Gupta: Co-ordinate Geometry in Three Dimensions, Pothisala.

b. Linear Algebra **50 Marks**

Unit-IV

i. Vector space,subspaces, span of a set Linear dependence and independence, dimension and basis

ii. Linear transformations :Definition, Examples, Range and Kernel of a map, rank and nullity Rank nullity Theorem and consequences.Inverse of a linear transformation

Unit-V

iii. Matrix associated with linear maps,Linear map associated with matrix ,Matrix operations, Rank and nullity of Matrix, Transpose and special types of matrices, Elementary row operations,Systems of linear equations, Matrix inversion

iv. Determinants, fundamental properties, Cofactors, minors, Product of determinants,characteristics roots and eigen values, Inner product space, Orthogonal matrices, Application to reduction to quadrics..

Books Prescribed:

1. V Krishnamurty,VP Mainra,JL Arora- An Introduction to linear Algebra-Affilited East West Press PVT LTD,New Delhi Ch 3,4,5,6,7

Reference Books:

1. S.K. Hoffman & Ray Kunze: Linear Algebra, PHI
2. S Kumaresan-Linear algebra,a geometric Approach-Prentice Hall of India
3. Rao &Bhimasankarn-Linear Algebra ,Hindustan publishing house

PAPER-II

Full Marks – 100 **Duration 3** hours

a. Differential Equations: **50 Marks**

Unit-I

i. Basic concepts of differential equations, First order First Degree equations.

ii. Solution of equations of First order but of higher degree.

Unit-II iii. Solution of Linear equation with constant coefficients.

Unit-III iv. Series solution and special functions excluding Bessel functions.

Books Prescribed:

i. J.Sinha Roy & S. Padhi: Elements of Ordinary Differential Equations with Applications, Kalyani Publishers, New Delhi, Ch.-1,2,3,4 &7.

Reference Books:

i. D.A. Murray: Introductory Course of Differential Equation, Longman

ii. Martin Braun: Differential Equation and their Application, Springer International.

iii. Simmons G F-Differential equations

PROGRAMMING IN C

Unit- IV

Overview of C, constrants, variables & data types operators and experessions, Managing I/O operators

Unit-V

Decision making and branching, looping, arrays, character strings, user defined functions, structure and union,

Books Prescribed:

1.E. Balguruswamy: Programming in ANSI C, Ch. -1-10.

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SECOND UNIVERSITY EXAMINATION

PAPER-III

Full Marks – 100 **Duration 3 hours**

A. Analysis **50 Marks**

Unit-I

i. Real Number System,Bounded and unbounded sets, Order completeness, Archmidean Property,Absolute value of a real Number, definition of Metric space , R as a metric Space,, Limit points of sets , Interior points, exterior points and boundary points of a set, Open set, closed set and closure of a set.Countable sets, Uncountable sets

ii. Sequences and series of real numbers,Limit point of a sequence, limit superior,limit inferor,Convergence of sequences and series, Weierstrass completeness principles, Cauchy General Principle of Convergence, Convergence of series of positive terms. Convergence tests: Comparison test, ratio test, root test, Cauchy condensation Test,Raabe Test,logarithmic test,Absolute convergence, Convergence test for alternating series.

Unit-II

iii. Limit and Continuity of functions, discontinuity of various type.Uniform continuity

iv. Differentiation: Differentiable functions, left and right derivatives, ,Rolles Theorem, Intermediate value Theorem ,Lagrange and Cauchy Mean value theorems, Higher derivatives, Taylor's theorem.

Unit-III

v. Riemann Integration: Definition and existence of Riemann integral, Theorems of integrability, Properties of Riemann integral, Fundamental theorem of calculus. Mean Value Theorem for Integral Calculus.

Books Prescribed:

S.C. Malik and ,Savita Arora: Mathematical Analysis, New Age International Publishers

Reference Books:

1. G. Das & S. Pattnayak: Fundamentals of Mathematical Analysis, Tata McGraw Hill
2. Richard R. Goldberg: Methods of Real Analysis, Oxford.
3. D. Somasundarm & B. Choudhury: A First Course in Mathematical Analysis, Narosa Publishing House.
4. T.M. Apostol: Mathematical Analysis, Narosa Publishing House, New Delhi.
5. Alton, H. Smith & Walter A. Albrecht,Jr.: Fundamental Concepts of Analysis, PHI.

B. Vector Calculus **50 Marks**

Unit-IV Vector Differential calculus: Scalar fields and vector fields, Vector calculus, Curves Arc length, Tangent, Velocity and acceleration, Directional Derivative, Gradient of a scalar field, Transformation of coordinate system of vector components, Divergence of a vector field, Curl of a vector field.

Unit-V Line Integrals: Integral theorems, Line integrals, Evaluation of line integrals, Double integrals, Transformation of double integral into line integrals.

Surfaces Tangent plane, First fundamental forms, Area Surface integrals: Triple integrals, Divergence theorem of Gauss, application of divergence theorem, Stokes theorem, application of Stokes theorem, Line integrals independent of path.

Books Prescribed:

1. Erwin Kreyszig: Advance Engineering Mathematics, Wiley Eastern Ltd., Ch.-8 Ch.-9

Reference Books:

1. S.C. Malik and ,Savita Arora: Mathematical Analysis, New Age International Publishers
2. M D Raisinghania Vector Analysis ,S Chand and Company Limited

PAPER-IV

Full Marks – 100 **Duration 3 hours**

a. Algebra: **50 Marks**

Unit-I

i. Group Theory: Definition and examples, subgroups, Counting principle, Normal subgroups, quotient groups, Homomorphism.

Unit-II

ii. Ring Theory: Definition and examples, some special classes of rings, Homomorphism, Ideals and quotient rings. Euclidean Ring,Polynomial rings

iii. Theory of Equations: Roots of equations, Relation between roots and coefficients, evaluating the roots of cubic and bi-quadratic equations, character and position of the root of an equation Descartes rule of signs

Books Prescribed:

1. I.N. Herstein: Topics in Algebra, Wiley India, New Delhi, Ch.-2 (2.1-2.7).Ch3

2. S Barnad and J M Child-Higher Algebra-MacMillan vhapter VI

Reference Books:

1. J.B,. Fraleigh: A first Course in Abstract Algebra, Addision – Wesley Publ. Company.

2. Galian-Contemporary Abstract Algebra,Narosa Publishing house

b. Numerical Analysis: 50 Marks

Unit-III

Errors, Root finding by Bisection method, Root finding by Iteration methods based on first degree equations: Secant method, Regula-Falsi method, Newton Raphson method(without rates of Convergence and order of convergence)
Numerical Solution of system of linear equations: Direct methods, Cramer's rule, Gauss Elimination methods, Gauss-Jordan Elimination method

Interpolations: Lagrange and Newton interpolations, Finite difference operators, Interpolating polynomials using finite differences,

Unit-IV

Differentiation: Methods based on Interpolation (linear and quadratic interpolation with non-uniform and uniform nodal points without error analysis), Methods based on Finite Differences(without error analysis).
Integration: Methods based on Interpolation(Trapezoidal rule with error term , Simpson's rule with error term, Composite integration methods.

Unit-V

Numerical solution of ordinary differential equation: Euler Method, Backward Euler method, Range-Kutta method(Second order, Fourth order method)(All these methods without convergence and error analysis)

Books Prescribed:

M.K. Jain , S.R.K Iyengar, R.K. Jain: Numerical Methods for Scientific and Engineering Computation , Willey Eastern Ltd. New Delhi (1995)
Chapter 1 (1.3), Chapter 2 (2.2, 2.3), Chapter 3(3.2), Chapter 4(4.2,4.3,4.4), Chapter 5(5.2, 5.7,5.9), Chapter 6(6.3,6.4).

Reference Books:

1. S.S. Sastry: Introductory Methods of Numerical Analysis, PHI, New Delhi.
2. R.G. Stanton: Numerical Methods fo rScientists & Engineers, PHI
3. S.D. Conte and Carl de Boor: Elementary Numerical Analysis, McGraw Hill, Kogakusha Ltd.

MATHEMATIC (HONS) (FOR BOTH ARTS & SCIENCE STUDENTS)

(WITH PRACTICAL COMPONENT)

COURSE STRUCTURE:

FIRST UNIVERSITY EXAMINATION

Paper-I			75 Marks
	a. Calculus	40 Marks	
	b. Linear Algebra	35 Marks	
Paper-II			75 Marks
	a. Differential Equation	40 Marks	
	b. Programming in C	35 Marks	
Paper-III	Practical: Windows/DOS/UNIX/MS-Office Programming in C		50 Marks

SECOND UNIVERSITY EXAMINATION

Paper-IV			75 Marks
	a. Analysis	40 Marks	
	b. Vector Calculus	35 Marks	
Paper-V			75 Marks
	a. Algebra	40 Marks	
	b. Numerical Analysis	35 Marks	
Paper-VI	Practical: Solution of Numerical Problems in C		50Marks

FINAL UNIVERSITY EXAMINATION

Paper-VII			75 Marks
	a. Probability	40 Marks	
	b. Differential Geometry	35 Marks	
Paper-VIII	a.Discrete Mathematical structure	40 Marks	75 Marks
	b. Linear Programming	35 Marks	
Paper-IX			75 Marks
	a. Complex Analysis	40 Marks	
	b. Partial Differential Equation	35 Marks	
Paper-X	Object Oriented Programming with C++		75 Marks
Paper-XI	Practical on C++ & Solution of Numerical Problems in C++		100 Marks

N.B. i. Each paper consist of five units.
ii. Numbers in the right hand side indicates marks in the respective topics.

FINAL UNIVERSITY EXAMINATION

There shall be no examination in Mathematics (Pass) in the Final University Examination.

N.B. i. Each paper consists of five units
ii. Numbers in the right hand side indicates marks in the respective topics.

DETAILED SYLLABUS

FIRST UNIVERSITY EXAMINATION

PAPER-I

Full Marks – 100 **Duration -3 hours**

c. Calculus **40 Marks**

Unit-I

iii. Asympotes,Curvature, Singular Points, Curve Tracing.

iv. Partial Differentiation, Maxima Minima of functions of two or more real variables.

Unit-II

Definite Integral, Riemann integral,Length of a curve, Area bounded by curves, Volume and surface of solid of revolution, multiple integrals,Beta function & Gamma Function.

Unit-III

Sphere, Cone, Cylinder, Central conicoids,

Books Prescribed:

iv. Gorakh Prasad: Text Book of Differential Calculus, Pothisala Pvt. Ltd., Allahabad, Ch. 9 10,11 (11.1-11.2), 12,14.

v. Gorakh Prasad: Text Book of Integral Calculus, Pothisala Pvt. Ltd., Allhabad, Ch 5 Ch.-6 (6.1-6.3), Ch.-7(7.1-7.2), Ch.-8(8.1-8.3),Ch 9 ,Ch.-10(10.1-10.6).Ch11

vi. R.N. Das: An Introduction to the Theory of Quadratic Surfaces, Kalyani Publishers. Ch.-I(1.1-1.6, 1.8), Ch.-II(2.1-2.9),Ch.-III(3.1-3.3), Ch.-IV(4.1-4.8), Ch.-V(5.1-5.4).

Reference Books:

ix. J. Edward: A Treatise of Differential Calculus

x. Das & Mukjherjee: Differential Calculus, U.N. Dhar & Sons., Pvt. Ltd., Calcutta.

xi. Das & Mukjherjee: Integral Calculus, U.N. Dhar & Sons., Pvt. Ltd., Calcutta.

xii. David Wider: Advanced Calculus, PHI.

xiii. P.K. Jain & Khalil Ahmad: Text Book of Analytical Geometry of Three Dimensions, Wiley Eastern Ltd. (New Age International Ltd.), New Delhi.

xiv. R.J.T. Bell: An Elementary Treaties on Co-ordinate Geometry of Three Dimensions ,Macmillan

xv. Shanti Narayan: Analytical Solid Geometry, S.Chand & Co.

xvi. N.Sharan & L. Gupta: Co-ordinate Geometry in Three Dimensions, Pothisala.

d. Linear Algebra **35 Marks**

Unit-IV

v. Vector space,subspaces, span of a set Linear dependence and independence, dimension and basis

vi. Linear transformations :Definition, Examples, Range and Kernel of a map, rank and nullity Rank nullity Theorem and consequences.Inverse of a linear transformation

Unit-V

vii. Matrix associated with linear maps,Linear map associated with matrix ,Matrix operations, Rank and nullity of Matrix, Transpose and special types of matrices, Elementary row operations,Systems of linear equations, Matrix inversion

viii. Determinants, fundamental properties, Cofactors, minors, Product of determinants,characteristics roots and eigen values, Inner product space, Orthogonal matrices, Application to reduction to quadrics..

Books Prescribed:

1. V Krishnamurty,VP Mainra,JL Arora- An Introduction to linear Algebra-Affilited East West Press PVT LTD,New Delhi Ch 3,4,5,6,7

Reference Books:

4. S.K. Hoffman & Ray Kunze: Linear Algebra, PHI

5. S Kumaresan-Linear algebra,a geometric Approach-Prentice Hall of India

6. Rao &Bhimasankarn-Linear Algebra ,Hindustan publishing house

PAPER-II

Full Marks – 100 **Duration 3** hours

b. Differential Equations: **40 Marks**

Unit-I

iii. Basic concepts of differential equations, First order First Degree equations.

iv. Solution of equations of First order but of higher degree.

Unit-II iii. Solution of Linear equation with constant coefficients.

Unit-III iv. Series solution and special functions excluding Bessel functions.

Books Prescribed:

ii. J.Sinha Roy & S. Padhi: Elements of Ordinary Differential Equations with Applications, Kalyani Publishers, New Delhi, Ch.-1,2,3,4 &7.

Reference Books:

iv. D.A. Murray: Introductory Course of Differential Equation, Longman

v. Martin Braun: Differential Equation and their Application, Springer International.

vi. Simmons G F-Differential equations

PROGRAMMING IN C **35 Marks**

Unit- IV

Overview of C, constrants, variables & data types operators and experessions, Managing I/O operators

Unit-V

Decision making and branching, looping, arrays, character strings, user defined functions, structure and union,

Books Prescribed:

1.E. Balguruswamy: Programming in ANSI C, Ch. -1-10.

.

PAPER-III

Practical: Windows/DOS/UNIX/MS-Office 50 Marks

Programming in C

The following Practicals should be done in addition to wprking with operating systems like UNIXand WINDOWS and prepare documents, tabulation using MS Office

1. Program to find sum of digits of a given number
2. Program to find ascending order of some numbers
3. Program to generate Fibinacci sequences
4. Program to compute factorial of a number
5. Program to test whether a number is prime or not
6. Program to find roots of a quadratic equation
7. Proram to gind GCD and LCM of two numbers
8. Program to find all the factors of a number
9. Program to check whether a number is palindrome
10. Program to generate PASCAL's Triangle
11. Program to find slope and midpoint of a line passing through two given points
12. Program to find the product of two complex numbers
13. Program to find addition of two matrices
14. Program to find multiplication of two matrice
15. Program to find Matrix Inverse
16. Program to find sum of the diagonal elements of a square matrix

SECOND UNIVERSITY EXAMINATION

PAPER-III

Full Marks – 100 **Duration 3 hours**

C. Analysis **40 Marks**

Unit-I

vi. Real Number System,Bounded and unbounded sets, Order completeness, Archmidean Property,Absolute value of a real Number, definition of Metric space , R as a metric Space,, Limit points of sets , Interior points, exterior points and boundary points of a set, Open set, closed set and closure of a set.Countable sets, Uncountable sets

vii. Sequences and series of real numbers,Limit point of a sequence, limit superior,limit inferor,Convergence of sequences and series, Weierstrass completeness principles, Cauchy General Principle of Convergence, Convergence of series of positive terms. Convergence tests: Comparison test, ratio test, root test, Cauchy condensation Test,Raabe Test,logarithmic test,Absolute convergence, Convergence test for alternating series.

Unit-II

viii. Limit and Continuity of functions, discontinuity of various type.Uniform continuity

ix. Differentiation: Differentiable functions, left and right derivatives, ,Rolles Theorem, Intermediate value Theorem ,Lagrange and Cauchy Mean value theorems, Higher derivatives, Taylor's theorem.

Unit-III

x. Riemann Integration: Definition and existence of Riemann integral, Theorems of integrability, Properties of Riemann integral, Fundamental theorem of calculus. Mean Value Theorem for Integral Calculus.

Books Prescribed:

S.C. Malik and ,Savita Arora: Mathematical Analysis, New Age International Publishers

Reference Books:

6. G. Das & S. Pattnayak: Fundamentals of Mathematical Analysis, Tata McGraw Hill
7. Richard R. Goldberg: Methods of Real Analysis, Oxford.
8. D. Somasundarm & B. Choudhury: A First Course in Mathematical Analysis, Narosa Publishing House.
9. T.M. Apostol: Mathematical Analysis, Narosa Publishing House, New Delhi.
10. Alton, H. Smith & Walter A. Albrecht,Jr.: Fundamental Concepts of Analysis, PHI.

D. Vector Calculus **35 Marks**

Unit-IV Vector Differential calculus: Scalar fields and vector fields, Vector calculus, Curves Arc length, Tangent, Velocity and acceleration, Directional Derivative, Gradient of a scalar field, Transformation of coordinate system of vector components, Divergence of a vector field, Curl of a vector field.

Unit-V Line Integrals: Integral theorems, Line integrals, Evaluation of line integrals, Double integrals, Transformation of double integral into line integrals.

Surfaces Tangent plane, First fundamental forms, Area Surface integrals: Triple integrals, Divergence theorem of Gauss, application of divergence theorem, Stokes theorem, application of Stokes theorem, Line integrals independent of path.

Books Prescribed:

2. Erwin Kreyszig: Advance Engineering Mathematics, Wiley Eastern Ltd., Ch.-8 Ch.-9 .

Reference Books:

3. S.C. Malik and ,Savita Arora: Mathematical Analysis, New Age International Publishers
4. M D Raisinghania Vector Analysis ,S Chand and Company Limited

PAPER-IV

Full Marks – 100 **Duration 3 hours**

c. Algebra: **35 Marks**

Unit-I

iv. Group Theory: Definition and examples, subgroups, Counting principle, Normal subgroups, quotient groups, Homomorphism.

Unit-II

v. Ring Theory: Definition and examples, some special classes of rings, Homomorphism, Ideals and quotient rings. Euclidean Ring,Polynomial rings

vi. Theory of Equations: Roots of equations, Relation between roots and coefficients, evaluating the roots of cubic and bi-quadratic equations, character and position of the root of an equation Descartes rule of signs

Books Prescribed:

3. I.N. Herstein: Topics in Algebra, Wiley India, New Delhi, Ch.-2 (2.1-2.7).Ch3

4. S Barnad and J M Child-Higher Algebra-MacMillan vhapter VI

Reference Books:

3. J.B,. Fraleigh: A first Course in Abstract Algebra, Addision – Wesley Publ. Company.
4. Galian-Contemporary Abstract Algebra,Narosa Publishing house

d. Numerical Analysis: 40 Marks

Unit-III

Errors, Root finding by Bisection method, Root finding by Iteration methods based on first degree equations: Secant method, Regula-Falsi method, Newton Raphson method(without rates of Convergence and order of convergence)

Numerical Solution of system of linear equations: Direct methods, Cramer's rule, Gauss Elimination methods, Gauss-Jordan Elimination method

Interpolations: Lagrange and Newton interpolations, Finite difference operators, Interpolating polynomials using finite differences,

Unit-IV

Differentiation: Methods based on Interpolation (linear and quadratic interpolation with non-uniform and uniform nodal points without error analysis), Methods based on Finite Differences(without error analysis).

Integration: Methods based on Interpolation(Trapezoidal rule with error term , Simpson's rule with error term, Composite integration methods.

Unit-V

Numerical solution of ordinary differential equation: Euler Method, Backward Euler method, Range-Kutta method(Second order, Fourth order method)(All these methods without convergence and error analysis)

Books Prescribed:

M.K. Jain , S.R.K Iyengar, R.K. Jain: Numerical Methods for Scientific and Engineering Computation , Willey Eastern Ltd. New Delhi (1995)

Chapter 1 (1.3), Chapter 2 (2.2, 2.3), Chapter 3(3.2), Chapter 4(4.2,4.3,4.4), Chapter 5(5.2, 5.7,5.9), Chapter 6(6.3,6.4).

Reference Books:

4. S.S. Sastry: Introductory Methods of Numerical Analysis, PHI, New Delhi.
5. R.G. Stanton: Numerical Methods fo rScientists & Engineers, PHI
6. S.D. Conte and Carl de Boor: Elementary Numerical Analysis, McGraw Hill, Kogakusha Ltd.

PAPER-VI

Full Marks – 50 Duration 3 hours

1. Practical in Numerical Problems in C

Programming in C for the following should be done in favour of the following:

1. Rank of a matrix
2. Determinant of a Matrix
3. Solution of System of linear equation by Crammers Rule
4. Eigen value and Eigen vector of a matrix
5. Bisection method.
6. Regula Falsi method.
7. Newton-Raphson method.
8. Lagrange interpolation.
9. Newton's forward and backward interpolation.
10. Trapezoidal and Simpson one-third rules.
11. Gauss Quadrature.
12. Gauss elimination method.
13. Euler's method.
14. Runge-Kutta's method.

Reference

1.Xevier C, C language and Numerical methods New Age International
2.Press W H ,Teukolsky,S A etc: Numerical Recipes in CCambrige University Press Indian Edition
3. Y Kanitkar Let Us C, BPB Publications

FINAL UNIVERSITY EXAMINATION

PAPER-VII

Full Marks – 75 Duration 3 hours

a. Probability **40 Marks**

Unit-I Sample Sets, Probability, Random Variables, Distribution and expectation of Random Variables, Integer valued Random Variables, Random Variables with density function. Conditioning and independence: Examples of conditioning, Basic formulae.

Unit-II Mean and variance: Multiplication theorem of variance and co-variance.

Books Prescribed:

1. K.L. Chung: Elementary Probability Theory with Stochastic Processes, Springer International Student Edition, Ch.-2(2.1-2.4), Ch.-4 (4.1-4.5), Ch.-5 (5.1, 5.2, 5.5), Ch.-6 (6.1-6.3).

b. Differential Geometry: **35 Marks**

Unit-III Theory of space curve: Equation to a curve. Arc length of a curve, Tangential vector. Osculating plane, Normal plane and Rectifying plane, Curvature and torsion and Frenet formulae, Formulae for cuvature and torsion. Some theorems on cuvature and torsion.Helics.

Unit-IV Osculating circle: Osculating sphere, spherical indicatrices involute and evolute, Bertrand curves, Co-ordinates in terms of arc-length, Intrinsic equation.

Unit-V Theory of surfaces: Introduction, Normal line and tangent plane, surface of revolution, characteristics, envelope and edge of regression. Developable surfaces, Fundamental differential form, Angle between two directions. Family of curves. Normal sections. Principal direction: Asymptotic direction, Conjugate directions and Geodesic.

Books Prescribed:

1.Presseler Elementary differential Geometry Springer Indian Student edition

PAPER-VIII

Full Marks – 75 **Duration- 3 hours**

DISCRETE MATHEMATICAL STRUCTURE **40 Marks**

UNIT-I

Discrete Mathematics I. Mathematical induction. Principle of inclusion and exclusion. Pigeon hole principle. Finite combinatorics. Generating functions. Partitions. Recurrence relations. Linear difference equations with constant coefficients.

UNIT-II

Partial and linear orderings. Chains and antichains. Lattices. Distributive

lattices. Complementation. Graphs and Planar graphs. Paths and circuits. Hamiltonian paths. Shortest

paths. Eulerian paths. Traveling salesman problem. Trees. Spanning trees.

UNIT-III

Truth functional logic and prepositional connectives. Switching circuits. Boolean

algebras. Duality. Boolean functions. Normal forms. Karnaugh maps.

Books prescribed-

C L Liu Elements of Discrete Mathematics-,Tatac grawhill Ch3 , Ch4(4.5-4.6),Ch5 (5.1-5.7) ,Ch6 (6.1,6.2,6.5,6.6,6.7) Ch10(10.1-10.7) Ch 12(12.1-12.9)

a. Linear Programming:

UNIT –I

,Linear Programming problem(Mathematical formulation, graphical solution),

UNIT-II

simplex method,Duality in Linear programming,

Prescribed Book:

1. KantiSwarup,P K Gupta and Man Mohan:Operation Research Sultan Chand and sons. Chapters.- ,2,3,4,5,.

PAPER-IX

Full Marks – 75 Duration 3 hours

a. Complex Analysis: 40 Marks

Unit-I Complex Number, Complex plane, Complex Function, Limits and derivatives,Cauchy Riemann equation, laplace equation, Harmonic Function, Logarithmic function, Analytic Function, Examples of Analytic Function.

Unit-II Complex Integration, Cauchy theorem, Cauchy Integral formula (without proof), Independence of Path Cauchy in equality, Liouville's theorem, Fundamental theorem of algebra, Power Series, Radius of convergence of power series.

Unit-III Taylor's series and Laurent series (without proof), Zeros and singularities, residues, Cauchey's residue theorem (without proof), Evaluation of real integral using residue theorem.

Book Prescribed:

1. Erwin Kreyszig: Advanced Engineering Mathematics, Wiley Eastern Pvt. Ltd., Ch.-12,14,16,17.

Reference Book:

1. S. Punnuswamy: Foundation of Complex Analysis, Narosa Publication House.
2. J.B. Conway: Functions of One Complex Variable, Springer International Student Edition.
3. L.V. Ahlfors: Complex Analysis, McGraw Hill Book Co., New York.

b. Partial Differential Equation: 35 Marks

Unit-IV Total differential equation, condition of integrability, methods of obtaining primitive, solution in inspection, homogeneous equations, partial differential equation of 1st order: classification of

integrals and their geometrical interpretation. Formation of partial differential equation, Lagrange's method of solving linear 1st order equations. Charpit's method for 1st order non-linear equations, standard forms.

Unit-V Linear Partial differential equations with constant coefficients, Homogeneous linear equations, reducible non-homogeneous linear equations.

Prescribed Book:

1. J. Sinha Roy & S. Padhi: A course on Ordinary & Partial Differential Equations, Kalyani Publishers, New Delhi, Ch.-12 & 13.

Reference Book:

1. N.M. Kapoor: A text book on Differential Equation, Pitambar Publication House.

PAPER-X

(OBJECT ORIENTED PROGRAMMING WITH C++)

Full Marks – 75 Duration 3 hours

Unit-I Principles of Object Oriented Programming – Object Oriented Programming paradigm, Basic concept of OOP, benefits of OOP, applications of OOP, Structure of a C++ program- Creating a source file, compiling and linking a C++ program.

Tokens, Expressions and Control structures – Key words. Identifiers, Data types,User defined data types, Derived data types, Symbolic constant, Variables, Operators in C++, Functions in C++ - Functions prototyping, call by reference, return by reference, inline function, default argument, virtual function, function overloading, Classes and Objects Defining class and member function, Structure of a C++ program with class, nesting of member function, memory allocation for objects, static data member, static member function, Friend Function, pointers to data members.

Unit-II Constructions and destructors – default constructor and parameterized constructor, copy constructor, dynamic constructor, constructor with default arguments, dynamic initialization of objects, constructor overloading, destructors and its functions.

Unit-III Operator Overloading and type conversions – Defining operator overloading, overloading unary and binary operators, overloading binary operator, using friend function, manipulation of strings using operators, rules for overloading operators, type conversions.

Unit-IV Inheritance: Extending classes – Defining derived classes, single inheritance, making a private member inheritable, multiple inheritance, Hierarchical inheritance, Hybrid inheritance, Virtual base class, Abstract classes, constructors in derived classes, Nesting of classes.

Unit-V Pointers, Virtual functions and Polymorphism – Pointers to objects, this pointer, pointers to derived classes, virtual functions, pure virtual function.

Prescribed Book:

1. E. Balguruswamy: Object Oriented Programming with C++, Ch.1-9.

Reference Book:

1. Robert: Object Oriented Programming in Turbo C++
2. Venugopal: Lafore Mastering C++
3. Ravichandran: Understanding C++

PAPER-XI

(PRACTICAL ON C++)

Full Marks – 100 Duration 6 hours

The practicals done in First year and Second year should be repeted in C++ in this course.

MATHEMATIC (HONS) (WITHOUT PRACTICAL COMPONENT)

For Colleges having no infrastructure facilities for Computer Practicals
(BOTH FOR SCIENCE AND ARTS. STUDENTS)

COURSE STRUCTURE:

FIRST UNIVERSITY EXAMINATION

Paper-I			100 Marks
	a. Calculus	50 Marks	
	b. Linear Algebra	50 Marks	
Paper-II			100 Marks
	a. Differential Equation	50 Marks	
	b. Programming in C	50 Marks	

SECOND UNIVERSITY EXAMINATION

Paper-III			100 Marks
	a. Analysis	50 Marks	
	b. Vector Calculus	50 Marks	
Paper-IV			100 Marks
	c. Algebra	50 Marks	
	d. Numerical Analysis	50 Marks	

FINAL UNIVERSITY EXAMINATION

Paper-V			100 Marks
	a. Probability	50 Marks	
	b. Differential Geometry	50 Marks	
Paper-VI			100 Marks
	a. Complex Analysis	50 Marks	
	b. Partial Differential Equation	50 Marks	
Paper-VII			100 Marks
	a. Mechanics	50 Marks	
	b. Mathematical Method	50 Marks	
Paper-VIII	Any one of the following:		100 Marks
	a. Number Theory		
	b. Graph Theory		
	c. Operation Research		

N.B. i. Each paper consist of five units.
ii. Numbers in the right hand side indicates marks in the respective topics.

DETAILED SYLLABUS

FIRST UNIVERSITY EXAMINATION

PAPER-I

Full Marks – 100 **Duration -3 hours**

e. Calculus **50 Marks**

Unit-I

v. Asympotes,Curvature, Singular Points, Curve Tracing.

vi. Partial Differentiation, Maxima Minima of functions of two or more real variables.

Unit-II

Definite Integral, Riemann integral,Length of a curve, Area bounded by curves, Volume and surface of solid of revolution, multiple integrals,Beta function & Gamma Function.

Unit-III

Sphere, Cone, Cylinder, Central conicoids,

Books Prescribed:

vii. Gorakh Prasad: Text Book of Differential Calculus, Pothisala Pvt. Ltd., Allahabad, Ch. 9 10,11 (11.1-11.2), 12,14.

viii. Gorakh Prasad: Text Book of Integral Calculus, Pothisala Pvt. Ltd., Allhabad, Ch 5 Ch.-6 (6.1-6.3), Ch.-7(7.1-7.2), Ch.-8(8.1-8.3),Ch 9 ,Ch.-10(10.1-10.6).Ch11

ix. R.N. Das: An Introduction to the Theory of Quadratic Surfaces, Kalyani Publishers. Ch.-I(1.1-1.6, 1.8), Ch.-II(2.1-2.9),Ch.-III(3.1-3.3), Ch.-IV(4.1-4.8), Ch.-V(5.1-5.4).

Reference Books:

xvii. J. Edward: A Treatise of Differential Calculus

xviii. Das & Mukjherjee: Differential Calculus, U.N. Dhar & Sons., Pvt. Ltd., Calcutta.

xix. Das & Mukjherjee: Integral Calculus, U.N. Dhar & Sons., Pvt. Ltd., Calcutta.

xx. David Wider: Advanced Calculus, PHI.

xxi. P.K. Jain & Khalil Ahmad: Text Book of Analytical Geometry of Three Dimensions, Wiley Eastern Ltd. (New Age International Ltd.), New Delhi.

xxii. R.J.T. Bell: An Elementary Treaties on Co-ordinate Geometry of Three Dimensions ,Macmillan

xxiii. Shanti Narayan: Analytical Solid Geometry, S.Chand & Co.

xxiv. N.Sharan & L. Gupta: Co-ordinate Geometry in Three Dimensions, Pothisala.

f. Linear Algebra **50 Marks**

Unit-IV

ix. Vector space,subspaces, span of a set Linear dependence and independence, dimension and basis

x. Linear transformations :Definition, Examples, Range and Kernel of a map, rank and nullity Rank nullity Theorem and consequences.Inverse of a linear transformation

Unit-V

xi. Matrix associated with linear maps,Linear map associated with matrix ,Matrix operations, Rank and nullity of Matrix, Transpose and special types of matrices, Elementary row operations,Systems of linear equations, Matrix inversion

xii. Determinants, fundamental properties, Cofactors, minors, Product of determinants,characteristics roots and eigen values, Inner product space, Orthogonal matrices, Application to reduction to quadrics..

Books Prescribed:

1. V Krishnamurty,VP Mainra,JL Arora- An Introduction to linear Algebra-Affilited East West Press PVT LTD,New Delhi Ch 3,4,5,6,7

Reference Books:

7. S.K. Hoffman & Ray Kunze: Linear Algebra, PHI

8. S Kumaresan-Linear algebra,a geometric Approach-Prentice Hall of India

9. Rao &Bhimasankarn-Linear Algebra ,Hindustan publishing house

PAPER-II

Full Marks – 100 **Duration 3** hours

c. Differential Equations: **50 Marks**

Unit-I

v. Basic concepts of differential equations, First order First Degree equations.

vi. Solution of equations of First order but of higher degree.

Unit-II iii. Solution of Linear equation with constant coefficients.

Unit-III iv. Series solution and special functions excluding Bessel functions.

Books Prescribed:

iii. J.Sinha Roy & S. Padhi: Elements of Ordinary Differential Equations with Applications, Kalyani Publishers, New Delhi, Ch.-1,2,3,4 &7.

Reference Books:

vii. D.A. Murray: Introductory Course of Differential Equation, Longman

viii. Martin Braun: Differential Equation and their Application, Springer International.

ix. Simmons G F-Differential equations

b.PROGRAMMING IN C **50 Marks**

Unit- IV

Overview of C, constrants, variables & data types operators and experessions, Managing I/O operators

Unit-V

Decision making and branching, looping, arrays, character strings, user defined functions, structure and union,

Books Prescribed:

1.E. Balguruswamy: Programming in ANSI C, Ch. -1-10.

SECOND UNIVERSITY EXAMINATION

PAPER-III

Full Marks – 100 **Duration 3 hours**

a.Analysis **50 Marks**

Unit-I

xi. Real Number System,Bounded and unbounded sets, Order completeness, Archmidean Property,Absolute value of a real Number, definition of Metric space , R as a metric Space,, Limit points of sets , Interior points, exterior points and boundary points of a set, Open set, closed set and closure of a set.Countable sets, Uncountable sets

xii. Sequences and series of real numbers,Limit point of a sequence, limit superior,limit inferor,Convergence of sequences and series, Weierstrass completeness principles, Cauchy General Principle of Convergence, Convergence of series of positive terms. Convergence tests: Comparison test, ratio test, root test, Cauchy condensation Test,Raabe Test,logarithmic test,Absolute convergence, Convergence test for alternating series.

Unit-II

xiii. Limit and Continuity of functions, discontinuity of various type.Uniform continuity

xiv. Differentiation: Differentiable functions, left and right derivatives, ,Rolles Theorem, Intermediate value Theorem ,Lagrange and Cauchy Mean value theorems, Higher derivatives, Taylor's theorem.

Unit-III

xv. Riemann Integration: Definition and existence of Riemann integral, Theorems of integrability, Properties of Riemann integral, Fundamental theorem of calculus. Mean Value Theorem for Integral Calculus.

Books Prescribed:

S.C. Malik and ,Savita Arora: Mathematical Analysis, New Age International Publishers

Reference Books:

11. G. Das & S. Pattnayak: Fundamentals of Mathematical Analysis, Tata McGraw Hill
12. Richard R. Goldberg: Methods of Real Analysis, Oxford.
13. D. Somasundarm & B. Choudhury: A First Course in Mathematical Analysis, Narosa Publishing House.
14. T.M. Apostol: Mathematical Analysis, Narosa Publishing House, New Delhi.
15. Alton, H. Smith & Walter A. Albrecht,Jr.: Fundamental Concepts of Analysis, PHI.

b.Vector Calculus **50 Marks**

Unit-IV Vector Differential calculus: Scalar fields and vector fields, Vector calculus, Curves Arc length, Tangent, Velocity and acceleration, Directional Derivative, Gradient of a scalar field, Transformation of coordinate system of vector components, Divergence of a vector field, Curl of a vector field.

Unit-V Line Integrals: Integral theorems, Line integrals, Evaluation of line integrals, Double integrals, Transformation of double integral into line integrals.

Surfaces Tangent plane, First fundamental forms, Area Surface integrals: Triple integrals, Divergence theorem of Gauss, application of divergence theorem, Stokes theorem, application of Stokes theorem, Line integrals independent of path.

Books Prescribed:

3. Erwin Kreyszig: Advance Engineering Mathematics, Wiley Eastern Ltd., Ch.-8 Ch.-9 .

Reference Books:

5. S.C. Malik and ,Savita Arora: Mathematical Analysis, New Age International Publishers
6. M D Raisinghania Vector Analysis ,S Chand and Company Limited

PAPER-IV

Full Marks – 100 **Duration 3 hours**

e. Algebra: **50 Marks**

Unit-I

vii. Group Theory: Definition and examples, subgroups, Counting principle, Normal subgroups, quotient groups, Homomorphism.

Unit-II

viii. Ring Theory: Definition and examples, some special classes of rings, Homomorphism, Ideals and quotient rings. Euclidean Ring,Polynomial rings

ix. Theory of Equations: Roots of equations, Relation between roots and coefficients, evaluating the roots of cubic and bi-quadratic equations, character and position of the root of an equation Descartes rule of signs

Books Prescribed:

5. I.N. Herstein: Topics in Algebra, Wiley India, New Delhi, Ch.-2 (2.1-2.7).Ch3

6. S Barnad and J M Child-Higher Algebra-MacMillan vhapter VI

Reference Books:

5. J.B,. Fraleigh: A first Course in Abstract Algebra, Addision – Wesley Publ. Company.
6. Galian-Contemporary Abstract Algebra,Narosa Publishing house

f. Numerical Analysis: **50 Marks**

Unit-III

Errors, Root finding by Bisection method, Root finding by Iteration methods based on first degree equations: Secant method, Regula-Falsi method, Newton Raphson method(without rates of Convergence and order of convergence)

Numerical Solution of system of linear equations: Direct methods, Cramer's rule, Gauss Elimination methods, Gauss-Jordan Elimination method

Interpolations: Lagrange and Newton interpolations, Finite difference operators, Interpolating polynomials using finite differences,

Unit-IV

Differentiation: Methods based on Interpolation (linear and quadratic interpolation with non-uniform and uniform nodal points without error analysis), Methods based on Finite Differences(without error analysis).

Integration: Methods based on Interpolation(Trapezoidal rule with error term , Simpson's rule with error term, Composite integration methods.

Unit-V

Numerical solution of ordinary differential equation: Euler Method, Backward Euler method, Range-Kutta method(Second order, Fourth order method)(All these methods without convergence and error analysis)

Books Prescribed:

M.K. Jain , S.R.K Iyengar, R.K. Jain: Numerical Methods for Scientific and Engineering Computation , Willey Eastern Ltd. New Delhi (1995)

Chapter 1 (1.3), Chapter 2 (2.2, 2.3), Chapter 3(3.2), Chapter 4(4.2,4.3,4.4), Chapter 5(5.2, 5.7,5.9), Chapter 6(6.3,6.4).

Reference Books:

7. S.S. Sastry: Introductory Methods of Numerical Analysis, PHI, New Delhi.
8. R.G. Stanton: Numerical Methods fo rScientists & Engineers, PHI
9. S.D. Conte and Carl de Boor: Elementary Numerical Analysis, McGraw Hill, Kogakusha Ltd.

FINAL UNIVERSITY EXAMINATION

PAPER-V

Full Marks – 100 Duration 3 hours

a. Probability **50 Marks**

Unit-I Sample Sets, Probability, Random Variables, Distribution and expectation of Random Variables, Integer valued Random Variables, Random Variables with density function. Conditioning and independence: Examples of conditioning, Basic formulae.

Unit-II Mean and variance: Multiplication theorem of variance and co-variance.

Books Prescribed:

1 K.L. Chung: Elementary Probability Theory with Stochastic Processes, Springer International Student Edition, Ch.-2(2.1-2.4), Ch.-4 (4.1-4.5), Ch.-5 (5.1, 5.2, 5.5), Ch.-6 (6.1-6.3).

b. Differential Geometry: **50 Marks**

Unit-III Theory of space curve: Equation to a curve. Arc length of a curve, Tangential vector. Osculating plane, Normal plane and Rectifying plane, Curvature and torsion and Frenet formulae, Formulae for cuvature and torsion. Some theorems on cuvature and torsion.Helices.

Unit-IV Osculating circle: Osculating sphere, spherical indicatrices involute and evolute, Bertrand curves, Co-ordinates in terms of arc-length, Intrinsic equation.

Unit-V Theory of surfaces: Introduction, Normal line and tangent plane, surface of revolution, characteristics, envelope and edge of regression. Developable surfaces, Fundamental differential

form, Angle between two directions. Family of curves. Normal sections. Principal direction: Asymptotic direction, Conjugate directions and Geodesic.

Books Prescribed:

1. B.P. Acharya & R.N. Das: Fundamentals of Differential Geometry, Kalyani Publisher, New Delhi., Ch.-1 (1.0-1.17), Ch.-2 (2.0-2.12).

PAPER-VI

Full Marks – 100 **Duration 3 hours**

a. Complex Analysis: **50 Marks**

Unit-I Complex Number, Complex plane, Complex Function, Limits and derivatives, Cauchy Riemann equation, Laplace equation, Harmonic Function, Logarithmic function, Analytic Function, Examples of Analytic Function.

Unit-II Complex Integration, Cauchy theorem, Cauchy Integral formula (without proof), Independence of Path Cauchy in equality, Liouville's theorem, Fundamental theorem of algebra, Power Series, Radius of convergence of power series.

Unit-III Taylor's series and Laurent series (without proof), Zeros and singularities, residues, Cauchey's residue theorem (without proof), Evaluation of real integral using residue theorem.

Book Prescribed:

1. Erwin Kreyszig: Advanced Engineering Mathematics, Wiley Eastern Pvt. Ltd., Ch.-12,13,14,15.

Reference Book:

1. S. Punnuswamy: Foundation of Complex Analysis, Narosa Publication House.
2. J.B. Conway: Functions of One Complex Variable, Springer International Student Edition.
3. L.V. Ahlfors: Complex Analysis, McGraw Hill Book Co., New York.
4. J H Mathews and R W Howell: Complex Analysis in Mathematics and Engineering, Narosa.

b. Partial Differential Equation: **50 Marks**

Unit-IV Total differential equation, condition of integrability, methods of obtaining primitive, solution in inspection, homogeneous equations, partial differential equation of 1^{st} order: classification of integrals and their geometrical interpretation. Formation of partial differential equation, Lagrange's method of solving linear 1^{st} order equations. Charpit's method for 1^{st} order non-linear equations, standard forms.

Unit-V Linear Partial differential equations with constant coefficients, Homogeneous linear equations, reducible non-homogeneous linear equations.

Prescribed Book:

1. J. Sinha Roy & S. Padhi: A course on Ordinary & Partial Differential Equations, Kalyani Publishers, New Delhi, Ch.-12 & 13.

Reference Book:

1. N.M. Kapoor: A text book on Differential Equation, Pitambar Publication House.

PAPER-VII

Full Marks – 100 **Duration 3 hours**

a. Mechanics **50 Marks**

Unit-I Methods of Plane Static: Introductory notes, Equilibrium of a particle. Equilibrium of a system of particles. Work and potential energy, Application in Plane Statics: Mass centers & Centre of gravity, Friction, Flexible cable, Plane kinematics of a particle, Motion of a rigid body parallel to a fixed plane..

Unit-II Methods of plane dynamics. Motion of a particle. Motion of a system, Projectile with and without resistance. Moment of inertia Kinetic energy and angular momentum. Rigid body rotating about a fixed axis.

Books Prescribed:

1. J.L. Synge & B.A. Griffith: Principle of Mechanics, International Students Edition, Ch.-2 (2.1-2.4), Ch.-3(3.1,3.2, 3.4), Ch.-4(4.1, 4.2), Ch.-5(5.1, 5.2), Ch.-6 (6.1, 6.2), Ch.-7(7.1, 7.2).

b.Mathematical Methods **50 Marks**

Unit-III Laplace Transformation: Laplace transform. Inverse transform ,Linearity, Laplace transforms of derivatives and integrals.

Unit-IV Shifting of the s-axis, shifting in the t-axis, unit step function, Differentiation and integration of transforms, Convolution.

Unit-V Fourier Series & Integrals: Periodic functions. Trigonometric series. Fourier Series, Euler formulae, Functions having arbitrary period, Even & odd functions. Half-range expansion, Determination of Fourier coefficient without integration. Approximation by trigonometric polynomials. Square error, the Fourier integral. Fourier transform

Book Prescribed:

1. Erwin Kreyszig: Advanced Engineering Mathematics, Wiley Eastern Pvt. Ltd., Ch.-5 (5.1-5.5), Ch.-10(10.1-10.6, 10.8, 10.9,10.10)

References

2. Murray.R Spiegel Laplace Transforms (Schaum series) Tata Mc Graw Hill
3. L C Andrews B K Shivamoggi; Integral transform for Engineers, Prentice Hall of India
4. Murray.R Spiegel: Fourier analysis (Schaum series) Tata Mc Graw Hill

PAPER-VIII (ELECTIVE)

Full Marks – 100 Duration 3 hours

A student is required to take anyone of the following and each paper carrying 100 marks.

a. Number Theory
b. Graph Theory
c. Operation Research

b. Number Theory:

Divigibility, Primes, Congruency, solution of congruency, Congruency of degree 1, the function ϕ (n). Number Theory from Algebric view point, multiplicative groups,

. Quadratic reciprocity: Quadratic residues, Jacobi symbols.

Functions of Number Theory: Greatest integer function, arithmetic function, Mobius inversion formula, the multiplication of arithmetic.

Some Diophantine Equations ax + by = c, positive solutions, other linear equations $x^4 + y^4 = Z^2$, sums of Four and Five squares Waring's Problem, Sum of fourth power.

Prescribed Book:

1. Ivan Niven and H.S. Zuckerman: An Introduction to Theory of Numbers, Wiley Eastern Pvt. Ltd., Ch.-1 (1.1-1.3), Ch.-2 (2.1-2.4, 2.10, 2.11), Ch.-3 (3.1-3.3), Ch.-4 (4.1-4.4), Ch.-5 (5.1-5.9).

c. Graph Theory:

Introduction, paths and circuits, Trees and fundamental circuits, Cut sets and cut vertices, Planar and dual graphs, Vector spaces of a graph.

Prescribed Book:

1. N. Deo, Graph Theory with Application to Engineering & Computer Science, PHI

Reference Book:

1. F. Harary: Graph Theory, Narosa Publication House.

d. Operation Research:

UNIT –I

Operation Research an overview,Linear Programming problem(Mathematical formulation, graphical solution),

UNIT-II

simplex method,

UNIT-III

Duality in Linear programming,

UNIT-IV

Transportation problem,

UNIT-V

Assignment problem

Prescribed Book:

2. KantiSwarup,P K Gupta and Man Mohan:Operation Research Sultan Chand and sons. Chapters.-1,2,3,4,5,10 and 11.

Reference Books:

1. B.S. Goel & S.K. Mittal: Operation Research, Pragati Prakashani, Meerut.
2. S.D. Sharma: Operation Research, Kedar Nath, Ram Nath Co., Meerut
3. P.K. Gupta and D.S. Hirra: Operation Research, S. Chand & Co. Ltd.
4. K.V. Mittal: Optimization Methods in Operation Research and System Analysis, Willey Eastern Ltd. New Delhi.
5. T.N. Mallik: Linear Programming (Theory & Application), U.N. Dhar & Sons Pvt. Ltd., Calcutta.

PHYSICS (PASS)

COURSE STRUCTURE:

FIRST UNIVERSITY EXAMINATION

Paper-I	Theory	3 Hours	75 Marks
a. Mechanics and Properties of Matter		45 Marks	
b. Thermal Physics		30 Marks	
Paper-II		3 Hours	75 Marks
a. Waves & Oscilltions		15 Marks	
b. Geometrical Physical Optics		45 Marks	
c. Special Theory & Relativity		15 Marks	
Paper-III	Practical:	4 Hours	50 Marks

SECOND UNIVERSITY EXAMINATION

Paper-IV	Theory	3 Hours	75 Marks
a. Electricity & Magnetism		45 Marks	
b. Electronics		30 Marks	
Paper-V	Theory	3 Hours	75 Marks
a. Atomic & Modern Physics		45 Marks	
b. Quantum Mechanics		30 Marks	
Paper-VI	Practical	4 Hours	50 Marks

FIRST UNIVERSITY EXAMINATION

PAPER-I

Full Marks – 75 Duration 3 hours

A. Mechanics &Properties of Matter 45 marks

Conservation of linear & angular momentum, Rotational motion: Moment of inertia, Parallel & Perpendicular axes theorem, Moment of inertia of circular disc, sphere and rectangular body, Newton's law of gravitation, Kepelar's laws, Gravitational field & potential Determination of 'g' by compound pendulum (Bar & Kater's), Elasticity: Elastic constants and their relations, Torsion of a right circular cylinder, Bending of beam fixed at one end and loaded at the other end. Surface tension and surface energy, pressure difference in a curved surface. Viscous motion and viscosity, Poiseuille's equation.

B. Thermal physics: 30 marks

Specific heat of gas, Definition of Cp & Cv ,Derivation of relation Cp – Cv =R .Thermodynamics: Zeroth law and concept of temperature, First law and internal energy, Reversible and irreversible process, Isothermal and adiabatic process(Equation & Work done), Second law, idea of entropy, Carnot cycle and engine, derivation of it's efficiency, Kelvin scale of temperature. Thermodynamic potential, Maxwell's relations and applications, Clusius-Clapeyron's equation, Joule-Thomson's effect, production of low temperature.

Books Recommended:-

1. **Symon:** Mechanics
2. **Newmann & Searle:** Properties of Matter
3. **Samal, Mishra & Mohanty:** Text Book Of +3 Physics
4. **K.N.Sharma:** B.Sc.Physics Vol.I
5. **D.S.Mathur:** Properties of Matter

PAPER-II

Full Marks – 75 Duration 3 hours

A. Waves and Oscillations: 15 Marks

Simple harmonic oscillation:(equation, amplitude, velocity, acceleration and energy),composition of SHM , Lisajous figure, Equation of wave motion and solution, Free ,damped and forced vibration, resonance, velocity of elastic and transverse wave, Laws of vibvration of string,progressive and stationary waves.

B. Optics: 45 Marks

Geometrical optics: co-axial system of two thin lenses, cardinal points, Chromatic and spherical aberration, Ramsden and Huygen's eye pieces.

Physical optics: Huygen's principle, Interference due to biprism and bimirror, Newton's ring, Michelson's interferometer, Fraunhoffer and Fresnel diffraction, Zone plate, Diffraction at a single slit, plane transmission grating, resolving power of grating, normal and anomalous dispersion, Polarization of light by reflection, Brewster's law, double refraction, Nicol prism.

C. Special Theory of Relativity: 15 Marks

Michelson-Morley experiment, Postulates of special theory of relativity, Lorentz transformations, length contraction and time dilation, variation of mass with velocity, equivalence of mass and energy.

Books Recommended:-

1. **Samal, Mishra & Mohanty:** Text Book Of +3 Physics Vol.I & II
2. **K.N.Sharma:** B.Sc. Physics, Part-I & II
3. **B.K.Mathur:** Principle of Optics
4. **N.Subramanyam, BrijlalL** A Text Book of Optics
5. **M.N.Avadhanulu:** Introduction of Laser

PAPER-III (PRACTICAL)

Full Marks – 100 Duration 4 hours

Experimental	30 Marks
Viva	10 Marks
Record	10 Marks

(Students are to perform one experiment during the examination and examiners should allot 50% of the experiments on Mechanics, Heat and Sound to examinees and the experiments on Light and Electricity to another 50% of the examinees by lottery)

Experiments relating to:

1. Accurate weighing with a balance.
2. Young's modulus of a wire.
3. Surface tension of liquids(capillary method)
4. Bar pendulum with movable knife edge
5. Rigidity modulus: static method.
6. Specific Heat of liquids(method of cooling)
7. Poisson's ratio of rubber.
8. Specific Heat of solids(method of cooling)
9. Velocity of sound: resonance method.
10. Sonometer-Verification of laws of transverse vibration of string.
11. Refractive index of liquids(traveling microscope methods)
12. Refractive index of liquids(Plane mirror & Convex lens methods)
13. Kohlarauch's method
14. Magnifying power of microscope.
15. Magnifying power of telescope.
16. E.C.E. of copper.
17. Comparison of capacity by De Sauty's method.
18. Figure of merit of a Galvanometer.
19. Measurement of high resistance.
20. End correction of meter bridge (Galvanometer with lamp & scale should be used]

Books Recommended:

1. **Worsnoff and Flint:** Advanced Practical Physics.
2. **B.B.Swain and K.Sailam:** B.Sc. Practical Physics.
3. **Ghosh:**Advanced Practical Physics.
4. **C.L.Arora:** B.Sc. Practical Physics, S.Chand & Company.
5. **Harnam Singh:** B.Sc. Practical Physics, S. Chand &Company.

SECOND UNIVERSITY EXAMINATION

PAPER-IV

Full Marks – 75 Duration 3 hours

A. Electricity and Magnetism 45 marks

Vectors: vector products, Gradient, Divergence and Curl operation. Electrostatic field & potential, Gauss theorem and applications, spherical shell, charged sheet, charged conducting plate. Parallel plates and cylindrical condenser, energy per unit volume, Biot-Savart's law, Ampere's law. Magnetic field due to current carrying conductor, Faraday's & Lenz's laws, Self induction of a simple coil, Mutual induction of two coils, Transient current in L.C.R. circuits, Ballastic galvanometer. AC in RL, RC and LCR circuits, Impedence, power factor, wattless current and resonance, Interaction between a current carrying conductor and an external magnetic field, Hysteresis, Properties of magnetic materials.(dia, para and ferro)

B. Electronics 30 Marks

Semicondutors, p-n junction, Zener diode, Bipolar junction transistor, Rectifiers(half wave and full wave) using p-n junction diode, Transister amplifier(CE mode)Criteria of sustained oscillations, Hartley and Colpitt oscillator, Amplitude and Frequency modulation, Demodulation. Elements of digital electronics, Logic gate and Boolean algebra"

Books recommended:-

1. **Page & Adams:** Principle Of Electricity & Magnetism
2. **K.N.Sharma & Sameer Kalia:** Text Book of B.Sc. Physics.
3. **Henry Jacobowitz:** Electronics made simple
4. **V.K. Mehta:** Fundamentals of Electronics.

PAPER-V

Full Marks – 75 Duration 3 hours

A. Atomic and Modern Physics 45 Marks

Discovery of the nucleus, Bhor's model of the atom, Stationary states energy levels, spectra of hydrogen like atoms, Bohr's correspondence principle, Quantization of angular momentum, Normal Zeeman effect, Raman

effect. X-rays: production, properties, Diffraction of X-rays by crystal lattices, characteristics and continuous spectrum, Mosley's law. Photoelectric effect, Compton scattering.

Laser : Elementary idea, Characteristics properties of Laser, Application of Laser, Ruby Laser and He-Ne Laser, Elementary idea about Semiconductor Laser

B. Quantum Mechanics **30 Marks**

Inadequacy of classical mechanics, Young's two slit experiment, Gamma ray microscope, Uncertainty principle, Dual nature of matter and radiation, De Broglie wave for free electron, Davison Germer experiment, Time dependent and independent Schrodinger equation, probabilistic interpretation, solution of Schrödinger equation for one dimensional barrier problem(rectangular potential hill and potential well)

Books Recommended:-

1. **J.B.Rajam:** Atomic Physics
2. **Samal Mishra & Mohanty:** A Text Book Of +3 Physics Vol.II.
3. **K.N.Sharma & Sameer Kalia:** Text Book of B.Sc. Physics
4. **Staraurs:** Introduction to Quantum Mechanics.
5. **M.N. Avadhanulu:** An introduction of Laser

PAPER-VI (PRACTICAL)

Full Marks – 100 Duration 4 hours

Experimental	30 Marks
Viva	10 Marks
Record	10 Marks

(Students are to perform one experiment during the examination and examiners should allot 50% of the experiments on Mechanics, Heat and Sound to examinees and the experiments on Light and Electricity to another 50% of the examinees by lottery)

Experiments relating to:

1. Rigidity modulus of a wire by Dynamic method.
2. Surface tension of liquids(Weighing drop method).
3. Viscosity by capillary flow method.
4. Young's modulus of a wooden scale by bending.
5. Moment of inertia of rotating/rolling solid cylinder.
6. Joule's calorimeter(Radiation correction)
7. Weight thermometer.
8. Determination of 'g' by Kater's pendulum.
9. Surface tension of mercury by Quink's method.
10. Latent heat of wax by cooling method.
11. Angle of minimum deviation of a prism(spectrometer)
12. I-D curve using spectrometer.
13. Young's experiment(Double slits).
14. Determination of wavelength of light by Newton's ring experiment.
15. Grating element, Determination of wavelength and grating element by plane transmission grating.
16. Galvanometer resistance by Kelvin's method.
17. Comparison of two resistances.
18. Comparison of EMF by stretched wire potentiometer.
19. Conversion of a Galvanometer to an Ammeter/Voltmeter.
20. V-I characteristics of a P-N junction.

(Galvanometer with lamp and scale should be used)

Books Recommended:

1. **Worsnoff and Flint:** Advanced Practical Physics.
2. **B.B.Swain and K.Sailam:** B.Sc. Practical Physics.
3. **Ghosh:**Advanced Practical Physics.
4. **C.L.Arora:** B.Sc. Practical Physics, S.Chand & Company.
5. **Harnam Singh:** B.Sc. Practical Physics, S. Chand &Company.

PHYSICS (HONS)

COURSE STRUCTURE:

FIRST UNIVERSITY EXAMINATION

Paper-I		Theory	3 Hours	75 Marks
	a. Mechanics		30 Marks	
	b. Properties of Matter		30 Marks	
	c. Waves and Oscillations		15 Marks	
Paper-II		Theory	3 Hours	75 Marks
	a. Heat & Thermodynamics		60 Marks	
	b. Statistical Physics		15 Marks	
Paper-III		Practical	4 Hours	50 Marks

SECOND UNIVERSITY EXAMINATION

Paper-IV		Theory	3 Hours	75 Marks
	a. Geometrical Optics		30 Marks	
	b. Physical Optics		45 Marks	
Paper-V		Theory	3 Hours	75 Marks
	a. Mathematical Method		45 Marks	
	b. Special Theory of Relativity		30 Marks	
Paper-VI		Practical	4 Hours	50 Marks

FINAL UNIVERSITY EXAMINATION

Paper-VII		Theory	3 Hours	75 Marks
	Electricity & Magnetism			
Paper-VIII		Theory	3 Hours	75 Marks
	a. Atomic & Modern Physics		45 Marks	
	b. Electromagnetic Theory		30 Marks	
Paper-IX		Theory	3 Hours	75 Marks
	a. Quantum Mechanics		45 Marks	
	b. Nuclear & Particle Physics		30 Marks	
Paper-X		Theory	3 Hours	75 Marks
	a. Electronics		45 Marks	
	b. Solid State Physics		30 Marks	
Paper-XI		Practical	6 Hours	100 Marks

FIRST UNIVERSITY EXAMINATION

PAPER-I

Full Marks – 75 Duration 3 hours

A. Mechanics **30 Marks**

Gradient, Divergence and Curl of vectors, Mechanics of a particle and a system of particles, D'Alembert's principle, Lagrange equation and simple application, Hamilton's principle and Lagrange equation, conservation theorems and symmetry properties.

Two body central force problem, equivalent one body problem, equation of motion and first integrals, equivalent one dimensional problem and classification of orbits, orbits for integrable power law potentials, scattering in a central force field.

Rotation of rigid bodies about an axis, compound pendulum(Bar and Kater's), moment of inertia, theorems of parallel and perpendicular axes, MI of circular disc, sphere and rectangular body.

Gravitational field and potential: Gravitational field and potential due to a spherical shell and sphere.

B. Properties of Matter **30 Marks**

Elasticity: Relations among elastic constants, bending of beams, torsion of right circular cylinder, vibrations of loaded springs and beams, Surface tension and surface energy, effect of temperature, pressure difference across a curved surface, shape of a large drop, velocity of gravity waves, capillary waves and ripples.
Fluid Motion: Bernoulli's theorem, critical velocity, venturimeter, viscosity of liquids and gases, Poiseulli's equation, Stoke's theorem.

C. Waves and Oscillations **15 Marks**

Free, Damped and Forced harmonic oscillator, resonance, Velocity of longitudinal waves in an elastic medium, SHM(Eqn, Amplitude,Velocity,Acceleration and energy), Composition of SHM and Lissajjous figure, superposition of waves, Progressive and stationary waves, combination of tones, beats, Vibration of strings, theory of struck, plucked and bowed strings.
Ultrasonics: Production and application

Books Recommended:

1. **Gupta, Kuma & Sharma:** Classical Mechanics, 21st Edn.
2. **Dr. A.N. Kansar:** Classical Physics, Vol.-1
3. **Brijlal, Subramaniyam & Jivan Sessan:** Mechanics & Electrodynamics, Euresia Publishing House Pvt. Ltd., Ram Nagar, New Delhi.
4. **D.S. Mathur:** Elements of Properties of Matter.
5. **Brijlal & Subramanyam:** Elements of Properties.
6. **Newmann & Searle:** Properties of Matter
7. **Saishal:** A Text Book of Sound.
8. **Basudev & Ghosh:** Principle of Acoustics, Sreedhar Publishers, 209-B, Bidhan Sarani, Kolkatta – 700006.
9. **A.B. Gupta:** Classical Mechanics & Properties Of Matter
10. **H. Goldstein:** Classical Mechanics.

PAPER-II

Full Marks – 75 Duration 3 hours

A. Heat, Thermodynamics and Radiation: **60 Marks**

Kinetic theory of gases, Postulates and calculation of pressure, Vanderwall's equation, critical phenomena, critical constants, triple point, reduced equation of state, Brownian motion, mean free path, calculation of specific heat, thermal conductivity and viscosity of gas.
Thermodynamics: Zeroth law and concept of temperature, First law and internal energy, reversible and irreversible process, isothermal and adiabatic process(equation and workdone), Second law, idea of entropy, Carnot cycle and Carnot engine, derivation of it's efficiency, Kelvin scale of temperature, Thermodynamical potential, Maxwell's relations and application, Clausius-Claperyon equation, Joule-Thomson's effect, production of low temperature, Liquifaction of gas, , adiabatic demagnetization, Nernst's heat theorem, Third law, Idea about thermoelectricity.
Radiation: Blackbody radiation, radiation pressure, Stefan's law, Kirchoff's law, Wien's law, Raleigh-Jean's law, Planck's law, Einstein's and Dedye's theory of specific heat of solid.

B. Statistical Physics **10 Marks**

Thermodynamic probability, entropy and probability, Thermodynamic function of a system having a finite number of energy levels, elementary idea on ensemble, partition function, phase space, probability distribution function for a classical system(Maxwell-Boltzman statistics),elementary idea about the distribution function in quantum-mechanical system(Fermi-Dirac and Bose-Einstein statistics)

Books Recommended:

1. **Zeemansky & P.K.Chakrabarty:** Heat & Thermodynamics
2. **P.K.Chakrabarty:** Advanced Text Book on Heat
3. **K.K.Sharma and B.S.Satyal:** Thermal & Statistical Physics.
4. **Saha & Srivastava:** Treatise on Heat
5. **Brijlal & N.Subramanyam:** Heat & Thermodynamics

PAPER-III (PRACTICAL)

Full Marks – 50 Duration 4 hours

Experimental	30 Marks
Viva	10 Marks

Record 10 Marks

(Students are to perform one experiment during Examination)

Experiments relating to:

1. Bar pendulum
2. Kater's pendulum
3. Y by bending of beam
4. n by dynamical method
5. Moment of inertia of a rolling/rotating cylinder
6. Surface tension of soap solution(soap bubble)
7. Viscosity by capillary flow method
8. Constant volume air thermometer
9. Coefficient of cubical expansion of water by sinker
10. Thermal conductivity by Lee's method
11. Absolute determination of frequency of a tuning fork by sonometer
12. Specific heat of solid by radiation correction
13. Weight thermometer
14. Latent heat of wax by cooling

Books Recommended:

1. **Worsnoff and Flint:** Advanced Practical Physics
2. **B.B.Swain and K.Sailam:** B.Sc. Practical Physics
3. **Ghosh:** Advanced Practical Physics
4. **C.L.Arora:** B.Sc. Practical Physics, S.Chand & Company.
5. **Harnam Singh:** B.Sc. Practical Physics, S.Chand &Company.

SECOND UNIVERSITY EXAMINATION

PAPER-IV

Full Marks – 75 Duration 3 hours

A. Geometrical Optics **30 Marks**

Fermat's principle, Cardinal points of optical system, defects of images, spherical aberration, chromatic aberration, astigmatism, Coma and their remedies, Abbe's sine condition for achromatism, Huygen's and Ramsden's eye pieces, resolving power of telescope and microscope, Rainbows, measurement of velocity of light by Fizeau method

B. Physical Optics. **45 Marks**

Huygen's principle, Interference of light waves, conditions of interference, intensity distribution among fringes ,production of fringes with Biprism, and Bimirror, Fringes of equal inclination and equal thickness in thin films, Phase change on reflection, Newton's ring, Intensity and sharpness of fringes, Fringes by transmitted light, Brister's fringes, Interferometer: Michelson and Fabry-perot and their uses, Fresnel and Fraunhoffer diffraction, Half period zones, zone plate, Diffraction at double slit , single slit, plane diffraction grating, concave grating and it's Rowland mounting, resolving power of plane grating, Polarisation of light by reflection, double refraction, Brewster's law, Nicol's prism, production of plane polarized light , Huygen's construction of wave fronts in uniaxial crystal, wave velocity and ray velocity. Ordinary and extra ordinary rays, Circularly and elliptically polarized light, Detection and analysis of polarized light, Babinet's compensator, Principle of sacharimetry.

Books Recommended:

1. **Satya Prakash:** Optics & Atomic Physics.
2. **B.K.Mathur:** Optics.
3. **Ajoy K.Ghatak:** Optics, Tata Mc Graw Hill Ltd. New Delhi
4. **F.A. Jenkins & H.E.White:** Fundamentals of Optics
5. **Eugene Hetch:** Optic, Pearson.
6. **N.Subramanyam, Brijlal:** A Text Book Of Optics
7. **M.N. Avadhanulu:** A Introduction of Laser.

PAPER-V

Full Marks – 75 Duration 3 hours

A. Mathematical Physics 45 Marks

Vector Algebra: Scalar and Vector products, polar and axial vectors, differentiation of vectors: Gradient, Divergence and Curl, Gauss, Stoke and Green's theorems, Orthogonal co-ordinates, expression for Gradient, Divergence and Curl in Cartetian, Spherical and Cylindrical co-ordinates. Complex variables: Limit, continuity and Cauchy-Riemann conditions, Cauchy's theorem, Cauchy's integral formula, Taylor's and Laurent series, Cauchy residue theorem, Series solution of linear second order differential equation for harmonic oscillator, Legendre, Bessel, Hermite and Lagurre differential equations, Gamma and Beta functions, Fourier and Laplace transforms.

B. Special Theory of Relativity 30 Marks

Michelson- Morley experiment, postulates of the special theory of relativity, Lorentz transformations, simultaneity and order of events, Length contraction and Time dilation, Relativistic addition of velocities, velocity dependence of mass, Mass energy relation, Relativistic Doppler effect, Relativistic Kinematics, Transformation of energy and momentum.

Books Recommended:

1. **Satya Prakash:** Mathematical Physics
2. **Rajput & Gupta:** Mathematical Physics.
3. **M. Das, P.K. Jena & B.K. Dash:** Introduction to Mathematical Physics.
4. **Erwin Kreszic:** Advanced Engg. Mathematics.
5. **G. Arfken:** Method of Mathematical Physics.

PAPER-VI (PRACTICAL)

Full Marks – 50 Duration 4 hours

Experimental	30 Marks
Viva	10 Marks
Record	10 Marks

(Students are to perform one experiment during Examination)

Experiments relating to:

1. Diameter of narrow wire.
2. Diffraction grating.
3. Molecular rotation of sugar solution.
4. Resolving power of a telescope.
5. Resolving power of a grating.
6. Diffraction pattern due to a single slit.
7. Cauchy's constant of a prism.
8. Newton's ring.
9. Comparison of e.m.f. using stretched wire potentiometer.
10. Comparison of two nearly equal resistances.
11. Constant of a Ballestic Galvanometer.
12. Measurement of high resistance by leakage.
13. Static characteristics of a triode.
14. Characteristic curves for a transistor.

Books Recommended:

1. **Worsnoff and Flint:** Advanced Practical Physics
2. **B.B.Swain and K.Sailam:** B.Sc. Practical Physics
3. **Ghosh:** Advanced Practical Physics
4. **C.L.Arora:** B.Sc. Practical Physics, S.Chand & Company.
5. **Harnam Singh:** B.Sc. Practical Physics, S.Chand &Company.

FINAL UNIVERSITY EXAMINATION

PAPER-VII

Full Marks – 75 Duration 3 hours

Electricity & Magnetism

Coulomb's law, Electric field and potential, Gauss's law, field due to a spherical, linear and plane charge distribution, Poisson's & Laplace's equations for potential, Electric dipole, Potential due to an arbitrary charge distribution, Force and torque on a dipole placed in an electric field. Dielectric polarization. Dielectric sphere in uniform field. Electrostatic energy of a system of charges, uniformly charged sphere.

Magnetic field, magnetic force between current elements, magnetic induction, vector potential, Ampere's circuital law. Magnetic flux, calculation of magnetic induction for circular and solenoidal currents, torque on a current loop in a uniform magnetic field, magnetic dipole, forces on an isolated moving charge. Electromagnetic inductions ,a conducting rod moving through a non-uniform magnetic field, a loop moving through a non-uniform magnetic field, a stationary loop with field sources moving, universal law of induction, mutual induction, self induction, energy stored in a magnetic field. Magnetic susceptibility and permeability, elementary theory of dia, para and ferro magnetism, hysteresis, permanent magnetic circuit theory and electric measurement.

Kirchoff's law and it's application to D.C. circuits. Sensitivity of Wheatstone bridge, mutual inductance. Ballistic galvanometer, search coil. Growth and decay of current in R-C,R-L,L-C and LCR circuits. Alternating current in RL,RC,LC and RLC circuits .Reactance, impedance and admittance, wattless current, series and parallel, resonant circuits, sharpness of resonance, Q-factor of a coil.

Books Recommended:

1. **Brijlal & Subramanyam:** Electricity & Magnetism
2. **D.C. Tayal:** Electricity & Magnetism
3. **D.C. Tayal:** Electricity & Electronics.
4. **A.S. Mahajan, A.A. Rangawala:** Electricity & Magnetism
5. **K.K. Tiwari:** Electricity & Magnetism
6. **M.H.Nayfeh & M.K.Brussel:** Electricity & Magnetism
7. **Page & Adams:** Electricity & Magnetism

PAPER-VIII

Full Marks – 75 Duration 3 hours

A. Atomic and Modern Physics: 45 Marks

Alpha particle scattering ,scattering cross section, Bohr's theory of H-atom, energy levels, Bohr-Sommerfeld theory of hydrogen like atom, Bohr correspondence principle, Idea of quantum numbers, , Normal Zeeman's effect, Stern-Gerlach experiment, Pauli's exclusion principle, Raman's effect, Photoelectric effect, X-rays: production, properties, applications, diffraction of X-rays by crystal lattices, characteristics and continuous spectrum, Mosley law.Compton scattering Theory of lasers, Einstein's A & B coefficients, characteristic properties of laser and applications of lasers, Ruby laser, He-Ne laser, elementary idea about semi-conductor laser.

B. Electromagnetic Theory 30 Marks

Maxwell's equations, displacement current, vector and scalar potential, boundary conditions at interface between different media. Poynting theorem and Poynting vector. Polarisation of electromagnetic wave, description of linear, circular and elliptical polarization.

Books Recommended:

1. **C.L. Arora:** Atomic & Nuclear Physics
2. **N.N. Avadhantu:** An Introduction to Lasers –theory & applications
3. **R. Murugeshan:** A Text Book Of Modern Physics
4. **Arthur Baiser:** A Text Book Of Modern Physics
5. **J.B. Rajam:** Atomic Physics
6. **Gupta, Kumar & Singh:** Electrodynamics
7. **Amit Sarin:** Concepts Of Electromagnetic Field Theory

PAPER-IX

Full Marks – 75 Duration 3 hours

A. Quantum Mechanics 45 Marks

Inadequacy of classical mechanics, photoelectric effect, Davisson-Germer experiment, matter wave dualism, De Broglie waves, wave packets, Heisenberg uncertainty principle, Superposition principle, wave function,

Schrödinger's time dependent and time independent wave equation and its solution for one dimensional barrier problem, rectangular potential hill and potential well, and particle in a box.

B. Nuclear and Particle Physics **30 Marks**

Size, mass and charge of nucleus, Nuclear force, nuclear spin, Mass defect and Binding energy, Semi-empirical mass formula, Liquid drop model, Nuclear fission, Elementary Shell model, Radioactive laws of growth and decay, Working principle of G.M. Counter, Cloud chamber and Bubble chamber, Principle of linear accelerator,Cyclotron.Classification of elementary particles and their salient properties.

Books Recommended:

1. **Ajoy K. Ghatak:** Quantum Mechanics
2. **Schawal:** Quantum Mechanics
3. **M. Das, P.K. Jena:** Introduction to Quantum Mechanics
4. **C.L. Arora:** Atomic & Nuclear Physics
5. **Singh, Bagde & Singh:** Quantum Mechanics

PAPER-X

Full Marks – 75 Duration 3 hours

A. Electronics **45 Marks**

Electronic Devices: Semi-conductor, P-n junction, working and characteristics of p-n junction diode, Zener diode, Bipolar junction transistor(BJT), h-parameters for different configuration, Field Effect Transisters. (FET), JFET and MOSFET.

Electronic circuits: Junction diode rectifier, Basic transistor amplifier, criteria of sustained oscillations, Hartley and Colpitt's oscillator, Amplitute modulation and demodulation, Frequency modulation and demodulation, Super Heterodyne receiver.

Radio wave propagation, Idea about Muf, Skip distance, Virtual height. Elements of digital electronics, Logic gate, Boolean algebra ,K- map, Half adder and full adder.

B. Solid State Physics **30 Marks**

Elementary ideas of crystal structure, Types of lattices, Crystal bonding, Unit cell. Reciprocal lattice, Crystal diffraction, Bragg's law and X-ray diffraction, Band Theory: Kronie –Panny model, band theory and study of band gaps conductors, semi-conductors and insulators on the basis of band gap.

Books Recommended:

1. **B.B. Swain:** Electronics Vol-I & II
2. **D.C. Tayal:** Electricity & Electronics
3. **R.K. Puri & V.K. Babbar:** Solid State Physics
4. **Henry Jacobowitz:** Electronics made simple
5. **V.K. Mehta:** Fundamental of Electronics

PAPER-XI (PRACTICAL)

Full Marks – 100 Duration 6 hours

Experimental	60 Marks
Viva	20 Marks
Record	20 Marks

(Students are to perform one experiment during Examination)

Experiments relating to:

1. Calibration of weight.
2. Surface tension (Quinck's method).
3. Young's modulus(Vibration method).
4. Viscosity by Stoke's method.
5. Viscosity by Searle's method.
6. Viscosity by Oscillation Disc method.
7. Temperature coefficient of Surface tension.
8. Thermal conductivity of glass/rubber (Calorimetric method).
9. J' by Joule's calorimeter.
10. Measurement of absolute value of Earth's field.

11. Biprism.
12. Brewster's law.
13. Calibration curve of a prism spectrometer.
14. Average diameter of lycopodium power.
15. Calibration of meter bridge.
16. Growth and decay of potential of a capacitance.
17. Growth and decay of current in a circuit containing resistance and capacitance.
18. L.C.R. circuit(Resonant frequency).
19. R.C. coupled triode amplifier.
20. Ripple factor and efficiency of a full wave bridge rectifier using diode valves.

Books Recommended:

1. **Worsnoff and Flint:** Advanced Practical Physics
2. **B.B.Swain and K.Sailam:** B.Sc. Practical Physics
3. **Ghosh:** Advanced Practical Physics
4. **C.L.Arora:** B.Sc. Practical Physics, S.Chand & Company.
5. **Harnam Singh:** B.Sc. Practical Physics, S.Chand &Company.

STATISTICS (PASS)

COURSE STRUCTURE:

FIRST UNIVERSITY EXAMINATION

There shall be four theoretical papers each carrying 75 marks and eachof 3 hours duration and two practical papers carrying 50 marks and each of 4 hours duration.

Paper-I (Theory)	Probability, matrices andNumerical Methods		75 Marks
	a. Probability Theory	45 Marks	
	b. Matrices	15 Marks	
	c. Numerical Analysis	15 Marks	
Paper-II (Theory)	Statistical Methods		75 Marks
Paper-III (Practical)	Practical-I		50 Marks
	a. Practical	40 Marks	
	b. Record and Viva-voce	10 Marks	

SECOND UNIVERSITY EXAMINATION

There shall be two theory papers each carrying 75 marks and each of 3 hours duration and one practical paper carrying 50 marks of 4 hours duration.

Paper-IV (Theory)	Applied Statistics		75 Marks.
	a. Design and Analysis of Experiments	30 Marks	
	b. Sampling Techniques	30 Marks	
	c. Vital Statistics	15Marks	
Paper-V (Theory)	Statistical Inference, Time Series and Statistical Quality Control.		75 Marks
	a. Statistical Inference	30 Marks	
	b. Time Series	30 Marks	
	c. Statistical Quality Control	15 Marks	
Paper-VI (Practical)	Practical-II		50 Marks
	a. Practical	40 Marks	
	b. Record and Viva-Voce	10 Marks	

DETAILED COURSE

FIRST UNIVERSITY EXAMINATION

PAPER-I (PROBABILITY, MATRICES AND NUMERICAL METHODS)

Full Marks – 75 Duration 3 hours

a. Probability Theory: 45 Marks

Unit-I Definition of probability, classical and axiomatic approach, laws of addition and multiplication probability, conditional probability, Independent events, pair wise independence.

Unit-II Random variables, Density function, mass function, distribution function, joint distribution of two variables, mathematical expectation, addition and multiplication theorem of expectation, moment generating function.

Unit-III Standard univariate distributions and properties. Discrete: Uniform, Binomial and Poisson distribution and their properties. Continuous: Normal distribution and its properties Gamma and Beta distributions.

Books Recommended:

1. S.C. Gupta and V.K. Kapoor: Fundamentalof Mathematical Statistics.
2. K.L.Chung: Elementary Probability Theory with Stochastic Process, Springer International Student Edn.
3. A.M.Goon, M.K. Gupta and B. Dasgupta: Fundamental of Statistics: Vol.-I, (6^{th} revised edition, World Press).

Books for Reference:

b. Matrices 15 Marks

Determinants: Its evaluation, matrices – operation, transpose and inverse, rank of matrices, solution of linear equations.

c. Numerical Methods 15 Marks

Unit-IV Finite difference: Operators E and their properties, factorial notation, separation of symbols, Newton's forward and backward formula, Divided difference, Lagrangen's formula.

Books Recommended:

1. H.C. Saxena: Finite Differences and Numerical Analysis.
2. B.S. Goeland S.K.Mittal: Numerical Analysis.
3. B.S.Vatssa: Theory of Matrices.

PAPER-II (STATISTICAL METHODS)

Full Marks – 75 Duration 3 hours

Unit-I Idea of population and sample, measures of central tendency, mean, median, mode, partition values, measures of dispersion, moments, skeweness and krtosis.

Unit-II Bivariate distribution, scatter diagram, regression lines, regression coefficients, fitting of curves by least square principle, (Polynomial, Expeoriential and Logarithmic).

Unit-III Correlation coefficient, rank correlation, partial and multiple correlations, Regression plane (three variable only). Theory of attributes: Consistency of data, interdependence of attributes, measures of association.

Unit-IV Basic concept of sampling distribution, large sample theory and small sample theory: point estimation of parameters, concepts of bias and standard errors of an estimate, standard errors of sample mean and sample proportion.

Unit-V Test of significance: Null and alternative hypotheses level of significance, Type –I error & Type-II eror, Distributions and chi-square, t and F statistics, (without derivations) test of mean and variance of normal population, test of equality of two means and test of equtity of two variances of two normal populations, other uses of chi-square, t and F statistics, large sample tests.

Books Recommended:

1. V.K. Kapoor and S.C. Gupta: Fundamental of Mathematical Statistics.
2. A.M. Goon, M.K. Gupta and B. Dasgupta: Fundamentals of Statistics, Vol.-I (6^{th} edition, World Press, Calcutta).
3. B.P. Acharya, R,.N. Das: A Course on Numerical Analysis.
4. C.B. Gupta: Fundamental of Statistical Methods.

PAPER-III (PRACTICAL)

Full Marks – 50 Duration 4 hours

a. Practical 40 Marks

b. Viva-voce & Records 10 Marks

Section-A

1. Construction of bivariate frequency distribution, Simple correlation coefficeient and regression coefficients and their interpretation.
2. Calculation of multiple and partial correlation and regression coefficients.
3. Fitting of polynomials, exponential and logarithmic curves.
4. Tests of significance based on Normal distribution: Tests of significance based on (a) One Sample (b) Two sample (c) paired sample.
5. Tests of significance based on chi-square, contingency table, Tests of significance for the equality of two variances.

Section-B

1. Fitting of Binomial, Possion and normal distributions.
2. Practical based on Determinants and Matrices.
3. Interpolation with equal and unequal intervals, Estimate of one or two missing values in equal intervals.

SECOND UNIVERSITY EXAMINATION

PAPER-IV(APPLIED STATISTICS)

Full Marks – 75 Duration 3 hours

a. Design and Analysis of Experiments: 30 Marks

Unit-I Analysis of Variance: One way and two way classification for one observation per cell and their analysis.

Unit-II Basic principle of design of experiments, Randomisation, replication and local control, C.R.D., R.B.D. L.S.D. Missing plot technique in RBD and ISD, efficiency of the designs.

b. Sampling Techniques 30 Marks

Unit-III Concepts of population and samples, need for sampling, complete survey and sample survey, Basic concepts of sampling, organizational aspect of survey sampling, sample selection and sample size, basic sampling methods, simple random sampling (SRS) with and without replacement.

Unit-IV Startified random sampling, proportional and optimal allocation, systematic sampling.

c. Vital Statistics 15 Marks

Unit-V Vital statistics: Vital rates and ratios, crude death rate, Infant mortality rate, specific death rate, standardized death rates, crude and specific birth rates, general fertility rate, Total fertility rate, gross and net reproduction rates, elements of life table and uses.

Books Recommended:

1. S.C. Gupta and V.K. Kapoor: Applied Statistics.
2. M.N. Das & N.C. Giri: Design of Experiments.
3. Praimal Mukhopadhyaya: Applied Statistics.
4. P.V. Kukahatme & B.V. Sukahatme: Sample survey methods and its applications.
5. K. Srinivasan: Basic Demographic Techniques and applications.

PAPER-V

(STATISTICAL INFERENE, TIME SERIES AND ANALYSIS QUALITY CONTROL)

Full Marks – 75 Duration 3 hours

a. Statistical Inference: 30 Marks

Unit-I Estimation: Biased and unbiasedness, Consistency of estimation, Minimum Variance, Unbiased Estimation, Estimation by the method of moments, Maximum Likelihood estimation (procedures of finding out the estimators only).

Unit-II Test of Hypothesis: Simple and Composite hypothesis, Critical Region, Level of Significance, Power of the test, unbiased test, Neyman pearson Lemma (for simple hypothesis against simple alternative) Test of parameters in case of normal distribution under Simple Hypothesis.

b. Time Series Analysis **30 Marks**

Unit-III Meaning and uses of Time Series, components of Time Series, Measurement of trend-Graphic method, Method of semi-average, method of moving average, method of least quares – linear and parabolic trend, Merits and Demerits of different methods of trend elimination.

Unit-IV Method of iterated averages, Approximation moving averages, Measurement of seasonal indices – Methods of simple averages, Ratio to trend and link relatives, method of trend elimination by fitting mathematical curves.

c. Statistical quality control **15 Marks**

Unit-V Basic concept of quality control, different types of control charts, control charts of variables, mean and Range, mean and standard deviation, control chart for attributes, P-Chart, C-Chart, Producer and consumer risks, Description of single and double sampling plans, OC and AOQ curves.

Books Recommended:

1. V.K. Kapoor and S.C. Gupta: Applied Statistics
2. S.C. Gupta and V.K. Kapoor: Fundamentals of Mathematical Statistics.

Books for Reference:

1. P. Mukhopadhyaya: Applied Statistics, Books & Allied (P) Ltd., Cal.-9

PAPER-VI (PRACTICAL-II)

Full Marks – 50 Duration 4 hours

a. Practical **40 Marks**

b. Viva-voce & Records **10 Marks**

Section-A

1. Analysis of CRD, RBD and Latin Square Design.
2. Analysis of RBD and LSD with missing plots.
3. Drawing of simple random sample. Estimation of population total Mean and proportion with standard error. Ratio and Regression estimation of population total.
4. Allocation of sample in stratified sampling with proportional and optimum methods. Estimation of population means and total with standard error. Comparison of efficiency with simple random sampling.

Section-B

1. Calculation of different vital rates.
2. Construction of life tables.
3. Minimum Variance Unbiased Estimator.
4. Power curve for test of mean of normal distribution.
5. Control chart for number of defective3s and for fractions defectives.
6. (x, R) and (x, 0) charts.
7. O.C. curve and AOQ curve for single sampling plan, O.C. curve and AOQ curve for double sampling plan.

STATISTICS (HONS)

COURSE STRUCTURE:

There shall be eight theoretical papers each of 75 marks and each of three hours duration & three practical papers out of which two papers carrying 50 marks each and 4 hours duration and another carrying 100 marks and 6 hours duration.

FIRST UNIVERSITY EXAMINATION

Paper-I (Theory) Real Analysis and Numerical Analysis 75 Marks

	a. Real Analysis	30 Marks	
	b. Numerical Analysis	30 Marks	
	c. Matrices	15 Marks	
Paper-II (Theory)	Statistical Methods & Computer Programming		75 Marks
	a. Statistical Methods		
	b. Computer Programming		
Paper-III (Practical)	Practical-I		50 Marks
	a. Practical	40 Marks	
	b. Record and Viva-voce	10 Marks	
	SECOND UNIVERSITY EXAMINATION		
Paper-IV (Theory)	Probability Theory		75 Marks.
Paper-V (Theory)	Probability and Sampling Distributions.		75 Marks
Paper-VI (Practical)	Practical-II		50 Marks
	a. Practical	40 Marks	
	b. Record and Viva-voce	10 Marks	
	FINAL UNIVERSITY EXAMINATION		
Paper-VII (Theory)	Applied Statistics-I		75 Marks.
	a. Design and Analysis of Experiments.	45 Marks	
	b. Vital Statistics	15 Marks	
	c. Indian Official Statistics	15 Marks	
Paper-VIII (Theory)	Applied Statistics-I		75 Marks.
	a. Sampling Theory	45 Marks	
	b. Time Series	30 Marks	
Paper-IX (Theory)	Statistical Inference		75 Marks.
	a. Sampling Theory	45 Marks	
	b. Time Series	30 Marks	
Paper-X (Theory)	Applied Statistics-III		75 Marks.
	a. Operation Research	30 Marks	
	b. Statistical Quality Control	30 Marks	
	c. Non Parametric Inference	15 Marks	
Paper-XI (Practical)	Practical-III		100 Marks
	a. Practical	80 Marks	
	b. Record and Viva-voce	20 Marks	

DETAILED COURSE

FIRST UNIVERSITY EXAMINATION

PAPER-I (REAL ANALYSIS, NUMERICAL ANALYSIS AND MATRICES)

Full Marks – 75 Duration 3 hours

a. Real Analysis: 30 Marks

Unit-I Basic concepts of Sequences and Series of real numbers, convergence, Cauchy condition and different tests of convergence (comparison test, Ratio test, Cauchy-Root test) Absolute convergence, continuity of function and elementary properties.

Unit-II Convergence of infinite and improper integrals, Beta and Gamma integrals, Definition and evaluation of double integrals.

b. Numerical Analysis 30 Marks

Unit-III Use of operators Eand Factorial notations and separation of symbols. Inter-prolation with equal intervals and unequal intervals. Divided difference formula, Lagrange's formulas, Central difference formulae:- Newton, Gauss Steriling's and .Bessel's formulae, inverse interpolation by Lagrange's method.

Unit-IV Numerical differentiation, numerical integration – Simpson's Weddle's, solutions of equations by Newton –Raphson method, Bisection method and method of false position.

c. Matrices **15 Marks**

Unit-V Rank of Matrices, Elementary transformation of matrix. Solution of linear equations, characteristics equations and latent roots, quadratic forms.

Books Recommended:

1. S.C. Mallick: Mathematical Analysis.
2. G. Das and S. Pattanaik: Real Analysis.
3. B.C. Das and B.N. Mukherjee: Differential & Integral Calculus
4. H.C. Saxena: Finite Differences & Numerical Analysis.
5. B.S. Goel & S.K. Mittal: Numerical Analysis
6. B.S. Vatssa: Theory of Matrices
7. B.P. Acharya & R.N. Das: A course on Numerical Analysis.

PAPER-II (STATISTICAL METHODS & COMPUTER PROGRAMMING)

Full Marks – 75 Duration 3 hours

a. Statistical Methods **45 Marks**

Unit-I Concepts of statistical population and sample. Qualitative and Quantitative data, nominal, ordinal and time series data, discrete and continuous data, measures of locations: mean, median, mode, partition values, measures of dispersion, moments, Skewness and Kurtosis.

Unit-II Absolute moments and factorial moments, Inequalities concerning moments, Sheppard's corrections, Cumulants. Bivariate data: Scatter diagram, principles of least squares. Fitting of polynomial, Exponential and logarithmic curves.

Unit-III Correlation and Regression: Karl-Pearson's coefficient of correlation, coefficient of determination, line of regression, Spearmnan's Rank correlation, coefficient, correlation ratio, multiple and partial correlation (three variables only). Regression plane (three variables only). Theory of attributes: Consistency of data, inter-dependence of attributes, measures of association.

b. Computer Programming **30 Marks**

Unit-IV Fortran-77, Fortran constants and variables, Arithmetic Algorithm, Input and output statements, Simple computer programs, Control statements, subscripted variables, Logical operators G.E., N.E., G.T., L.T.

Unit-V Computer Program: Mean, variance, correlation coefficient, regression coefficients, solution of linear equations.

Books Recommended:

1. S.C. Gupta & V.K. Kapoor: Fundamentals of Mathematical Statistics.
2. A.M. Goon, M.K. Gupta and B. Dasgupta: An outline of Statistical Theory – Vol.-I
3. Seymour Lipschutz: Programming with FORTRAN, Arthur PQR Schaum Outline Series.
4. C. Xavier: Fortran-77 and Numerical Methods.

PAPER-III (PRACTICAL-I)

Full Marks – 50 Duration 4 hours

a. Practical **40 Marks**

b. Viva-voce & Records **10 Marks**

Section-A

1. Interpolation with equal and unequal interval using Newton, Lagrange, Sterling and Bissel's formula and estimation of on or two missing values in equal interval.
2. Problems relating to inverse interpolation.
3. Numerical integration – use of Simpson's Weddle's and Euler-Maclaurin's summation formula.
4. Solution of equation by Newton-Raphson's iteration Method.
5. Solution of linear equations.

6. Determination of characteristics roots.
7. Quadratic forms and reduction to canonical forms.

Section-B

1. Calculation of moments from grouped and ungrouped data with Sheppard's correction.
2. Various measures of dispersion, Skewness and Kurtosis.
3. Simple correlation coefficient from ungrouped data and from bivariate frequency table, computation of liens of regressions.
4. Multiple and partial correlation coefficient for trivariate data and plane of regression of three variables.
5. Fitting of polynomials and exponential curves by the methods of least squares.

SECOND UNIVERSITY EXAMINATION

PAPER-IV(PROBABILITY THEORY)

Full Marks – 75 Duration 3 hours

Unit-I Random experiment, sample point and sample space, event, algebra of events, definition of probability: classical and axiomatic approach, merits and demerits of these approaches, Theorems on probability, independent events, Bayes' theorem and its applications..

Unit-II Random variables; Discrete and continuous random variables, probability mass function, probability density function and c.d.f.; illustration of random variables and its properties, expectation of random variables and its properties, moments and cumulants, m.g.f. and c.g.f. characteristics function and its properties.

Unit-III Standard univariate probability distributions: Binomial, Poisson, Geometric, Negative Bionomial, Hyper Geometric, Uniform (Discrete Distributions and their properties).

Unit-IV Uniform (Continuous) Normal, Beta and Gamma distributions and their Properties.

Unit-V Limit Laws: Convergence in probability, almost sure convergence, convergence in mean square and convergence in distribution, Cheby Shev's inequality, weak law of large numbers and its applications, Basic concepts of Stochastic Processes, Random walk and Gamblers Ruin Problems.

Books Recommended:

1. S.C. Gupta and V.K. Kapoor: Fundamental of Mathematical Statistics.
2. W.Feller: Introduction to Probability and its applications (Vol.-I).
3. Kai Lai Chung: Elementary Probability theory with stochastic processes.
4. B.V. Gnadenko: Probability Theory.

PAPER-V (PROBABILITY AND SAMPLING DISTRIBUTIONS)

Full Marks – 75 Duration 3 hours

Unit-I Bivariate probability distributions, marginal and conditional distribution, independence of variates (only general ideas to be given), expectation and conditional expectation.

Unit-II Sampling distributions, Idefinition of random sample, parameter and statistic, sampling distribution of a statistic, standard error of sample mean, sample proportion and sample moments, sampling distribution of sample mean and sample variance of normal distribution.

Unit-III Sampling distributions of Chi-squares, t and F statistics. Their properties and inter-relations.

Unit-IV Bivariate normal distribution and its properties, Marginal and conditional distribution of bivariate normal distribution, Distribution of sample correlation coefficient r when population correlation p=0.

Unit-V Large sample test: Concept of test of hypothesis (Nul and Alternate hypothesis). Test of single proportion and difference of proportions, single mean and difference of two means. Test of significance of variance. Small sample test: Related tests of significance based on t, F and Chi-square statistics.

Books Recommended:

1. S.C. Gupta and V.K.Kapoor: Fundamental of Mathematical Statistics.
2. A.M. Goon, M.K. Gupta and B.Dasgupta: Fundamental of Statistics – Vol.-I.
3. A.M. Goon, M.K. Gupta and B.Dasgupta: An outline of Statistical Theory – Vol.-I

PAPER-VI (PRACTICAL-II)

Full Marks – 50 Duration 4 hours

a. Practical **40 Marks**

b. Viva-voce & Records **10 Marks**

Section-A

1. Fitting of Binomial, Poisson and normal distributions, with testing of goodness of fit.
2. Large sample tests: Test for signle proportion, Test for single mean, Test for difference of proportions, Test for difference of means, Test of standard deviation.
3. Tests of significance based on :
   a. One sample
   b. Two sample
   c. Paired sample
   d. Significance of correlation coefficient.
4. Tests of significance based on Chi-square.
   a. Contingency table
   b. Significance of variance
5. Test of significance for Equality of two variances.

FINAL UNIVERSITY EXAMINATION

PAPER-VII (APPLIED STATISTICS)

Full Marks – 75 Duration 3 hours

A. Design and Analysis of Experiments: **45 Marks**

Unit-I Analysis of Variance: One way model and two way model, Principles of experimentation; Randomisation, Replication and Local control, Description and Analysis of completely randomized design and Randomised block design, Missing plot technique in R.B.D. & its analysis (one observation only).

Unit-II Latin square design – description and analysis, missing plot analysis in L.S.D., Comparison of efficiency – CRD, RBD and LSD.

Unit-III Factorial experiment, Advantages of factorial experiment, analysis of 2^2 and 2^3 factorial experiments, confounding advantages and disadvantages, complete and partial confounded factorial experiment in 2^3. Factorial design and its analysis

B. **Vital Statistics:** **15 Marks**.

Unit-IV Vital Statistics: Vital rates & ratios, crude death rate, Infant mortality rate, specific death rate, standardized death rates, crude and specific birth rates, general fertility rate, Total fertility rate, gross and net reproduction rates, Elements of life table and uses.

C. **Indian Official Statistics** **15 Marks**

Unit-V Present official statistical system in India, methods of collection of official statistics, their reliability and limitations and the principle publications containing such statistics on the topics – population, agriculture and industry.

Books Recommended:

1. S.C. Gupta and V.K. Kapoor: Fundamental of Applied Statistics.
2. M.N. Das and N.C. Giri: Design and Analysis of Experiment.
3. Parimal Mukhapadhyay: Applied Statistics.
4. Govt. of India, New Delhi: Guide to Current Indian Official Statistics, Central Statistical Organization.
5. M.P. Saluja: Indian Official Statistics System, Statistical Publishing Society, Calcutta.

PAPER-VIII (APPLIED STATISTICS-II)

Full Marks – 75 Duration 3 hours

A. Sampling Theory: 45 Marks

Unit-I Population and sample, sampling and census, steps involves in sample surveys, random sampling and nonrandom sampling, sampling and non sampling errors.

Unit-II Simple random sampling with 'and' without replacement, methods of drawing simple random sample, stratified random sampling (proportional and optimum allocation).

Unit-III Systematic sampling – Estimation of population values with standard errors for the above methods. Ratio and regression methods of estimation, comparison of efficiency.

B. Time Series Analysis: 30 Marks

Unit-IV Meaning and uses of Time Series, components of Time Series measurement of Trend-Graphic method, method of semi-average, method of moving averages, method of least squares – linear and parabolic trend, variate difference method. Merits and Demerits of different methods of trend elimination.

Unit-V Method of iterated averages, Approximation moving averages, Spencer's 15 point formulae, Measurement of seasonal indices – Methods of simple averages, Ratio to trend and link relatives, method of trend elimination by fitting mathematical curves, determination of cyclical component.

Books Recommended:

1. P.V. Sukhatire and B.V. Sukhatire: Sampling theory of Surveys with application.
2. W.G. Cochran: Sampling Techniques.
3. S.C. Gupta and V.K. Kapoor: Fundamental of Applied Statistics.
4. Parimal Mukhopadhyay: Applied Statistics.

PAPER-IX (STATISTICAL INFERENCE)

Full Marks – 75 Duration 3 hours

A. Statistical Estimation 45 Marks

Unit-I Parameter space, sample space, point estimation, requirement of a good estimator. Unbiasedness, minimum variance unbiased estimators, Cramer- Rao inequality, sufficiency and completeness, Rao-Blackwell theorem and its use.

Unit-II Consistency and efficiency criteria of estimation, linear models, estimability and BLUE, method of least squares, Gaus-Markov theorem, Estimation by the method of moments.

Unit-III Method of maximum Likelihood estimation, properties of maximum likelihood estimator (consistency and sufficiency only). Interval estimation: Confidence interval for the parameters of normal distribution.

B. Statistical Testing of Hypothesis 30 Marks

Unit-IV Simple and composite statistical hypotheses, Null and Alternate hypotheses, critical region, two kinds of errors, level of significance and power of a test, Neyman-Pearson Lemma, M.P. Tests and M.P. critical region (for simple hypotheses only).

Unit-V UMPU test and UMPU critical region (for simple hypothesis), concept of likelihood ratio test procedure and its application for normal parameters only.

Books Recommended:

1. H.C. Saxena & P.U. Surendran: Statistical Inference.
2. A.M. Goon, M.K. Gupta & B. Dasgupta: An outline of Statistical Theory: Vol.-II.
3. S.C. Gupta and V.K. Kapoor: Fundamental of mathematical Statistics.

PAPER-IX (APPLIED STATISTICS-III)

Full Marks – 75 Duration 3 hours

A. Operation Research` 30 Marks

Unit-I Linear Programming problems: Mathematical formulation, method of graphical solution, general linear programming, problems, slack and surplus variables, reformulation and general LPP.

Unit-II Simplex method: Introduction, simplex algorithm and computational procedure, artificial variables, formulation LPP and solution by simplex method, unrestricted variables, solution of simultaneous linear equations using simplex method.

B. Statistical Quality Control: 30 Marks

Unit-III Meaning and uses of sac, chance and assignable causes of variation, process and product control, natural tolerance limits and specification limits, 3-sigma control limits, control charts:

i. For Variables: Mean and range, Mean and standard deviation.

ii. For attributes: p-chart, c-chart.

Unit-IV Principles of acceptance sampling problem of lot acceptance, stipulation of good and bad lots, producer's and consumer's risks, single and double sampling plans and their O.C. functions, concepts of AQL, LTPD, AOQL, average amount of inspection & ASN function, rectifying inspection plans, Dodge and Roming tables.

C. Non-parametric Inference: 15 Marks.

Unit-V Non-parametric Test: One sample and two sample sign tests, Wold-Wolfourtz runs test, Run test for randomness, median test, Wilcoron-Mann-Whitney test.

Books Recommended:

1. P.K. Gupta & Man Mohan: Operation Research and Theory of Games, Sultan Chand & Sons.
2. S.C. Gupta and V.K. Kapoor: Fundamental of Applied Statistics, Sultan Chand & Sons.
3. Parimal Mukhapadhyay: Applied Statistics.
4. K. Srinivasan: Basic Demographic Techniques & Applications.

PAPER-XI (PRACTICAL-III)

Full Marks – 100 Duration 6 hours

a. Practical 80 Marks

b. Viva-voce & Records 20 Marks

1. Analysis of variance – one way and two way classified data.
2. Analysis of C.R.D. , R.B.D. and Latin Square Designs.
3. Missing plot technique in R.B.D. and L.S.D. with analysis.
4. Analysis of 23, 24 factorial experiments.
5. Non-parametric tests – based on sign, median and run test.
6. Calculation of power of a test of normal mean and known variance.
7. Measurement of cecular trend by least squares and moving average method.
8. Measurement of seasonal variation by simple average, ratio of trend, ratio-to-moving average and link-relative method.
9. Control chart for number of defectives and for fractions defectives.
10. (x, R) and (x, 0) charts.
11. O.C. curve and AOQ curve for single sampling plan O.C. curve and AOQ curve for double sampling plan.
12. Simple random sample: Estimation of population mean, total and proportion with standard errors.
13. Stratified random sampling: Estimation of population mean and total for proportional and optimum allocation with standard errors. Comparison of efficiency with simple random sampling, estimation of gain due to stratification.
14. Systematic sampling:: Drawing of a systematic sample, comparison of efficiency with S.R.S. and stratified random sampling.

15. Calculation of mortality and testability and reproduction rates.
16. Construction of complete life table and abridged life table.
17. Conversion of practical problem to the standard L.P. from and introduction to slack and surplus variables.
18. Solution of LPP by graphical and simpler method.

TEXTILE SCIENCE (PASS)

FIRST UNIVERSITY EXAMINATION

PAPER-I (THEORY)

Full Marks – 75 Duration 3 hours

Unit-I Definition and classification of Textile fibers, Essential and desirable properties of Textile fibers, Physical and Chemical structures, properties and uses of natural fibres such as Cotton, Flax, Jute, Manila, Sisal Silk, Wool etc.

Unit-II Structure requirement of fiber forming polymer, Types of Polymerisation reactions, Basic principle of formation of various fiber forming polymer, Types of polymerization reactions, Basic principle of formation of various fiber forming polymer, polyester, Nylon-66, Nylon-6, Polyacryl nitrile, Polypropylene, viscose rayon, cellulose acetate, molecular architecture, Determination of molecular mass, importance of molecular mass and its distribution on properties of polymers.

Unit-III Glass transition temperature, The concept of order in fiber, polymer crystallinity and orientation, importance of amorphous phase.

Unit-IV Man made fibers, properties and structure, fiber identification, fiber blend and fiber analysis.

PAPER-II (THEORY)

Full Marks – 75 Duration 3 hours

Unit-I Definition of Yarn, Z-twist, S-twist, principle of yarn formation, different type of yarn and their use, different yarn numbering system.

Unit-II Brief study of principle of fabric formation, fabric classification, Notation weaves & plain, twill stain, Rif, Huck aback creps, drafting and peg plan.

Unit-III Study of various elements of Handlooms, various types of Handloom, Basic concept of power loom, principle of knitting.

Unit-IV Concept of fine art and design, their colouration, perception of colour, theory of colour vision, colour mixing, colour specification and colour specifying system.

Unit-V Classification of dyes, Chemistry of different types of dyes, such as Direct, Reactive, Vat, Acid, Basic, Naphthol and Disperse dyes.

PAPER-III (PRACTICAL-I)

Full Marks – 50 Duration 4 hours

1. Morphological structure of all fibers by microscope/ projectina.
2. Maturity test of cotton fibers.
3. Identification of fibers.
4. Bland analysis of fibers.
5. Measurement of Yarn count.
6. Measurement of Yarn twist.
7. Determination of wrap and weft per inch in a fabric.
8. Determination of wrap and weft count from fabric by Beesely balance.

SECOND UNIVERSITY EXAMINATION

PAPER-IV (THEORY)

Full Marks – 75 Duration 3 hours

Unit-I Fabric preparation, Gray inspection, Cropping, sizing and designing methods (enzyme, acid oxidative etc.). Type of blending agents, their preparation & properties. Technology of bleaching natural, Synthetic & blended fabrics. Evaluation of bleached fabrics in terms of whiteness and chemical degradation.

Unit-II Development of Caustic Soda- Mercerization, Physical & Chemical changes in cotton as a result of mercerization, Methods and equipments for Yarn and fabric mercerization, hot mercerization, Determination of mercerization efficiency, liquid ammonia treatment and its comparison with caustic soda mercerization.

Unit-III Dyeing, classification of dye according to method of application. Dyeing of cellulose and protein fibers with different type of dyes, Dyeing of nylon, polymer and acrylic Dyeing of Polyester, Cellulose, Polyester wool and wool acrylics.

Unit-IV Concept of Tie & Dye particular, Technique involved in Tie & Dye for producing a particular design in fabric, Development of Dyeing machinery for batch, Semi continuous & continuous dyeing, fastness grades, evaluation of wash, light, crock, perspiration and sublimation, fastness properties of dyed fabrics.

PAPER-V (THEORY)

Full Marks – 75 Duration 3 hours

Unit-I **Printing:**

Printing methods and styles of printing, printing of natural and synthetic fiber with various classes of dyes. Printing of Polyster-cotton blends, developments in printing machinery, machines for ageing and steaming, printing thinkers and auxiliaries.

Unit-II **Finishing:**

Introduction to the finishing of textiles calendaring, sanforization, Easy care finishing of cellulosics and blends including the chemistry of cross linking, minimum application and foam technology, softening and stiffening, Rot and moulded proofing, milling, moth proofing of wool, weighting of silk, water proofing and water ecpellency, flame retandancy, setting of synthetic fabric, Art state & soil release finishing, Machines used in finishing.

Books Recommended:

1. **V.A. Shenai:** Textile Fiber.
2. **Monchrift:** Man-made Fiber
3. **S.P. Misra:** Fiber science
4. **E.P. G. Gole, H. Dvilensky:** Textile Science
5. **J.T. Marsh:** Textile Science
6. **Bernard P. Corbman:** Fiber to Fabric formation
7. **Clark:** Textile Printing

PAPER-VI (PRACTICAL-II)

Full Marks – 50 Duration 4 hours

1. Scouring of cotton yarn and fabrics.
2. Bleaching of cotton yarn, fabric by using hypo9chlorite and H_2O_2 methods.
3. Dyeing of cotton yarn by direct dye, reactive dye, Vat dye.
4. Dyeing of silk ley acid and basic dyes.
5. Dyeing of yarn by Tie & Dye Method
6. Visit of a local Textile industries and Submission of report in maximum ten pages
7. Study of fastness properly of dyed cloth.

ZOOLOGY (PASS)

COURSE STRUCTURE:

FIRST UNIVERSITY EXAMINATION

There shall be four theoretical papers each carrying 75 marks and eachof 3 hours duration and two practical papers carrying 50 marks and each of 4 hours duration.

Paper-I (Theory)	Non chordate & Cell Biology	75 Marks
Paper-II (Theory)	Genetics, Developmental Biology & Resource Biology	75 Marks
Paper-III (Practical)	Practical Related to Theory Paper-I & II	50 Marks

SECOND UNIVERSITY EXAMINATION

There shall be two theory papers each carrying 75 marks and each of 3 hours duration and one practical paper carrying 50 marks of 4 hours duration.

Paper-IV (Theory)	Chordate & Ecology	75 Marks.
Paper-V (Theory)	Human Physiology, Biochemistry	75 Marks
Paper-VI (Practical)	Practical Related to Theory Paper-IV & V	50 Marks

DETAILED COURSE

FIRST UNIVERSITY EXAMINATION

PAPER-I

Full Marks – 75 Duration 3 hours

Candidates are required to answer one question from each unit.

Unit-I

Broad Outline classification of the following non-chordate Phyla and the types mentioned in each phyla with habit, habitat, morphology, anatomy and life history.

1. Protozon *Englena and Paramecium*
2. Porifera *Sycon*
3. Coelenterate *Aurelia*

Unit-II

1. Phylum – Plashelminthes – *Fasciola*
2. Nemathe lminthes – *Ascaris*
3. Annelida – *Hirudo*

Unit-III

1. Arthropada: Prawn
2. Mollusca: Pila
3. Echirodemata: Asterias

Unit-IV

1. Call concept, Prokaryotes and eqkaryte cell types.
2. Ultrastructure of typical animal cell and elementary knowledge about the functions of subcellular components such as endoplasmic reticulum and mitochondria.

Unit-V

1. Structure and working of a light microscope.
2. Principle and working of phase contrast microscope.
3. Centrifugation and mechanism of centrifugation, cell fractionation.

PAPER-II

Full Marks – 75 Duration 3 hours

Candidates are required to answer one question from each unit

Unit-I

1. Structure of chiromosomes and their behavior during cell division (Mitosis and meiosis)
2. Mendal's Laws of inheritance
3. Linkage and crossing over

Unit-II

1. Chemical nature of gene and its replication.
2. Sex linked inheritance. Sex linkage in Drosophila sex linkage in Human beings (Haemophillia and colour blindness).
3. Determination of sex. Sex chromosome mechanism and genic balance.

Unit-III

1. Structure of male and female gamets.
2. Mechanism of fertilization.
3. Development of Frog upto gastrulation and origin of three germ layers.

Unit-IV

1. Definition of resource, renewable and non-renewable resources.
2. Renewable resource: Forestry with reference to social Forestry, Aquaculture and its scope in Odisha.

Unit-V

1. Habit, breeding and distribution of tiger and deer in Odisha.
2. Life history and culture methods of mulberry and tasar, Silk moth and Honey bee.

Books Recommended:

PAPER-III (PRACTICAL)

Full Marks – 50 Duration 4 hours

Practical related to theory papers I & II

1. Dissections: Anatomical features of the following types earthworm, Prawn, cockroach & Pila
2. Microscopic preparations of the following: Englena, Paramecium, and other protozoans species, gemmules of Sporges, Hydrozoan Colonies, Green gland and Statecysts of Prawn, Crusstacean Larvae, Tube feet of Starfish, and study of museum specimens related to theories.
3. Identification and comment on Embsryological slide & of various stages of frog development.
4. Identification of animal association like symbiosis, commensalisms and parasitism, Renewable and non-renewable resources, silk moth, Honey bees, fossils
5. Squash preparation of onion tip and grasshopper testis for demonstration of chromosomes and identification of different stages of mitosis and meiosis
6. Viva-Voce
7. Class record, field report/collection

SECOND UNIVERSITY EXAMINATION

PAPER-IV

Full Marks – 75 Duration 3 hours

Candidates are required to answer one question from each unit.

Unit-I

1. Broad outline classification of the phylum Chordata upto order but upto subclasses in cash of protochordates, Agnatha, Pisces, Aves and Manmalia.
2. Habit, habitat and morphological organization and anatomy of the Hemichordates: Balanoglossus.
3. Urochordata: Herdmania

Unit-II

1. Cephachordata: Amphioxus
2. 2. Pisces: Scoliodon
3. Amphibian: Frog and Toad digestive and Respiratory system.

Unit-III

1. Reptilia: Calotes Circulatory system
2. Aves: Circulatory and respiratory system
3. Mammalian: Rabhit/Rat skin and brain of rabbit

Unit-IV

1. Definition, Scope and subdivisions of Ecology.
2. Ecosystem: concept of ecosystem, structural component of ecosystem, Pond as an aquatic ecosystem.
3. Food chain, food web, Trophic level and elementary concept on energy flow in ecosystem.

Unit-V

1. Temperature and light as ecological factors.
2. Biogeochemical: Carben and nitrogen cycle.
3. Environment: Atmosphere, various zones of atmosphere.
4. Lithosphere: Process of Soil formation, Soil profile, Major oil groups of India.

PAPER-V

Full Marks – 75 Duration 3 hours

Candidates are required to answer one question from each unit

Unit-I

1. Physiology of digestion of carbohydrate, proteins and fats.
2. Composition and function of mammalian blood, process of clotting, types of heart, control of heart beat.

Unit-II

1. Mechanism of Urine formation and function of loop of Henle in mammals.
2. Structure and function of a vertebrate neuron.
3. Structure of skeletal muscles and mechanism of muscle contraction.

Unit-III

1. A general idea about mammalian hormone secreting glands.
2. Hormones of pituitary and thyroid glands and their functions.
3. Physical and chemical properties of protoplasm.

Unit-IV

1. Chemical nature of enzymes and mechanism of enzyme catalysis.
2. Hydrogen-ion concentration (PH) and its determination, buffers and buffering action.

Unit-V

1. Definition and evidence in support of organic evolution with reference to paleontology and embryology.
2. Lamackism, Darwinism and New-Darwinism.
3. Distribution of animals geological time table.

PAPER-VI (PRACTICAL)

Full Marks – 50 Duration 4 hours

1. Dissections: Anatomical feature of
   a) Scoliodon
   b) Frog/Toad (Cranial nerves & hyoid apparatus)
   c) Calotes (Except peripheral nervous system)
2. Temporary Preparations:
   a) Amphioxus
   b) Scales of fishes
   c) Blood film of Frog and Mammals
   d) Feathers of birds
   e) Pectin of birds
3. Museum specimens and bones of different chordate groups. Models of DNA, RNA, Purine and Pyrimidine bases.
4. a) Estimation of total count of RBC, WBC and hemoglobin in Mammlien blood.
   b) Estimation of human salivary digestion.
   c) Measurement of pH saliva, urine or any other solution.
5. Simulation of Ecosystem in the Laboratory
6. Viva-Voce
7. Class record/filed report and filed collection.

ZOOLOGY (HONS)

COURSE STRUCTURE:

FIRST UNIVERSITY EXAMINATION

Paper-I (Theory) Non chordate 75 Marks

Paper-II (Theory)	Cell Biology and Resource Biology	75 Marks
Paper-III (Practical)	Practical based on Theory Paper- I & II	50 Marks
	SECOND UNIVERSITY EXAMINATION	
Paper-IV (Theory)	Chordata and ecology	75 Marks.
Paper-V (Theory)	Human Physiology, Biochemistry	75 Marks
Paper-VI (Practical)	Practical related to Theory paper- IV & V	50 Marks
	FINAL UNIVERSITY EXAMINATION	
Paper-VII (Theory)	Animal development and Genetics	75 Marks.
Paper-VIII (Theory)	Taxonomy, Biostatistics, Ethology and Basic Biotechnology	75 marks.
Paper-IX (Theory)	Biochemistry and molecular biolog	75 Marks.
Paper-X (Theory)	Animal Physiology, Endocrinology and Microbiology	75 Marks.
Paper-XI (Practical)	Practicals based on Theory Paper VII to XI	100 Marks

DETAILED COURSE

FIRST UNIVERSITY EXAMINATION

PAPER-I

Full Marks – 75 Duration 3 hours

Candidates are required to answer one question from each unit.

Unit-I

1. Broad outline classification of the following non-chordate phyla and the types mentioned in each phyla with habit, habitat, morphology, anatomy and life history.
2. Protozoa- Euglena, Paramecium and Polystomella.
3. Porifera- Sycon.
4. Coclenferata: Aurella and Ctenophora.

Unit-II

1. Phylum- Platyhelminthes: Fasciola and Taania.
2. Annelida: Hirudo

Unit-III

1. Arthropoda: Prawn and Peripatus.
2. Mollusca: Pila
3. Echinodermata: Asterias

Unit- IV

1. Prvasitism and host specificity with reference to Trypanosoma, Plasmodium, Blood fluke and filarial worms.
2. Camal system
3. Polymorphism in coelenterate.

Unit-V

1. Mouth parts and feeding habits of insects.
2. Torsion in Gastropoda.
3. Peari Culture.
4. Larval forms in Echinodermata

PAPER-II

Full Marks – 75 Duration 3 hours

Candidates are required to answer one question from each unit.

Unit-I

1. Cell concept, Prokaryotes and eukaryotes cell types.
2. Ultrastructure of typical animal cell. Structure and functions of sub-cellular components, such as ribosome, mitochondria, endoplasmic reticulum, Golgi bodies, Lysosomes and nucleus.
3. Plasma membrane (Structure and function)

Unit-II

1. Resolving power of microscopes:
   i) Compound microscope.
   ii) Phase contrast microscope.

2. i) Autoradiography.
   ii) Cell Fraction and Centrifugation.
   iii) Microtomy and calorimetry.

Unit-III

1. Centrioles and basal bodies: Structure, Chemical composition, origin of cilia, basal bodies and centrioles.
2. Structure of chromosomes and their behavior during cell division (Mitosis and meiosis)
3. Lamp brush and polytene chromosomes.

Unit-IV

1. Definition of resource, renewable resource: Forestry with reference to social forestry, Aquaculture and its scope in Odisha.
2. Energy and its conservation- only commercial source of energy such as Coal, Petroleum, Natural gas, nuclear fuels and electricity energy.

Unit-V

1. Habit, breeding and distribution of the following wild mammals in Odisha: Tiger, Deer and Elephants.
2. Wild life of India, mode of Wild life conservation.
3. Life history and culture methods of tassar Silk moth and Honey bees.
4.

PAPER-III (PRACTICAL)

Full Marks – 50 Duration 4 hours

Based on Paper-I & II

(a) Dissections: Students are required to dissect and study the anatomical features of the following types: Earthworm, Prawn, Cockroach, Apple Snail.
(b) Microscopic preparation of the following, Amoeba, euglena, Paramecium, Spiculas and Gemmules of sporges, Hydrozoan colonies, Green gland and stat cyst of Prawn, Crustacean Larvae, Mouth parts of mosquito, tube feet of star fish.
(c) Study of museum specimens related to theory Paper-I
(d) Collection and study and identification of different stages of silk- worm and honey bees and other resources relating to theory Paper-II
(e) Field Study field report to be assigned the Teacher.
(f) Viva-Voce
(g) Class record, Collection, Field work & report.

SECOND UNIVERSITY EXAMINATION

PAPER-IV

Full Marks – 75 Duration 3 hours

Candidates are required to answer one question from each unit.

Unit-I

1. Broad outline classification of the Phylum Chordata upto orders, but upto sub-classes in case of Protochordates, Angatha, Pisces, Aves and Mammalia.
2. Habit, Barbitat and morphological organization of the Hemichordata: Balanoglossus.
3. Urochordata: Herdmania.

Unit-II

1. Cephalochordata: Amphioxuz
2. Agratha: Petromyzon
3. Pisces: Scoliodon

Unit-III

1. Amphibia: Frog and Toad
2. Reptilia: Calotes
3. Aves: Columba Circulatory and respiratory system of columba
4. Rabbit/Rat: Skin and Brain
5.

Unit-IV

1. Comparative anatomy of vertebrates from evolutionary point of view of the following system.
   i) Integumentary

ii) Blood Vascular
iii) Urinogenital system

2. Phylogeny and inter- relationship of Protochordate groups.
3. Affinities of Cyclostomata.

Unit-V

1. Parental care and neoteny in Amphibia.
2. Skull of reptiles in relation to classification.
3. Biting mechanism of snakes.
4. Salient features and affinities of prototheria and Metatheria.

PAPER-V

Full Marks – 75 Duration 3 hours

Candidates are required to answer one question from each unit.

Unit-I

1. Definition, scope and subdivisions of Ecology, Bio-sphere, components of Biosphere.
2. Ecosystem: Concept of ecosystem structural component of an ecosystem, the pond as an aquatic ecosystem.
3. Food chain, food web, Trophic level and elementary concept on energy flow in ecosystem.

Unit-II

1. Temperature and light pH, salinity, Humidity as ecological factors.
2. Biogeochemical cycles: Carbon, nitrogen and oxygen cycle.
3. Concept of population and concept of Biotic community.

Unit-III

Biotic relationship: The intraspecific and the inter specific interrelations. The intraspecific interrelations social organization of termites and bees.

Interspecific relations: Symbiosis, Parasitism, Commensalism and mutualism, Mutualism between plants Species, between animal and plant and between animal species.

Concept of pollution with particular reference to water and air.

Unit-IV

1. Definition and evidences in support of organic, evoluation with reference to, palaceontology, embryology and comparative physiology and biochemistry. Geological Time Scale Comparative anatomy.
2. Theories of evolution: Lamarkism and dArwinism, Neo-Darwinism.
3. Isolation: Isolating agents- Geographical, Spatial and reproductive.

Unit-V

1. Adaptations
2. Geographical distribution of animals: (Zeo Geographical realms)
3. Evolution of man.
4. Evolution of horse.

PAPER-VI (PRACTICAL)

Full Marks – 50 Duration 4 hours

Practical: Chordates, Eco Evolution

1. Dissection-

Calotes- circulatory & Cranial Systems, apparatus. Scoliodon / Internal ear.
Mounting- Feathers of birds, Ampulae of Lorenzinic scale of fishes.

2. Museum specimens of diff chordate groups
3. Bones and Histological slides related to paper-IV and paper-V

2. Ecology

1. a) Study of model ecosystem like pond ecosystem.
   b) Measurement of pH of different water samples.
   c) Quantification of fish respiration.
   d) Determination of O_2 contents of Water Sample by Winkler's Method

FINAL UNIVERSITY EXAMINATION

PAPER-VII

Full Marks – 75 Duration 3 hours

Candidates are required to answer one question from each unit.

Unit-I

1. Gametogenesis, structure of male and female gametes.
2. Mechanism of fertilization and its significance.
3. Cleavage- its rule, types, mechanism, role or yolk in cleavage.

Unit-II

1. Outlines of development of Amphioxus, Frog and Chick with reference to cleavage gastrulation and origin of three germ layers.
2. Fate of germ layers- Listing of derivatives of germ layers.

Unit-III

1. Cyto-differentiation, Organizer concept (Spemann's expt.)
2. Tadpole larva of Frog and its metamorphosis.
3. Development of extra embryonic membranes, types of Placenta and placentation in mammels.

Unit-IV

1. Concept of heredity, Mendelian principle of inheritance Back Cross and Test Cross, Incomplete dominance, Co-dominance, epistasis.
2. Linkage and Crossing-over, Chromosome mapping.
3. Concept of multiple alleles, interaction of genes.

Unit-V

1. Sex-linked inheritance: Sex linkage in Drosophila and man. (Haemophilia and colour blindness).
2. Determination of Sex in Drosophila, Man, birds, bees, grasshopper.
3. Sex anomalies of man- Turner syndrome, Klinefelters and autosomal abnormality- Down's syndrome.

PAPER-VIII

Full Marks – 75 Duration 3 hours

Candidates are required to answer one question from each unit.

Unit-I

1. Definition of Taxonomy, artificial and natural classification and their meaning, Binomial Classification.
2. The species concept, Race and sub-species.
3. Five kingdom system of classification of life: Monera, Protista, Fungi, Plantae and Animalia- Knowledge of each kingdom in brief.

Unit-II

1. Use and scope of Biometry.
2. Average: Arithmetic Mean, Median and Mode.
3. Frequency distribution, graphical representation of data (Frequency, Polygon, histogram).
4. Dispersion in data and measurement of standard deviation.
5. 't' test and Chi- square test.

Unit-III

1. Concept of animal behavior.
2. Innatebehaviour- Kinesis and Taxes.
3. Learned behaviour such as conditional reflex.
4. Concept of biological clock.

Unit-IV

1. Concept of Genetic Engineering as Biotechnology.
2. Elementary idea about restriction endonucleases and Plasmid.
3. Elementary knowledge about recombinant DNA technology and its application.
4. Transgenic animals and their utility.

Unit-V

1. Application of Biotechnology in medicine. (Hybridoma technology, Preparation of vaccine)
2. Application of Biotechnology in Agriculture. (Pest & herbicide resistant crop, antisense technology)
3. Application of Biotechnology for environmental pollution.

PAPER-IX

Full Marks – 75 Duration 3 hours

Candidates are required to answer one question from each unit.

Unit-I

1. Structure, types and significance of biomolecules such as amino acids, carbohydrate, proteins and lipids.

Unit-II

1. Enzymes: Chemical nature of enzymes, classification, mechanism of enzyme action, kinetics and factors affecting enzyme actions.
2. Physical and chemical properties of protoplasm.
3. Antigen and antibody (elementary idea).

Unit-III

1. Hydrogen ion concentration (pH) and its determination.
2. Buffers and buffering actions.
3. Metabolic pathways such as glycolysis, TCA cycle and electron transport in cells.

Unit-IV

1. Structure and Chemical composition of DNA and RNA and their types.
2. Replication of DNA Evidences of semi conservative replication.
3. Molecular concepts of genes- Split gens- exon and introns one gene one polypeptide.

Unit-V

1. Genetic code, deciphering of G-Code, and its properties.
2. Protein synthesis (Central dogma) – transcription and the process of translation in ribosomes.
3. Regulation of Gene Action or regulation of protein synthesis (Jacob and Monod operon model) in prokaryotes.

PAPER-X

Full Marks – 75 Duration 3 hours

Candidates are required to answer one question from each unit.

Unit-I

1. Structure and function of Neurons, Basic of Neuronal excitability, conduction of nerve inpulse, neurotrans- mitters and synapse.
2. Mechanism of muscle contraction with reference to twitch, summation, titanic condition, fatigue, recruitment.
3. Structure of nephron, mechanism of urine formation and function of coop of Henle in mammals.

Unit-II

1. Physiology of digestion in man of carbohydrates, fats, and proteins.
2. Composition and function of mammalian blood, clotting & Agglutination. Haemodynamics
3. Physiological types of heart, Regulation of heart beat. Stalings' Laws.
4. Blood group: ABO and Rh- factor.

Unit-III

1. Respiration: Mechanism and control of breathing. Transport of respiratory gases-O_2 and CO_2. Respiratory pigments.
2. Oxygen equilibrium curves, for M, Hb, Root & Botir's effect.
3. Hormones of Pituitary thyroid and adrenal glands is lets of functional effects.

Unit-IV

1. Chemical nature of hormones: Pheromones, Prostagland I Steroid, Peptide and Amino acid derivatives, Examples & sources.
2. Elementary Knowledge of hormones of insects.
3. Mechanism of hormones (Protein & Steroid) action.

Unit-V

1. Virus: Characteristic, size structure and mode of infection of Bacterial viruses (Phage).
2. Viral disease of Man: influenza, small pox and Mumps (Elementary Knowledge).
3. Bacterial structure types and multiplication, life cycle, Bacterial disease, Tuberculosis, Diphtheria & Leprosy.
4. Role of microbial toxing and enzymes. Antibiotics (Bried nature & action).

PAPER-XI (PRACTICAL)

Full Marks – 100 Duration 6 hours

A. Ani. Dev., Genetics, Taxonomy, Ethology, Bio Statistics and Biotechnology

1. Animal Development

a) Study from W.M. preparation of different development all stages of Frog and chick embryos.
b) Study from microtome- Section preparation of different developmental Stages of from and chick. a & b- observation from purchased slides
c) Whole mount preparation chick embryos of 24, 48 & 72 hours old.

2. Genetics-

a) Temporary aceto- carmine (or orcein) squash preparation of onion root tips to study mitosis.
b) Temporary aceto- carmine (or orcein) squash preparation of grasshopper testis to study meiosis
c) Preparation of mitotic chromosomes from bone marro of rats/mice.

3. Biostatistics

Statistical problems can be given to the students for solving (Problems may invo 'Chi' – square test, t-test mean, median, drawing of histrogram, graphs etc.) Students may be supplied with a mixture of pulses of 2 different colours, e.g. Green & Black (say' mung' and 'bin') or of 2 different sizes- assuming that they belong to the same sp. They are to sort them out- count them separately and analyse statistically, if they, follow 3:1 Mendelian Principle, Mixture may contain 29:92, 30:93, 30:88……..)

4. Squash (aceto carmine stain) preparation of onion root tip and gasshopper. Tests to study different divisional stages of mitosis and meiosis.

(B) Animal Physiology, Microbiology, Biochem. & Mol. Biol.

1. Animal Physiology:

a) Effect of temperature on heart beat of rats.
b) Total count RBC & WBC by hemocytometer.
c) Preparation of hematin crystals.

2. Microbiology:

a) Enumeration of micro- organisms.
b) Microbiological quality of milk.

3. Biochemistry:

a) Estimation of casein content in milk.
b) Assay of urease activity.
c) Assay of amylase activity.
d) Extraction of lipid.

VOCATIONAL COURSES:

COMPUTER APPLICATIONS

(Same as Computer Science & Data Processing Pass Course)

FOOD SCIENCE AND QUALITY CONTROL

(Food Science and Quality Control is a Vocational Subject for B.Sc. (+3 Degree Pass Examination)

1. The First examination will be held after the end of first year of admission into +3 Courses in Sience and shall consist of two Theory papers carrying 75 marks eachand one Practicalpaper,varying 50marks.Examination duration for P-I and P –(Theory), is 3 hours and for P-III (Practical), 6 hours.
2. The second examination will be held on the second year of admission into +3 courses in Science and shall consist of two Theory papers carrying 75 marks each and one Practical paper carrying 50 marks. Examination duration for P-IV & P-V (Theory) is 3 hours and for P-VI (practical) 6 hours.
3. Each Unit of the course shall have one question with an alternative. Hence, each question paper shall have five questions with their corresponding alternatives. All questions shall be compulsory.

COURSE STRUCTURE:

FIRST UNIVERSITY EXAMIANTION

Paper-I	**Theory**	**75 Marks**
	Group-A	
Unit-I	Basic Nutrition	15 Marks
	Group-B	
Unit-II	Food Sanitation and Hygiene	15 Marks
	Group-C	
Unit-III-V	Food Processing and Preservation (Each Unit Carries 15 Marks)	45 Marks
Paper-II	**Theory**	**75 Marks**
	Group-A	
Unit-I-III	Food Chemistry (Each Unit carries 15 Marks)	45 Marks
Unit-IV & V	Food Analysis (Each Unit carries 15 Marks)	30 Marks
Paper-III	**Practical**	**50 Marks**

Related to food processing and food preservation covering various seasonal fruits and vegetables.

SECOND UNIVERSITY EXAMINATION

Paper-IV	**Theory**	**75 Marks**
Unit-I-V	Food, Microbiology (Each Unit carries 15 Marks)	
Paper-V	**Theory**	**75 Marks**

Unit-I-V Food Quality & Its control (Each Unit carries 15 Marks)

Paper-VI **Practical** **50 Marks**

Practical related to food analysis, adulteration and toxicology.

DETAILED COURSES:

FIRST UNIVERSITY EXAMIANTION

PAPER-I (THEORY : FOOD SCIENCE))

Full Marks – 75 Duration 3 hours

Group-A : Basic Nutrition

Unit-I **15 Marks**

i. Introduction to Nutrition, Food as a source of nutrients, function of foods Defination of nutrition, nutrients, adequate, optimum and good nutrition. Inter relationship between nutrition and health Visible symptoms of good health.

ii. Food Guide: Basic five food groups, how to use food guide.

iii. Types of nutrients present in food: Sources, Classification, Physiological function and deficiency diseases of protein, carbohydrate, lipids, Vitamins & Minerals. Importance of fruits and vegetables in Human diet and their nutrient value.

Group-B : Food Sanitation & Hygiene

Unit-II **15 Marks**

i. Food contamination : Sources and transmission, water, air, sewage, soil and other agnets.

ii. Food Sanitation: Food Spoilage, Elementary idea about the Micro-organisms involved in spoilage, Principles of bacteriology of water for food sanitation.

iii. Hygienic handling of food: Preparation and handling: Temperature control and storage.

Group-C : Food Processing and Preservation

Unit-III **15 Marks**

i. Principles involved in Food deterioration' Microbial spoilage, Food enzymes, Insects, Temperature, Moisture, Oxygen, light etc.

ii. Methods of food preservation and processing, Principles of preservation, Preservation by temperature, by preservatives deep freezing, dehydration, fermentation, high osmotic pressure and by radiation..

Unit-IV **15 Marks**

i. Food Additivies: Need for food additive different categories of food additives- Antioxidants, Chelating agents, colouring agents, curing agents, Emulsions, flavours and flavor enhancers, improvers, anti-caking and anti-foaming agents, Humectants, Sequestrants, leavening agnets, sweetening agents, pH control agents, stabilizers thickeness.

ii. Chemical preservatives used in the preparation of Jam, Jelly, Sauces, Chutneys and Pickles.

iii. Additives and food safety; Evaluation of safety, safety Vs. Hazards; Unintentional additives: Radio active fall-out agricultural contaminants.

Unit-V **15 Marks**

i. Milk and Milk Products: Composition, nutritive value, Milk Protein, effect of heat, acid and enzymes; Milk processing, Pasteurization, Milk products.

ii. Egg: Structure, Composition, nument value, quality of egg and its evaluation, effect of cooking, heating preservation of egg.

iii. Fresh Foods: Meat: Classes of meat, composition nutrient value, aging, tenderization and curing of meat Fish: Composition, nutrient value, spoilage, preservation and spoilage.

PAPER-II (THEORY)

Full Marks – 75 Duration 3 hours

Group-A : Food Chemistry

Unit-I **15 Marks**

i. Introduction to Food Chemistry; Moisture in foods: Hydrogen bonding, bound water, determination of Moisture.

ii. Pigments and Colours: Chlorophylls, Myoglobin and haemoglobin, anthocyanins, flavonoids, tannirs, betalins, quinines and xanthones, carotenoids, Synthetic colours.

iii. Flavours: The Sensation of flavor – Taste, Odour, Control of flavor and aroma in processed food: Measurement of flavours, flavor intensifier, Synthetic flavours.

Unit-II **15 Marks**

i. Fats and Oils (Lipids): Occurrence in Foods and composition, Structure, Physical and Chemical properties, Rancidity, Reversion, Hydrogenation, effect of heat on fats and oils, Role of food lipids in flavours.

ii. Carbohydrates: Sources, classification: General properties Solubility, fermentation, acid hydrolysis, enzyme hydrolysis, effect of heat, sweetness, changes during cooking & Processing.

Unit-III **15 Marks**

i. Proteins: Sources, basic structure, Physical and Chemical properties: homogeneity, electrophoresis, sedimentation, Osmotic pressure, amphoterism, hydration, methods of denaturation and coagulation effect of heat or cooking on proteins.

ii. Vitamins and Minerals: Types of vitamins, sources, recommended intake and losses during cooking and storage of fat – soluble vitamins (Vit.-A, Vit.-D, Vit.-K) and water soluble vitamins (Thiamine, Riboflavin, Niacin, Folic acid, Biotin, Pantothenic acid, Vit.B -12, Vit.-C).

Minerals : Macronutrients (Calcium, Phosphorous, Sulphur, Magnesium, Sodium, Potassium & Chlorine) and Micronutrients (Iron, Zinc, Copper, Iodine, Chromium, Cobalt) Fortification and Restoration of minerals and Vitamins in food.

Group-B : Food Analysis

Unit-IV **15 Marks**

i. Food Sampling: Terminology, Statistical concept, Sampling errors, Preparation of food samples: Mechanical, enzymatic and chemical Methods, reliability of analysis.

ii. Proximate constituents and analysis: Moisture, Ether extract, Ash value, pH and acidity measurement, Solid content, Estimation of Moisture in food by overy drying, distillation or Kari Fischer Method: Estimation of total protein by Kjeldahl's Method.

iii. Estimation of Minerals: Phosphorous, Iron, Copper, Sulphur, Chloride.

Unit-V **15 Marks**

Analysis of:

i. Some common additives- Sulphur dioxide, Sodium benzoate, Colours in foods.

ii. Sugars – By Volumetric and Polarimetric methods.

iii. Oils- Moisture, insoluble impurities, free fatty acids, refractive index, iodine value, saponification and unsaponip ficable matter.

iv. Milk – Fat, Total solids, Lactose, Proteins, Resazurin test, Preservtives in Milk.

v. Fruit Products: Analysis of JAM, fruit juices and Beverages, tomato sauce.

PAPER-III (PRACTICAL)

Full Marks – 50 Duration 4 hours

1. Fruit Beverages:
   a. Ready to serve: Orange, Mango, Pineapple, Grapes.
   b. Condial – Lime, Citrus fruits.
   c. Squash- Lime, Orange, Mango etc.
   d. Fruit Syrup- Lime, Pineapple etc.

2. Preparation of Jam, Jelly, Marmalade:
   a. Jam: Papaya, Mango, Pineapple, guava, apple, mixed fruit Jam.
   b. Jelly – Guava, apple, green mango.
   c. Marmalade: Citrus fruit, orange, lemon.
3. Tomato Products: Juice, Puree, Paste, Sauce, Chutney, Ketchup.
4. Sauces: Chilli, Tomato, Capsicum, Soyabean.
5. Pickles: Oil pickle, Fresh Pack Pickle, Fermented Pickle.
6. Preserved and Dehydrat3ed Products: Murabba, Petha, Different types of chips, Papad, Dried Food Products.
7. Organisation of Birthday party/ Marriage anniversary/ religious festivals.
8. On Job training: During the First Year.
9. Practial Record, duly signed in full by the student and signature of the class teacher with date at the end of each experiment.
10. Viva-Voce.

SECOND UNIVERSITY EXAMINATION

PAPER-IV (THEORY : FOOD MICROBIOLOGY)

Full Marks – 75 Duration 3 hours

Unit-I **15 Marks**

i. Micro-organisms associated with food: Bacteria, Molds, Yeast.

ii. Food as a substrate for Micro-organisms: pH, Moisture requirement: Water activity, Oxidation – reduction potential, nutrient – content, combined effects of factors effecting growth.

iii. Chemical changes caused by Micro-organism.

Unit-II **15 Marks**

i. Toxicology: Definition, naturally occurring toxins in foods.

ii. Toxicity of Chemical additives:Preservatives, antioxidants, colouring substances, flavours, sweeteners.

iii. Mycotoxins, carcinogens, Toxic metals.

Unit-III **15 Marks**

Contaminating and spoilage of following kinds of foods:

a. Cereals and cereal products.
b. Sugars and sugar products
c. Vegetables and fruits.
d. Milk and Milk products.
e. Eggs and Poultry.

Unit-IV **15 Marks**

i. Foods in relation to disease:
Bacterial: Botulism, Infant botulism, Salmonellosis, Gastroenterities, Shigellosis. Non-bacterial: Fungal illness, viral health hazards.

ii. Investigation of food – borne diseases outbreaks: Objectives of investigation, Personnel involved in investigation, materials and equipment required, field investigation, laboratory testing, interpretation and application of results, preventive measures.

Unit-V **15 Marks**

i. Production of cultures for food fermentations: General principles of culture maintenance and preparation – bacterial cultures, yeast culture and mold cultures.

ii. Foods and enzymes from micro-organisms : As food: Single cell protein (SCP) Fats, Amino acids, As Enzymes: Amylases, Invertase, Pectolytic enzymes, Proteolytic enzymes.

PAPER-V (THEORY : FOOD QUALITY AND IT'S CONTROL)

Full Marks – 75 Duration 3 hours

Unit-I Food Quality 15 Marks

i. Sensory evaluation: Characteristic requirements for conducting sensory tests, Evaluation Card – Types of tests : Difference tests, Rating test, Sensory tests, Descriptive tests.

ii. Objective evaluation: Basic guidelines, Tests for objective evaluation – Chemical methods, Physico Chemical methods, Microscopic examination, Physical methods.

iii. Instruments used for texture evaluation.

Unit-II 15 Marks

i. Food Adulteration: Various types of adulterants, Methods of detection.

ii. Principles of food packaging: Types of containers, food packaging materials and forms, package testing, safety of food packaging, environmental considerations, Govt. regulation of food and nutritional labeling.

Unit-III Food Canning Technology 15 Marks

i. Development of canning industry, heat sterilization of canned food, rigid metal container, glass container, and closures, flexible packaging for thermo processed foods.

ii. General canning procedures: Canning procedures for fruits, vegetables, meats & poultry.

iii. Factory affecting nutrient content of canned food.

Unit-IV Food Quality Control 15 Marks

i. Quality Control in Agricultural produce.

ii. Quality contrl in production and marketing of fruit products – Fruit Products Order.

iii. Food standard and certification for Quality control: Indian Standards Institution – Agmark standard & Codex Alimenatarius.

iv. Quality control of Food Products for export.

v. Role of Trade and industry in Food Quality Control.

Unit-V 15 Marks

ii. Effective implementation of Food laws and regulation – Food Adulteration Act., Fruit Products Order (FPO), Meat product order, Cold Storage Order, Other Acts and orders.

iii. Agencies responsible for quality control: International Agencies, State Agencies, Private Agencies, Processing Industries.

PAPER-VI (PRACTICAL)

FOOD MICROBIOLOGY AND FOOD ANALYSIS

Full Marks – 50 Duration 4 hours

1. Simple physical and chemical tests to determine the quality and to determine the adulterants in the following:
   a. Milk and Milk products.
   b. Oils and Fats
   c. Fruits, Vegetables, Cereals.
   d. Spices and condiments.
   e. Canned and preserved foods.
2. Determination of acidity in foods and food products by using P^H meter.
3. Determination of brix by refractometer.
4. Isolation of pathogers from the contaminated food or food products and their identification.
5. Bacterial counts in fresh and contaminated foods by colory counter.
6. Identification of bacteria by Gram Staining technique.
7. Spectrophbtometric/colorimetric determination of bacteria growth.
8. Estimation of casein content in Milk.
9. Spot identification of prepared microslides of bacteria Molds, Yeasts.
10. On job training: During second year.

11. Practical Record, duly signed in full by the student and signature of class teacher with date at the 3end of each experiment.
12. Viva-Voce.

Books Recommended:

1. **Basic Nutrition**
   i. **Mundambi & Raj Gopal:** Fundamentals of Food and nutrition, New Age Int.
   ii. **N. Swaminathan**: Advanced Text Book of Food and Nutrition, Vol.-I & II.
   iii. **Wilson, Fisher & Fugua:** Principles of Nutrition, Wiley Eastern Ltd.
2. **Food Sanitation and Hygiene:**
   i. **Van Nostrand:** Principles of Food Sanitation, IInd Edition, AVI Book.
   ii. **Longree Willey:** Quality Food Sanitation, Inter Sci. Publ.
   iii. **Hobbs and Giebert & Edward:** Food Poisoning and Food Hygiene, Anmol Publ.
3. **Food Processing and Preservation:**
   i. **Giridharilal, Siddappa & Tondon:** Preservation of fruits and vegetables, AVI Publ.
   ii. **Manay and Shadaksharaswami:** Food: Facts and Principles, New Age Int.
   iii. **G. Cruess:** Commercial Processing of fruits and Vegetables.

4. **Food Chemistry**
   i. **L.H. Meyer:** Food Chemistry
   ii. **B. Srilakshmi:** Food Science, New Age Int.
   iii. **Manay & Shadaksharaswamy:** Food : Facts & Principles, New Age Inter.
   iv. **Potter & Hotchkiss:** Food Science, CBS Publ. Dist.
   v. **H. Charley:** Food Science, John Wiley & Sons.
   vi. **Gaman & Sherrington:** Science of Food, Pergamon Press (3rd Edn.)
5. **Food Analysis**
   i. **Krik and Sawyer:** Pearson's Chemical Analysis of Food, Longman Sci. Tehcnical.
   ii. ISI Hand Bok of Food Analysis, Publ. by ISI, New Delhi.
   iii. **Pomernz & Melean:** Food analysis: Theory and Practice, AVI Publ.
   iv. **A.Y. Sathe:** A First Course in Food Analysis, New Age Int.
   v. **S. Rangmma:** Hand Book of Analysis and Quality Control for Fruits and Vegetable Products.
   vi. Manuals of Analysis of Fruits and Vegetables Products, Tata McGraw Hill, Publ.
6. **Food Microbiology**
   i. Food Microbiology: Frazier and Westhoff, Tata McGraw Hill Publ. Co. Ltd.
   ii. **G.H. Banward:** Basic Food Microbiology, CBS Publ. & Dist.
   iii. **J.M. Hay:** Modern Food Microbiology, CBS Publ. & Dist.
7. **Food Toxicology**
   i. **S.C. Wasan**: Food Adulteration
   ii. **Walker, Tayloss (Eds.): ** Nutritional and Toxicological Aspects of Food Processing.
   iii. **Miller Elsevier (Eds.) :** Toxicological Aspects of Food, Sc. Publ.
8. **Food Quality and Control**
   i. Prevention of Food Adulteration Act/., 1985.
   ii. **W.A. Gould:** Food Quality Assurance (AVI Publ.)
   iii. **Bender, Kaamar & Kahah:** System Analysis for Food Industries, AVI Publ.
   iv. **Poter & Hotchkiss:** Food Science, CBS Publ. & Dist.
   v. **Ramesh V. Bhat & B.S.N. Rao (Ed.):** National Srategy for Food Quality Control.
   vi. **Frazier & West Hoff:** Food Microbiology, Tata McGraw Hill publ. Co. Ltd.
   vii. **Jackson, Mionigan & Shinn:** Fundamental of Food Canning Technology, AVI Publ. Co., West Port.

INDUSTRIAL CHEMISTRY

COURSE STRUCTURE:

FIRST UNIVERSITY EXAMIANTION

Paper-I	**Theory**		**75 Marks**
Group-A	Industrial Aspects of Chemistry	20 Marks	
Group-B	Unit operation in Chemical Industries	15 Marks	
Group-C	Utilities, Fluid flow and heat transport in Industries	20 Marks	
Group-D	Material and Energy Balance	20 Marks	
Paper-II	**Theory**		**75 Marks**
Group-A	Inorganic Chemical Industries	15 Marks	
Group-B	Metallurgy Industries	15 Marks	
Group-C	Unit Process in Organic Chemical Manufacture	15 Marks	
Group-D	Natural Product Industries	15 Marks	
Group-E	Synthetic Organic Chemical Industries	15 Marks	
Paper-III	**Practical**		**50 Marks**

SECOND UNIVERSITY EXAMINATION

Paper-IV	**Theory**		**75 Marks**
Group-A	Spectroscopy methods of analysis	15 Marks	
Group-B	Chromatography and Miscellaneous methods of analysis.	15 Marks	
Group-C	Biotechnology	15 Marks	
Group-D	Principle construction and working of Instruments.	15 Marks	
Group-E	Pollution and Waste Management	15 Marks	
Paper-V	**Theory**		**75 Marks**
Group-A	Industrial Economics	25 Marks	
Group-B	Anyone a. Pharmaceuticals b. Petrochemicals	50 Marks	
Paper-VI	**Practical**		**50 Marks**

DETAILED COURSES:

FIRST UNIVERSITY EXAMIANTION

PAPER-I (THEORY)

Full Marks – 75 Duration 3 hours

Group-A : Industrial Aspects of Chemistry **20 Marks**

1. Chemical Process: Unit operation, Physical Principles, Chemical conversions, Basic chemical batch, batch process, continuous process, chemical process Selection, Design, Operation, Chemical process control, instrumentation, Market evaluation, safety, patent.
2. Raw materials for Organic Compounds:

a. Petroleum : Natural Gas, Fractionation of crude oil, Cracking, Reforming and hydroforming.

b. Coal: Types, structure, properties, Distillation of Coal and Chemical derived.

c. Renewable natural resources: Cellulose and Starch, their properties, Modification, Important Industial Chemicals derived from them. Alcohol and alcohol based chemicals, Oxalic acid, Furtural.

3. Basic Metallurgical Operations:

a. Concentration of ore, Calcination, roasting, Smelting, reduction, purification.

b. Inorganic materials of industrial importance: Alumina, Silica, Silicates, Clays, Mica, Carbon, Zeolite, their availability, forms, structure and modification.

4.

a. Surface Chemistry and Interfacial phenomena: Adsorption, isotherm, Sol, Gel, Emulsion, Micro emulsion, Micelles, Aerosols, Hydrotopes Effect of surfactants.
b. Catalyst: Types, Homogeneous and Heterogeneous, Basic Principles and mechanisms, Factors effecting the performance, phase transfer catalysis, Enzyme catalysed reactios Rate, Model, Industrially important reactions such as Ammonia, Nitric acid.

Group-B: Unit Operations in Chemical Industries. 15 Marks

5. Distillation: Batch and continuous distillation, separation of azeotropes.
6. Absorption Equipments – packed columns, spray columns, bubble columns, packed bubble columns.
7. Evaporation: Introduction Equipments – Short tubes, Forced circulation, falling film, Climbing (upward) film and wiped film (agitated) Evaporators.
8. Drying: Introduction, Free moisture, bound moisture, drying curve, Equipments – Tray, rotary, flash fluid, bed, drum and spray driers.
9. Crystallisation, nucleation, Crystal growth, Equipments tank, agitated, evaporator and draft tube crystallizer.

Group-C: Utilities, fluid Flow and Heat transport in Industries. 15 Marks.

10. Utilities:
    Fuel: Types of fuels, calorific values of fuels, specification for fuel oil.
    Boilers: Types of boiler and their functioning.
    Water:Specification for Industrial use, Water treatment.
    Steam: Generation and use.
    Air: Processing of air, specification for Industrial use.
11. Fluid Flow: Fans, Blowers, Compressors, Vaccum Pumps, ejector Pumps, Receprocating Pumps, Gear Pumps.
12. Heat transport: Heat exchangers, finned tube and refrigeration – Cycle.

Group-D: Materials and Energy Balance 20 Marks

13. Dimensions and Units: Basic chemical calculations, Atomic Weight, molecular weight and equivalent weight. Mole composition of liquid and gaseous mixtures.
14. Material balance without chemical reaction. Flow diagram for material balance. Simple material balance with or without recycle or bypass for Chemical Engineering operation such as distillation and Crystallisation.
15. Material Balance involving chemical reactions: Concept of limiting reactant, conversion and yield. Gas phase reaction with/without recycle of bypass.
16. Energy Balance: Heat capacity of pure gases and gaseous mixtures at constant pressure, sensible heat exchange in liquids.

Books Recommended:

1. **H. Steiner:** Introductionto petroleum chemicals, Pergaman Press.
2. **A.G. Hail:** Chemistry and Technology of Cellulose
3. **O.B. Wurzburg:** Modified starches, Properties and uses.
4. **A.R. Baiky:** Text Book of Mattanurgy
5. **H. Ries:** Clay, John Wiley's and Sons.
6. **Reigal:** Industrial Chemistry, Rainhold Publication
7. **H.R. Sephard:** Aerosol Science and Technology.
8. **B. Delmon & C.Jannet:** Catalysis: Heterogeneous and Homogeneous.
9. **J. Fendier and E.Fendler:** Catalysis in Micellar and Macro molecular System.
10. **D.O. Kale:** Unit Operations – I & II., Pune Vidyarthi Griha Prakashan, Pune.
11. **W,.C. MC Cabe and J.C. Smith:** Unit Operations in Chemical Engineering, McGraw Hill Co., New York.

PAPER-II (THEORY)

Full Marks – 75 Duration 3 hours

Group-A : Inorganic Chemical Industries 15 Marks

1. Sulphur and Sulphuric acid.
2. Nitrogen Industries : Ammonia, Nitric acid.
3. Phospherous Industries: Phusphorous, Phosphoric acid.
4. Chlor- alkali Industries: Sodaash, chlorine, caustic soda.
5. Fertilizer: Type, need, classification, source, manufacture of ammonium nitrate, ammonium sulphate, Urea, Calcium Cyanamide, Superphosphate, Triple – super-phosphate.
6. Cement: Types of cement, composition, manufacturing process, setting of cement.
7. Ceramics: Introduction, Types, manufacturing process, application of refractories.
8. Glass: Types, composition, manufacturing process, physical and chemical properties, application.

Group-B: Mettallurgy Industries: 15 Marks

9. Iron and Steel: Manufacture of cast iron, properties, effect of impurities, Modern trend in blast furnace varieties, manufacture of steel, Heat treatment, vaccum treatment, mechanical treatment, classification, Ferroalloys.
10. Copper: Extraction, properties, alloys, uses.
11. Nickel: Extraction, properties, alloys, uses
12. Zinc: Extraction, properties, uses.
13. Lead: Extraction, properties, uses.
14. Alloys: Theory, types, modes of formation, Heat treatment.
15. Corresion: Types, mechanism, preventive methods.

Group-C: Unit Process in Organic Chemical manufacture: 15 Marks

16. Nitrating agent: Kinetic and mechanism of continuous and batch nitrations of benzene to nitro benzene.
17. Chlorinating agents: Kinetics and mechanism for commercial manufacture of chclorobenzene, chloral dichlore fluoro methane.
18. Oxidation: Types of oxidation, oxidizing agents, liquid and gas phase oxidation, Manufacture of benzoic acid Phthalic anhydride, acetaldehyde.
19. Hydrogenation: Kinetics and thermodynamics of hydrogenation reaction, Catalysts for hydrogenation, hydrogenation of vegetable oil.
20. Alkylation: Types of alkylation, Thermodynamics & Mechanism of alkylation reactions, manufacture of alkyl benzenas.

Group-D: Natural product Industries 15 Marks

21. Oil, Fats, Wax and Soap: Refining of crude vegetable oil, hydrogenation of oil, manufacture of soap, Types, Cleansing action, recovery of glycerine, manufacture of detergent, specific actions of soap and detergents.
22. Sugar: Manufacture of sugar from Sugarcane.
23. Pulp and Paper: Manufacture of pulp and paper.
24. Rubber: Types, refining, Vulcanisation, Properties, Synthetic Rubber.
25. Adhesives: Bonding process, classification, preparation and use of different types of adhesives natural and synthetic.

Group-E: Synthetic organic chemical Industries 15 Marks

26. Petrochemicals: Chemicals from C1 Methane and Synthetic Gas C_2, ethylene and acetylene, chemicals from aromatic compounds.
27. Pesticides: Classification, manufacture of insecticides.
28. Dyes: Colour constituents, fibers, dying, classification, synthesis of nitrosodyes, nitrodyes, azodyes, triphenyl methane dyes.
29. Perfumes: Introduction, preparation of citronellol, vanillin cinamic aldehyde, natural perfumes.

30. Pharmaceuticals: Introduction, important drugs, Sulphadrugs anti pyretics, analgesic antimalazial antibiotic.
31. Polymer: Synthetic fiber, Rayon, Manufacture, Production of Cellulose from wood, classification of polymer, Properties and formation of Plastic, Flowchart of formal dehyderesin.

Books Recommended:

1. **L.L. Heuch:** Science of ceramic chemical processing.
2. **A. Paul:** Chemistry of Glasses.
3. **G.H. Steewart:** Science of Ceramics.
4. **M.G. Gopal Rao, Marshal Sitting:** Outlines of Chemical Technology, East West Press.
5. **B.K. Sharma:** Outlines of Chemical Technology, Goel Publishing House, Meerut.
6. **P.H. Groggins:** Unit Process in Organic Synthesis, McGraw Hill.
7. **M.G. Fontana and N.D. Green:** Corrosion and Corrosion Engineering, McGraw Hill Book.
8. **O.A. Hougen, K.M. Watson and R.A. Ragatz:** Chemical Process Principles, Part-I, Asia Publishing House, Bombay.

PAPER-III (PRACTICAL)

Full Marks – 50 Duration 4 hours

1. Experiment involving fractional distillation and crystallization.
2. Boiling Point diagram.
3. Measurement of partition coefficients.
4. Determination of sulphuric acid, phosphoric acid in a mixture.
5. Ore analysis – Dolomite, Limestone and Calcite.
6. Analysis of alloy: Cupronickel.
7. Determination of flash point and ignition point of liquids.
8. Limit tests for heavy metals like Pb, As, Hq, Fe and ash contents.
9. Water analysis: Hardness and COD.
10. Alkylation reaction using Friodatcraft reaction.
11. Experiments using pH meter. Potentio meter, Conducto meter, Refracto meter and Polarimeter.
12. Testing of alloys and identification of plastic and rubber.

SECOND UNIVERSITY EXAMIANTION

PAPER-IV (THEORY)

Full Marks – 75 Duration 3 hours

Group-A: Spectroscopic methods of analysis: 15 Marks

1. Spectroscopy: Introduction, electromagnetic radiation, Molecular absorption, spectra Radiation Sources.
2. Visible Spectrometry: Laws of absorption, Deviation from Beer's law Schematic diagram of Perkin, Elmer Model- 4000 Spectro photometer.
3. Ultaviolet Spectroscopy: Absorption in organic molecules Electronic transitions, Absorption by inorganic systems, Applications: Determination of pk value of acid, Photometric titration.
4. Infrared Spectroscopy: Molecular Vibrations, Vibrational frequencies, Instrumentations, Important spectral regions.
5. NMR Spectroscopy, Theory, Instrumentations, Chemical Shift shielding effect, application.
6. ESR Spectroscopy: Theory, Instrumentation, application.

Group-B: Chromatography andMiscellaneous Methods 15 Marks

7. Liquid Chromatography, Introduction
   Liquid Solid Chromatography, Liquid-Liquid chromatography, Impair Chromatography, Classification of Impair Liquid Chromatography, Principle of Ion pair extraction.

8. Partition Chromatography, Introduction, Procedure, Theory Theoretical plate Theory, Movement of Solute in Chromats graphic column, Limitations of Plate Theory.
9. Conductometric Titrattions: Conductivity, Specific conductance, Molar and equivalent conductance, Method of measurement Application: Solubility of Sparingly soluble salt, Acid base titration.
10. Potentiometric Titration: Introduction, Procedure, Methods of end point location: Graphical, Differentiation, Pinkh of Tread Well Methods Applications: Oxidation Reduction Titration, Precipitation Titration, Complexometric Titration.
11. Thermometric Analysis: Introduction: Types, Principle, Automatic Thermogravimetric Analysis, Indstumentatiaon, Derivative Thermo Gravimetric analysis, Differential Thermal Analysis, Principle, Theory, Simultaneous, TGA, DTA, curve.

Group-C: Biotechnology: 15 Marks

12. Introduction: Fundamental bioscience, applied bio science, Advent of Biotechnology, Biotechnology through ages.
13. Permeutation: Biochemical process, microbial processing, production of ethanol, acetone and butanol.
14. Microbial Energy: Biogas and Methanogenic microbes.
15. Microbial Food Production Single Cell protein, Algal Biotechnology, Microbial production of flavours, other products like poly saccharides, Pharmaceuticals, Vitamins, enzymes.
16. Mining and Metal Biotechnology: Mineral cycling, Microbial transformation of metal, Leaching and extraction.

Group-D: Principle, Construction and Working of the following Instruments: 15 Marks

17. Glass, Bimetallic and Pressure Spring thermometers.
18. Manometer, Barometer, Bourdon pressure gauge (Diaphargm type only) Macleod and pirani gauges.
19. Density and Viscocity measurements.

Group-E: Pollution and Waste Management: 15 Marks

20. Sources of Pollution: Air, Oxygen, Nitrogen cycle, water, Biosphere, Flora and Fauna and salt.
21. Pollutants and their statutory limits, Pollution evaluation methods.
22. Pollutants of air, water (organic and Inorganic) soil (Pesticides), Radiation pollution.
23. Green house effect, Ozone hole.
24. Effluent Treatment and Waste Management: Principles and equipments for aerobic treatment, absorption, filtration, sedimentation, Bag filters, electrostatic precipitator, absorbers, solid waste management.

Books Recommended:

1. **B.K. Shrama:** Instrumental Methods of Chemical Analysis, Goel Publishing House, Meerut.
2. **Y.R. Sharma, R.C. Acharya:** Analytical Chemistry, Kalyani Publisher, Delhi.
3. **Keshav Trehan:** Biotechnology, Wiley Eastern Ltd.
4. **D.P. Eckman:** Industrial Instrumentation, John Wiley.
5. **J.H. Perry and D. Greenb**: Chemical Engineer's Hand Book, McGraw Hill, NY.
6. **H.R. Jones:** Pollution control in Industries.
7. Effluent Treatment and Water Disposallnst, of Chem. Engineering.
8. **B.K. Sharma:** Industrial Chemistry, Goel Publishing House, Meerut.
9. **W.L. Badger & J.T. Banchero:** Introduction to Chemical Engineering, McGraw Hill Co. NY.

PAPER-V (THEORY)

Full Marks – 75 Duration 3 hours

Group-A: Industrial Economics 15 Marks

1. Factors involved in Project cost estimation methods employed for the estimation of capital investment.
2. Capital formation, Elements of cost accounting.

3. Interest and Investment costs, Time – Value of money, equivalence, Depriciation, methods of determining depreciation, taxes.
4. Aspects of marketing, pricing policy, profitability criteria, Economics of selecting alternatives.
5. Variation of cost with capacity, Break, even point, Optimum batch sizes, production scheduling.
6. Concept of scientific management of Industry.
7. Functions of management: Decision making, Planning, organizing, Control, Location of Industry, Material, Management, Inventory.
8. Management of human resources selection incentives, welfare and safety.
9. Industrial Analysis: Sampling Procedures, sampling of bulk materials, Techniques of sampling solids, liquids and gases, Collecting and processing of data.

Books Recommended:

1. **E.H. Hempal:** Economics of Chemical Industry.
2. **L.L. Bethal:** Industrial organization and Management.
3. **R.B. Drun:** Introduction to Instrumental analysis, McGraw Hills.
4. **Prasanna Chandra:** Projects Planning Analysis Selection, Implementation and Review, Tata McGraw Hill, New Delhi

Group-B **50 Marks**

The candidates are to choose anyone of the following electives:

a. Phramaceuticals:

1. Development of pharmaceutical Industry in India.
2. Phramacopoeias: Development of Indian Pharmacopoeia and Introduction to BP, USP, EP, MP and other important Pharmacopoeias.
3. Need, Methods of sterilization and quality control.
4. Pharmaceutical Exceipients: Chemistry, Process of manufacture and quality Glidants, Lubricant, diluents, Preservatives, antioxidants, Emulsifying agents, coating agents, binders, colouring agents, flavoring agents, gelation and other additives, Surgical dessing, sutures, Ligatures with selection, packing materials, ancillary materials, packing machinery, Phyte chemicals: Cultivation, Collection, preparation for the market and storage of medicinal plants, Chemical constitution of plants including carbohydrates, proteins, fats, wax, volatile oils, terpen, steroids, saponins, flavanoids, tannins glycosides and alkaloids, Isolation procedure for active ingradients with examples for alkaloid, safogenin, dioxgenin and diaproh.

   Pharmaceutical quality control: Sterility testing, Pyrogen is testing and glass testing.

   Raw materials, process of manufacture of the followings, Chloroamphenicol, Furazolidine, Mereurochrome, Inprofen, Sulphaguanidine pentobarbital, chlrophenaramine maleate at atenolol Ephirdrine.

Books Recommended:

1. **T.N. Vasudevan:** Practical Pharmacognosy
2. Indian Pharmacopoea – 1985.
3. **Ramshad:** Practical Pharmacognosy.
4. Pharmaceutical Exoipients.
5. Pharmaceuitical Dosage Forms.
6. **W.O. Foye:** Principles of Medicinal Chemistry, Lae and Febigeon Publication.
7. **Wilson Et.al.:** Text Book of Organic Medicinal and Pharmaceutical Chemistry, Lipoinelt Topan.
8. **Korolkoves & Burkhatter:** Essentials of Medicinal Chemistry, Wiley, Inerscience.

b. Petrochemicals:

Introduction to crude oil, Exploratory methods, oil reservoirs, Transportation of crude oil, constitution of crude oil, Natural gas- constituents. Distillation of crude oil: Separation of natural gas & different fractions based on relative volatilities. Significance of the following: four point depressants, drag reducer, viscosity reducer, ignition and flash points, Octane number, Doctor, solution.

Detailed Discussions on the following operations with respect to process, mechanism, catalyst used and application of cracking, catalytic and hydrocracking, Ismoerisation, Reforming and alkylation.

Manufacture of the following:

Methane, ethylene, acetylene and C4 hydrocarbons Manufacture of the following form methane: Carbon black, Chlorinated methanes.

Manufacture of the following from ethylene, ethanol, styrene, Vinyl chloride, ethanolamine, acrylonitrile. Manufacture of cumene, acrylonitrile and glycerine from propelene. Manufacture of butadiene and isobutene from C4 hydrocarbon. Manufacture of Vinyl chloride, chloroprene, acetaldehyde and acryle nitrile from acetylene. Manufacture of butadiene and isobuterie from Chydrocarbon. Preparation, structure, application and selectivity of various catalysts used in petrochemical industries. Indian Petrochemical industries – Indian reserves, quality and petroleum distribution and future. Importance of petroleum and petrochemical Industries in the context of Indian Economy.

PAPER-VI (PRACTICAL)

Full Marks – 50 Duration 4 hours

The candidates will be asked to perform the experiments in the examination of 4 hrs. duration. One question will be from the item 1 and 2 and the second question will be from 3 or 4 depending on the elective paper choosen by the candidate. The mark distribution be as follows:

1. Compulsory question (from item 1 to 2).
2. Elective question (from either of the item 3 and 4).
3. Viva-Voce
4. Record.

Detailed Courses:

1. Analysis of common raw materials as per industrial specification such as – Phenol, aniline, formaldehyde, acetone, oils.
2. Synthesis of common Industrial Compounds:
   Bromoaniline, 3-Nitroaniline, Sulphanilamide, 4. Nitrobenzoic acid.

3.

A. Active ingradient analysis of a few types of formulations using acidimetry, alkalimetry and potentiometry titrations.
B. Determination of sulphate ash, loss on drying & others tests of bulk drugs, complete I.P. monographs of drugs using variety of testing methods.
C. Determination of MIC of some antibacterial drugs by zone/cup method.

4.

A. Viscosity of surface tension measurement of hydrocarbons and hydrocarbon mixtures.
B. Determination of calorific value of fuels.
C. Characterisation of Coke, Bitumen, Petrol, Kerosene, Diesel' and furnace oil with respect to flash point, Viscosity.

INDUSTRIAL FISH AND FISHERIES

COURSE STRUCTURE:

FIRST UNIVERSITY EXAMIANTION

Paper-I **Theory** **3 Hrs.** **75 Marks**

1. Taxonomy
2. Food & Feeding
3. Anatomy
4. Behaviour

5. Reproduction

Paper-II	**Theory**	**3 Hrs.**	**75 Marks**

1. Growth
2. Fish Genetics
3. Capture Resources
4. Marine Fisheries
5. Aquarium.

Paper-III	**Practical**	**4 Hrs.**	**50 Marks**

SECOND UNIVERSITY EXAMINATION

Paper-IV	**Theory**	**3 Hrs.**	**75 Marks**

1. Pond Constrution
2. Hatchery Technology
3. Aquaculture
4. Prawn Culture
5. Mariculture

Paper-V	**Theory**	**3 Hrs.**	**75 Marks**

1. Fish Pathology
2. Fishing Methods
3. Post Harvest Technology
4. Fishery Economics
5. Fishery Extension

Paper-VI	**Practical**	**4 Hrs.**	**50 Marks**

DETAILED COURSES:

FIRST UNIVERSITY EXAMIANTION

PAPER-I (THEORY)

Full Marks – 75 Duration 3 hours

Unit-I

Taxonomy: Recent classification, Data required for classification & their mode of collection, morphology of typical elasnobranch & telecast, Variation in forms & Structure used in taxonomic studies.

Commericlly important fish-Important orders, geuera & species of elasnobranch and telecast of India origin.

Unit-II

Food & Feeding: Natural food & feeding habite of fishes. Qualitative and Quantitative estimation, Food consumption & Stomach content analysis, seasonal change & food preferable, food selectivity & Feeding Intensity.

Unit-III

Anatomy: Alimentary Canal & Associated glands, Respiratory system & Accessory, respiratory organ, circulatory system, Nervous & haterialline system.

Unit-IV

Behaviour: Fish behaviours with reference to parental, care social & Migration and visual and reproductive.

Unit-V

Reproduction: Reproductive system of fishes, different types, sex differences, sexual maturity, classification of maturity stages, pituitary gland of Carps.

PAPER-II (THEORY)

Full Marks – 75 Duration 3 hours

Unit-I

Growth & Ageing: Growth, Absolute and Relative growth, Isometric & allometric growth, Determination of growth length frequency analysis, Determination of Age.

Unit-II

Genetics: Principles, Chromosomes, Sex – determination, Hybridization and Cryopreservation.

Unit-III

Capture Resources: Inland capture fishery resources of India, Reverine, Reservoirs & Estuarine fisheries, Fisheries pf Chilika lake, Conservation and Management of Resources.

Unit-IV

Marine Fisheries Resources of India: Historical background and recent trends, problems of inshore fisheries, Hilsu fishery, saradine fishery & Shark fishery.

Unit-V

Aquarium: Aquarium – Construction, Maintenance of home aquarium, Ornamental fishers & fresh water aquarium Plants.

PAPER-III (PRACTICAL)

Full Marks – 50 Duration 4 hours

Section-A: Dissection **12 Marks**

Students are expected to dissect and display the following system in addition to Morphological Studies.

a. Carp/Catfish- Digestive, Nervous & Circulatory.
b. Prawn – Digestive & nervous.
c. Pituitary gland of carp.

Section-B: Taxonomy **08 Marks**

Students are expected to study the taxonomy of a few fresh water, Marine and fishes of commercial importance basing on their variation in forms and structure scales, mouth, jaws, teeth & spine etc.

Section-C: Aquarium preparation etc. **10 Marks**

Students should prepare the aquarium and study the details of it – water quality, temperature control, pebbles, decorative hydrophyfes and fishes etc. Maintenance, Cleanest and Oxygen supply is to be properly regulated.

Section-D: Historical Preparation **10 Marks**

Students are required to study permanent slides related to the syllabus including gills, skin, kidney, spleen, liver, testis & ovary etc. of different types of fishes. Five spots are to be set.

SECOND NIVERSITY EXAMIANTION

PAPER-IV (THEORY)

Full Marks – 75 Duration 3 hours

Unit-I

Pond Construction: Preparation and Management of fresh water pond. Soil and water characteristic, Construction of fish farm, fertilization Aquatic weeds and their eradication, Weeds fish.

Unit-II

Hatchery Technology: Fish BreeQuing, Induced breeding, hatchery technology, Transport of board fish & fish seed, fry preservation.

Unit-III

Aquaculture: Defination, history, Scope & types – Systerms of Aquaculture, composite fish, culture, polyculture, Air breathing Fish culture, Sewage Fed aqua Culture, Integrated fish culture.

Unit-IV

Prawn Culture: Fresh Water Prawns, Breeding & Culture, Polyculture, Nuitrition and feeding technique, Fresh water Pearl Culture.

Unit-V

Mariculture: Defination, Scope, culture of pearl oyster, Shrimp culture, Brachish Water Aquaculture.

PAPER-V (THEORY)

Full Marks – 75 Duration 3 hours

Unit-I

Pathology: Fish diseases, Infections diseases like protozoan, bacterial & fungal etc. Common pathogens and pathological changes, precaution & control of disease.

Unit-II

Fishing Methods: Crafts and gears

Unit-III

Post harvest technology: Principles of fish preservation (Traditional & advanced Methods). Processing of fish products & byproducts, Edible & Industrial Product.

Unit-IV

Fishery Economics: Defination, Application of Economics Principles, Law of Diminishing returns, risk & profits in Fisheries, Fish' Marketing & resource Management, Co-operative & Marketing.

Unit-V

Fisheries Extension: Objectives & Principles, Fisheries as a tool in Rural Development, Extension strategies etc.

PAPER-VI (PRACTICAL)

Full Marks – 50 Duration 4 hours

Section-A: **08 Marks**

Students are required to conduct the following experiments out of which one will be asked in the examination.

a. Determination of pH of water sample by P_H meter.
b. Estimation of dissolved Oxygen, dissolved CO_2 and their dual variation.
c. Estimation of Moisture content in Carps, Catfishes and Marine fishes.
d. Quantitative estimation of Planktons.

Section-B: Fish Pathology and Microbilogy **08 Marks**

Identification of common pathogens of fish, Microscopic preparation of parasites.

Section-C: Post harvest technology **08 Marks**

Students are to conduct and study the different methods of practice in the preservation of fish by different methods. They will be asked to conduct and show the method in the examination.

Section-D: Sessional & Job training report **08 Marks**

Students are required to submit the job training report. They are also required to submit a self renovative idea/ detail experiment/collection/methods etc. basing on theory paper IV & V.

Section-E: Fisheries Economics & Extension **08 Marks**

Students are to visit processing units and fish farms to study economic aspects. They are also to participate in fishing and fish processing activities of Govt. and private agencies. They have to submit a project report basing on their activities and interaction, which will be evaluated in the examination.

Section-F: Sessional records & Viva-Voce **10 Marks**

SERICULTURE

DETAILED COURSES:

FIRST UNIVERSITY EXAMIANTION

PAPER-I (THEORY)

Full Marks – 75 Duration 3 hours

Unit-I

Introduction, Definition, Scope, Origin and History of sericulture, world silk industry, silk industry in India, Silk producing states in India, World output of silk, Silk production in India, Export and Indigenous utility.

Unit-II

Characteristic of sericulture industry, its prospects and problems, different types of textile fibers, superiority and specialty of silk fibers.

Unit-III

Different types of silkworm and their systematic position, distribution, climate and host plant requirements.

Unit-IV

Moultinism, and Voltinism, Life History of Bombay-x-mori and Antharea Mylleta Morphology of egg, larva, pupa, adults.

Unit-V

Anatomy of organ systems, silk gland, development and metamorphosis, Factors influencing growth and development.

PAPER-II (THEORY)

Full Marks – 75 Duration 3 hours

Unit-I

1. Agro-climate for mulberry Tasar/Eri/Muga cultivation.
2. Soil quality, Physiochemical properties of soil for mulberry Tasar/Eri/Muga cultivation.
3. Manures, fertilizer and Water management.

Unit-II

1. Pruning and harvesting of mulberry Tasar/Eri/Muga leaves.
2. Economic of Mulberry Tasar/Eri/Muga cultivation.
3. Diseases of mulberry Tasar/Eri/Muga, leaves
4. Fungal, bacterial, Viral and mycoplasmal disease of mulberry, Tasar/Eri/Muga.

Unit-III

1. Root knot, mineral deficiency of mulberry, Tasar/Eri/Muga.
2. Control of diseases.
3. Fungicides and methods of application.

Unit-IV

1. Mulberry Tasar/Eri/Muga pests – classification.

2. Life cycle, Symptoms of infection of mulberry Tasar/Eri/Muga pests.
3. Period of occurance and types of damage.

Unit-V

1. Infection and damage caused by caterpillars, grass hoppers, melay bugs scale insects.
2. Damage caused by aphids, termiles, mites and slugs.
3. Integrated pest management.
4. Weeds of mulberry Tasar/ Eri/ Muga and its control.

PAPER-III (PRACTICAL)

Full Marks – 50 Duration 4 hours

(Based on the contents of theory paper-I & II)

Disection (5) (Major and Minors)	15+5	20 Marks
Identification/Spotting (5)	3x5	15 Marks
Practical Record & Field Report/Training Report		10 Marks
(Related to study field trip/training, if any)		
Viva-Voce		05 Marks

SECOND NIVERSITY EXAMIANTION

PAPER-IV (THEORY)

Full Marks – 75 Duration 3 hours

Unit-I

Silk Physiology – Food, Feeding behavior, food digestion, utilization and assimilation efficiency in silkworm.

Unit-II

Metabolic rates and growth of larval, instars and moulting.

Unit-III

Mating behaviours of Bomby-x-mori A. Mylitta, P. Ricini patterns of egg laying, clutch size, Fecundity and fertility.

Unit-IV

Viability of egg, Laval survival and mortality, Adult life span.

Unit-V

Histology of silk gland and secretion of silk, kritting of cocoon, Eclosion.

PAPER-V (THEORY)

Full Marks – 75 Duration 3 hours

Unit-I

Collection and grading of cocoons and silks, silk seed technology, seed production techniques, Grairage.

Unit-II

Post cocoon technology, stifing, cooking and reeling techniques, manual and mechanical reeling, reeling machines.

Unit-III

Chemistry, structure and physical characteristics of different types of silks, silkworm genetics.

Unit-IV

Marketing of cocoons, Market set up and network, Role of co-operative, Testing of silk.

Unit-V

History and laws, Direct and indirect employment generation and potential in sericulture and silk industry.

PAPER-VI (PRACTICAL)

Full Marks – 50 Duration 4 hours

(Basing on theory paper IV & V)

1. Viva-voce 10 Marks
2. Lab. Record/Field Trip/Training Report. 10 Marks
3. Identification /Spotting (5) 15 Marks (3 x 5)
4. Dissection/ Demonstration of actual skill in Silk technology Like binding of cocoons, processing and reeling of silk. 15 Marks

INFORMATION TECHNOLOGY

COURSE STRUCTURE:

FIRST UNIVERSITY EXAMIANTION

Paper-I	**Theory**	**3 Hrs.**	**75 Marks**
A. Problem solving using 'C'		40 Marks	
B. Elements of OOP using Java.		35 Marks	
Paper-II	**Theory**	**3 Hrs.**	**75 Marks**
A. Introduction to Internet and web design.		40 Marks	
B. Visual Programming and Application Development.		35 Marks	
Paper-III	**Practical**	**4 Hrs.**	**50 Marks**

(The students should perform minimum 10 major level Experiments 5 each from Paper-I and II**)**

SECOND UNIVERSITY EXAMINATION

Paper-IV	**Theory**	**3 Hrs.**	**75 Marks**
A. Business Data Processing		37.5 Marks	
B. System Analysis and Design		37.5 Marks	
Paper-V	**Theory**	**3 Hrs.**	**75 Marks**
A. Computer Networking		37.5 Marks	
B. Elements of UNIX Operating System and Shell Programming		37.5 Marks	
Paper-VI	**Practical**	**4 Hrs.**	**50 Marks**

Experiments on BDP and UNIX Operating System including Shell Programming.

(The students should perform minimum 10 major level Experiments 5 each from BDP and UNIX including Shell Programming.**)**

DETAILED COURSES:

FIRST UNIVERSITY EXAMIANTION

PAPER-I (THEORY)

Full Marks – 75 Duration 3 hours

A. Problem Solving Using C 40 Marks.

1. Introduction

- Introduction to computers, characteristics of Computers, Application Areas, Block Diagrams of a Computer.
- Stored Program Concept, Editors, Trsnslators, Different Level Languages, Ideas on Assemblers, Compilers and Interpreters.

2. Logic Develeopments

- Problem Analysis, Flow Chart, Algorithms.
- Variables, Constants, Expressions and their manipulations.
- Data Types and Operators, I/O statements, Assignments Statements.
- Control Strategies: WHILE, DO-WHILE, IF and SWITCH.

3. Structured Programming

- Looping with FOR structure
- Arrays andSTrings
- Functions and Pointers, Subroutine concept.
- Programming Examples.

Text Book:

1. **E. Balguruswamy:** Programming in ANSI C.
2. **V.K. Jain:** Computer for Begineers.

B. Elements of OOP using Java 35 Marks

1. Introduction

- Objects, Messages, Classes, Encapsulation, Inhereritance, Polymorphism.

2. Object Modelling Concepts

- Modeling as Design Technique, The object Modelling Technique.
- Objects and Classes.
- Links and Associations, Concepts of Advanced Links and Associations.
- Generalisation and Inheritance.

3. Basic Java Programming Concepts.

- Primitive Data Types, Variable Names, Scope, Operators, Expressions.
- Control flow statements, Arrays
- Anatomy of Java Applications and Applets.

Text Book:

1. **E. Balguruswamy:** Programming with JAVA

PAPER-II (THEORY)

Full Marks – 75 Duration 3 hours

A. Introduction to Internet and Web Design. 40 Marks

1. Internet

- The world of Internet
- Packet Switching
- TCP/IP and its Importance

2. Internet Browsers.

- Search Engines, Browsing versus Information Retrieval, Browsing Software.
- Hypermedia Display, Users of URL, Automatic Web Searching.
- Audio and Video Communication
- Internet Security.

3. Web-Page Designing-I

- HTML Generators
- HTML Documentations, Tag, Links and Examples.
- Manipulating Header, Footer, Colour, Comments, Alignments, Paragraph, Tab, Images and Pictures.

4. Web-Page Designing-II

- Ordered and Unordered List, Nested list, Tables Formatting and Editing Features.
- Defining different Styles, in-line, Internal and External style Sheets, Linking of Sheets in HTML Documents, Working with multiple style.

Text Book:

1. **Mathews Leon:** Internet for Everyone by Alexis Leon.
2. **Ivan Bayross:** HTML/DHTML, BPB Publication

Reference Book:

3. **Christian Crumlish:** The ABC of the Internet, BPB Publication.

B. Visual Programming and Application Development: 35 Marks

1.

- Introduction, Graphical Development Environment.
- Basic elements of VP, Event Driven Programming.
- Applications of VP Pros and Cons of VP.

2. Visual Basic – Overview.

- Introduction, Integrated, Development Environment.
- Elements of Programming.
- Flow Control statements.

3. Concepts of Visual Basic.

- VB Project – Components, Development and types.
- VB Project Elements –Forms, Menus etc.
- Event Driven Programming, Graphics, Clipboard and Multimedia Using VB.
- Error0Handling, Debugging and Deploying Applications.

4. Client/ Server and Internet Development using VB.

- Building multilier applications.
- Building the Business Logic, Deploying Tracking System.
- Building IIS applications, Data Driven DHTML applications.
- Building Active X Documents.

Text Book:

1. Complete Reference, Visual Basic 6.0, TMH Publication.

PAPER-III (PRACTICAL)

Full Marks – 50 Duration 4 hours

Practical : Experiment on Paper-I & II

(The Students should perform minimum 10 major level Experiments 5 each from Paper-I and II)

SECOND UNIVERSITY EXAMIANTION

PAPER-IV (THEORY)

Full Marks – 75 Duration 3 hours

A. Business Data Processing 37.5 Marks

1. Introduction

- File Processing systems, database systems and the evolution of database technology.
- Aims and importance of database technology: data independence, data sharing, data integrity, data redurdancy control.

2. Business Files and Structured.

- Elements, Fields and Records.
- Fixed a variable length.
- Record layout segmentational/indexed/relative fields.

3. Working with database Management Systems.

- Creation and modification.
- Searching, sorting, indexing.
- Setting system environment.

4. Screens and Reports.

- Designing custom screens.
- Creation and Printing of reports.
- Labels.

5. Database Programming.

- Managing strings, numbers and dates using built-in-functions, memory variables.
- Designing and developing Programmes.
- Debugging techniques, procedure files.

Text Book

1. **Bipin Desai:** Bipin Desai.
2. **R.K. Taxali:** Foxpro 2.6 for Windows.

B. System Analysis and Design. 37.5 Marks

1. **Overview of System Analysis & Design:**
- System Definition, System Development Life cycle, Project Selection, feasibility, design, implementation, Testing and evaluation.
2. **Project Selection Feasibility Study:**
Sources of Project request, Preliminary investigation, technical, economical and operational feasibility.
3. **System Requirement Specification and Analysis:**
Fact finding Technique, Data Dictionary, DFD.
4. **Detailed Design:**
Physical file design involving design involving databases.
5. **System Control and Quality Assuracnce:**
Software design and documentation tools, testing (Unit, Integration) conversion methods.
6. **Hardware and Software Selection:**

Preliminary Ideas of Selecting Hardware & Software

Text Book

1. **James A. Senn:** Analysis and Design of Information System.

Reference Book

1. **D. Millington:** System Analysis and Design.

PAPER-V (THEORY)

Full Marks – 75 Duration 3 hours

A. Computer Network 37.5 Marks

1. **Introduction**
- Computer Networks – definition and advantages.
- Transmission technology in Broadcast Networks and Point-to-point Networks.
- Introduction to local area Network, Metropolitan area networks.
- Wide area Networks, Wireless Networks, and Internetworks.
2. **Local Network Technology**
- Protocol Hierarchies
- Design Issues for the Layers
- The OSI reference Model
- The TCP/IP reference Model
3. **Local Network Technology**
- Local area Network topologies and characteristics
- The IEEE standard 802.3 and Ethernet.
4. **Wireless Networks**
- Wireless LAN Protocol
- Introduction to Satellite Networks.

Text Book:

1. **A.S. Tenenbaum:** Computer Network.

A. Elements of Unix Operating System and Shell Programming 37.5 Marks

1. **Introduction to Unix Progamming Environment**
- Introduction to Unix System
- The file system, Process Management.
- Common Unix commands
- The vieditor
- Introduction to the Bourne shell
- Shell variables
- Command line Processing.
2. **Unix filters and other commands**
- Pr. Head, tail, cut, paste, sort, uniq, trjoin etc.
- Grep, egrep, fgrep, etc.

- Stat, fstat, umask, chmod
- Exec, fork, wait system

Text Book:

1. **Sumitabha Das**: Unix
2. **Y. Kanitkar:** Unix Operating System.

PAPER-VI (PRACTICAL)

Full Marks – 50 Duration 4 hours

Experiment on BDP or Unix Operating System

The students should perform minimums 10 major level Experiments 5 each from B.D.P. and UNIX including shell Programming.

(D) ELECTIVE COURSES:
1. MINOR ELECTIVES

MATHEMATICS AND STATISTICS

(For Biology Students)

Full Marks – 100 Duration 3 hours

Unit-I Definition of function. 20 Marks

Simple examples of different kinds of functions, Exponential and logarithmatic functions and their graphs, solving problems using log tables.

Principle for counting, formula for permutation and combination with and without repetition(derivation of formula is not required), statement of Binomial theorem with application to simple problems.

Unit-II Calculus 20 Marks

a. Differential Calculus: Concept of limit with simple problems, Derivatives of sum, product quotient of functions. Application of derivatives in finding tangents and normals of standard curves, elementary knowledge of partial derivatives.
b. Anti Derivative: Definition of anti derivative, anti derivative of simple functions, integration as the reverse process of differentiation, integration by parts, Simple problems of integration and solution of differential equation type $dy/dx = kf(x)$ and $dy/dx=f(x)\ g(y)$.

Unit-III 20 Marks

a. Determinants: Its evaluation matrices: Operation, transpose and inverse and rank of matrices, solutionof linear equations.
b. Preliminaries of coordinate geometry, linear equation & in equations and then graphical solutions. Straight line, circle, parabola, Elipse, hyperbola with their graphs (equations in simple forms with out derivation) simple problem solving.

Unit-IV 20 Marks

a. Idea of population and sample, moments, skewness and kurtosis, concepts of random variables, Unvariate distributions: Binomial, Poisson, Exponential and Normal distribution,s Their means and variances, Area under Normal Cuves.
b. Bivariate distribution, scatter diagram, regression lines, regression coefficients, fitting of curves by least square principle (Polynomial, Exponential and logarithmic) Correlation coefficient, regression plane Theory attributes.

Unit-V 20 Marks

Test of significance: Null and Alternative hypotheses, level of significance, Description of chi-square, t and F statistics (without derivation of distribution functions), test of mean and variance of normal population, test of equality of two means and test of equality of two variances of two normal populations, other uses of Chi-square, t and F statistics, large sample tests.

Books Recommended:

1. **G.Das and Others:** Topics in Mathematics.
2. **B.S. Vatssa:** Theory of Matrices.
3. **M.N. Das:** Statistical Method and Concepts, Wiley Eastern Ltd.
4. **C.B. Gupta:** Fundamentals of Statistical Methods.

BIOLOGY

(For Physical Science Students)

Full Marks – 100 Duration 3 hours

1. Basic characters of living organisms and difference between living and non-living.
2. Cell – a unit of living organisms. Organisation of a typical cell.
3. Chemical basis of Life- Biomolecules like carbohydrates, lipids, proteins and nuclic acids. Macromolecular organization and structural complexes.
4. Physiological basis of life – Autotrophic mode of living. Neural and hormonal integration of functions, Respiration, nutrition, locomotion, circulation, excretion, Reproduction the process of procreation.
5. Genetics the science of heredity – Chromosomes – number and structure, cell division – mitosis & meiosis, Mendelian principles.
6. Nomenclature and classification of organisms, Diversity in, Animals, plants and Microbes.
7. Origin of life and Evolution of living organisms.
8. Ecology, the science of interdependence of living organisms and environment, Environmental perturbation and management for conservation.
9. Frontiers in Biology in 21sdt century, Human genoune, Biotechnology, cloming, Organ transplants, AIDS & career, exobiology, space biology.
10.

2. MAJOR ELECTIVES

ANTHROPOLOGY

PAPER-I SOCIAL ANTHROPOLOGY

Full Marks – 100 Duration 3 hours

Unit-I Development of Anthropology in the formative period, Branches of Anthropology.

Unit-II Concept of group, Types, Institutions; Organisations, Associations (characteristics).

Unit-III Social groups: Features and functions of the following family, Linenge, Clan/Gotra, Phratry, Moiety.

Unit-IV Kinship and Marriage (with reference to primitive societies) Types of kins, kinship terminology, Usages, Rules of primitive marriage, Types of marriage, Ways of acquiring mates.

Unit-V Nature and Scope of Applied Anthropology and action Anthropology. Application of anthropology in administration. Application of anthropological in tribal welfare.

Books Recommended:

1. **D.N. Majumdar & T.N. Madan:** An Introduction to Social Anthropology.
2. **G.P. Murodoca:** Social Structure.
3. **Beals & Hoijer:** Introduction to Anthropology.
4. **Robein Fox:** Family and Marriage
5. **Paul Bohaman:** Social Anthropology

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PAPER-II BIOLOGICAL ANTHROPOLOGY

Full Marks – 100 Duration 3 hours

Unit-I Theories of Evolution: Lamarkism, Neo-lamarkism, Darwinism, Neo-darwinism Synthetic theory of evaluation.

Unit-II Prehistoric man and their culture, Fossil evidence of Humen evolution, Pryopethecus, Aurtrolopithecus, Pithecantheopus, Neauderthat man, Grimaldi, Cromagman.

Unit-III Race – Concept, biological basis of race.
Major racial types – caucosoid, Mangoloid, Negroid and their distribution, Race formation, Racial criterions – skin, colour, hair, face.

Unit-IV Human adaptation, Meaning and Mechanisms of adaptation, Physiological adaptation to altitude, Cold, Heat, Genetic adaptation, Cultural adaptation.

Unit-V Applied physical anthropology: Growth and Nutrition, Forensic Anthropology, Sports anthropology, Medical Anthropology.

Books Recommended:

1. **R,.M. Sarkar**: Fundamentals of Physical Anthropology.
2. **B.M. Das:** Outlines of Physical Anthropology.
3. **E.A. Hoston:** Up from the Ape
4. **K.B. Lal:** Organic Evolution
5. **A.L. Kroeber:** Anthropology.

BIOTECHNOLOGY

PAPER-I

Full Marks – 100 Duration 3 hours

Unit-I Introduction to Biotechnology:

Concepts and definition of biotechnology. History of biotechnology, Scope of biotechnology, Interdisciplinary nature of Biotechnology, Importance of biotechnology in India.

Unit-II DNA, the master molecule:

Characters of DNA which make it most suitable as genetic material. Structure of DNA, Walson –Crick Model. DNA as the genetic material. Types of DNA: B DNA, viral DNA, SS DNA, Cytoplasmic DNA (Mitochondrial & chloroplast DNA) plasmid DNA.

Unit-III Gene Concepts

Replication of DNA, One gene – One polypeptide concept. Gene function in Prokaryotes. Mechanism of flow of information.

Unit-IV Prokaryotes as the Tools of Biotechnology:

Difference between prokanptes & eukaryotes. Basic structure of virus. Culture of bacteria, Bacterial growth bacterial and Viral replication.

Unit-V Recombinant DNA Technology - I

Isolation of DNA, Restrictionendonucleares, Introduction of DNA into prokaryotes (techniques) and concept of cloning.

PAPER-II

Full Marks – 100 Duration 3 hours

Unit-I Recombinant DNA Technology-II

PCR technology, Blotting technique (Southern, Northern & Western blotting), C-DNA Technology, DNA finger printing, DNA-hybridisation technique.

Unit-II Biotechnology in Agriculture:

Transgenic plants (production of herbicide persistant plants insect resistant plants etc.) Nif gene transfer, Germplasm conservation, Somatic hybridistion and tis application.

Unit-III Biotechnology in food and other Industries:

Single cell protein production. Gene manipulation in brewery. Production of organic acids and enzymes, use of cell free enzymes in industries.

Unit-IV Biotechnology in Pharmaceutical Industry

Production of antibiotics, Production of vaccines, Monoclonal antibiotics, Gene therapy.

Unit-V Environmental Biotechnology:

Biogas production, Biofertiliser, Composting and vermicomposting technologies, Bioremediation, Biotransformation, Biofertilizer.

CHEMISTRY

(There shall be two theory papers each carrying 100 marks and each of 3 hours duration)

PAPER-I

Full Marks – 100 Duration 3 hours

Unit-I Chemical Bonding

a. Ionic Bond: General characteristics, Lattice energy, Solvation energy fajan's rule, percentage of ionic character from dipole energy, moment and Electro negativity difference.
b. Covalent Bondl: General Characteristics, Valence-Bond approach, Concept of resonance and resonance Energy, Concept of Hybridisation, Directional characteristics and geometry of the following types of molecules of ions: AB_2, AB_2E, AB_4, AB_3E, AB_2E_2, AB_5, AB_4E, AB_3E_2, AB_2E_3, AB_6, AB_5E, AB_4E_2 (Where 'E' represents ione pair of electron), Qualitative treatment of Molecular orbital theory: Bonding, Antibonding, non-bonding molecular orbitals, MO configuration of H_2, N_2, O_2, F_2, CO, NO, HF and their ions.
c. Hydrogen Bond: Theory of Hydrogen bonding, Its occurrence, nature and consequence.

Unit-II Compunds of p-block elements (Preparation and structure)

a. Carbon family: Carbides, silences, Silicates.
b. Boron family: Boric acid, Diborane.
c. Nitrogen family: Hybrides of nitrogen.
d. Halogen family: Oxides and Oxyacids of Chlorine.
e. Oxygen family: Oxygen fluorides, peracids of sulphur.

Unit-III

a. Co-ordinate compounds.
   Nomenclature, Werner's theory, Isomerism, Valence Bond theory with special reference to octahedral and square plane complex, Limitation of valence Bond theory.
b. Nuclear Chemistry
   Natural and Artificial radioactivity, Nuclear transmutation, Nuclear fission and fusion, Radio active isotopes and their application in industry, Agriculture and medicine.

Unit-IV

a. Adsorption and surface phenomena:
   Physiosorption and Chemiosorption, Adsorption isotherm, derivation Freudlich and Langumir adsorption isotherms and their applications.
b. Homogeneous equilibria:
   Law of Mass action, Le-chatelier Principle, Their application to:
   i. Dissociation of PCL_5
   ii. Dissociation of N_2O_4
   iii. Dissociation of NH_3
   iv. Hydroloysis of Ethyl acetate.

Unit-V Thermodynamics:

a. The First Law of Thermodyanamics, The Law, Concept of the free energy, entropy and Thermodynamics criteria of equilibrium, Effect of temperature and pressure on equilibrium, Effect of temperature and pressure on equilibrium, Relation between equilibrium law of thermodynamics: The law, enthalpy, energy, Heat capacities, isothermal and adiabatic processes.
b. Thermochemistry: Hess's and Kirchoff's laws calculations based on these laws (Heat of formation, heat of reaction and heat of combustion).
c. Second law of thermodynamics: The law, concept of the free energy, entropy and thermodynamic criteria of equilibrium, effect of temperature and pressure on equilibrium relation between equilibrium constant and free energy.

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PAPER-II

Full Marks – 100 Duration 3 hours

Unit-I

a. Organometallic compounds:
   Grigoard's Reagent: Preparation and synthetic uses.
b. Esters containing active methylene group:
   i. Acetoacetic Ester: Synthesis (Claisen reaction), Synthetic uses, Keto-enol tautomerism.
   ii. Malonic Ester: Preparation and synthetic uses.
c.

Unit-II

a. Carbonhydrates:
   Classification, Configuration of sugars, glucose and fructose (Osazone formation, mutarotation), Elucidation of the structure of d-glucose (open chain and ring structure), Interconversion of sugars.
b. Bio-Chemistry:
   Amino Acids (nomenclature, structure, Acid-base properties synthesis of Alpha-Amini Acids), Formation and geometry of peptides, Proteins and their functions.

Unit-III

a. Aryl Oxygen Compounds:
   Phenols: Preparation (diazo reaction and fusion) Properties (acidity, reactions with alkyl and aryl halides, Etherification, electrophonic substation, Kolbe synthesis, Diazonium coupling), Comparison with alcohols.
b. Aryl Aldehydes and Ketones:
   Preparation (Etards reaction, Friddal craft reaction), Properties (Addition reactions, Caninzzaro's Benzoin, Perkin and lodoform reactions).
c. Aryl carboxylic Acids:
   Preparation (oxidation, hydrolysis of nitiriles, Grignard's reaction), Properties (Acidity, reaction with PCL_5, $SOCl_2$ Alcohol, NH_3 and electrophilic substitution).

Unit-IV

a. Aryl Nitrogen Compounds
   i. Nitro hydrocarbons: Preparation and properties, Reduction of Nitrobenzene, TNT.
   ii. Amines: Preparation, Properties, structure and Synthesis, uses of benzene diazonius salt, Comparision with Aliphatic amines.
b. Alicyclic Compounds: Preparation, Reactions and stability.

Unit-V

a. Electro Chemistry:
   Specific, Equivalent ad Molar conductances, Laws, Variation of conductance with concentration for strong variation of conductance with concentration for strong and weak electrolytes, determination of degree of ionization, solubility product and degree of hydrolysis, conductemetric titrations, reversible cells and simple idea on redox potential.
b. Acid and Bases:
   Lewis concept, Lowry-Bronsted and HSAB concept of relative strength of acids and basis, PH theory of acid-base indicators, Buffer solutions, buffer capacity and Buffer range.

Books Recommended:

1. **Satya Prakash, G.D. Tuli, Basu & R.D. Madan:** Advance Inorganic Chemistry, Vol-I, S. Chand Co. Pvt. Ltd.
2. **Bahl and Tuli:** Essential of Physical Chemistry, S. Chand & Co. Ltd.
3. **B.S. Bhal & A. Bhal:** Advanced Organic Chemistry, S. Chand Co. Ltd.

CONSERVATION AND MANAGEMENT OF NATURAL RESOURCES

PAPER-I CONSERVATION AND MANAGEMENT OF PHYSICAL AND CHEMICAL NATURAL RESOURCES.

Full Marks – 100 Duration 3 hours

Unit-I

Concept of resource: Classification of physical and chemical resources; Importance of natural resources in the human society; Impact of industrialization on natural resources.

Unit-II

Fundamental concepts regarding inexhaustible resources:

i. Immutable resources like solar energy, atomic energy, wind power, geothermal energy and tidal power;
ii. Mutable resources (atmosphere, water, soil) and
iii. Non-maintainable resources like gems, metals, non metallic minerals like glass, sand, gypsum and metals.

Unit-III

Potential of physical and chemical resources, their conversion and efficiency of energy recovery pattern, suitability in the context of economic standard (developed and developing countries) and environmental conservation: Demographic quotient and economic standard.

Unit-IV

Technologies available for conservation of natural resources: Solar pond technology, solar photovoltaic system, efficient solar cooker, cooking Chula and energy conservation, Wind mill, water harvesting technology, management of industrial byproducts like fly ash.

Unit-V

Environmental law of conservation of natural resources, conventions and international treaties on conservation of natural resources, conservation education and value systems; Energy perspectives in rural and urban system.

PAPER-II

Full Marks – 100 Duration 3 hours

Unit-I

Concept of resource, classification of resources, classification of natural biological resources (fossil fuels, plants animals, microbes), Industrial revolution and modern age, fundamental principles of ecosystem and conservation of resources.

Unit-II

Fundamental concepts regarding biological resources:

i. Exhaustible resources like fossil;
ii. Maintainable biological resources like plants, animals and microbes.
iii. Mutable resources (transgenic organism and food, cultivars, cloning and human genome).

Unit-III

Potential of biological resources, their conversion and efficiency of energy recovery pattern, Biodiversity and resource conservation, intellectual property right, WTO and environmental standards (pollution and conservation); Demographic quotient.

Unit-IV

Examples of biological resource conservation such as agriculture (sustainability in traditional and conventional method), Forestry (agroforestry, energy plantations), Aquaculture (intensive farming Vs. energy maximization), Wild animals, National parks and biosphere reserves in Orissa.

Unit-V

Environmental aesthetics and ecological conservation, Problems of environmental pollution (air, water and soil) and its impact on biological resources, Ecological balance and biodiversity threatened and endangered species.

DISASTER MANAGEMENT

PAPER-I ENVIRONMENT HAZARD AND RISK MANAGEMENT

Full Marks – 100 Duration 3 hours

Unit-I

Definition of Hazard and Disaster, Natural and Technological hazards, Hazardous installation, Hazardous materials, Toxic substances, Pathogens and matagens, Toxic chemicals and hazards, Concept of toxicity, LC50 and LD50 concepts, Toxicity tests, Mechanism of Toxicant action.

Unit-II

Definition of hazardous waste, solid waste generation, concept of solid waste management. On site handing and processing, disposal techniques – open dumping land filling, incineration, composting, potential methods of disposal – Utilization, recovery and recycling.

Unit-III

Concept of risk analysis, methodologies for risk analysis advantages and limitation, Hazard identification, evaluation, vulnerable analysis, methodologies of safe distance and safe handling.

Unit-IV

Disaster Management – Concept of disaster management plan, Guidelines, methodologies, forecasting and warning system of disasters, Emergency preparation, pre-disaster phase, actual disaster phase, case studies.

Unit-V

Disaster Assistance – Technological assistance, Rescue, Relief camps, Provision for human needs, Information administration.

PAPER-II NATURAL AND INDUSTRIAL DISASTERS AND ITS MANAGEMENT.

Full Marks – 100 Duration 3 hours

Unit-I

Land slides: Definition, causes and types of land slides, Theoretical backgrounds of debris and flow analysis, Preparation of Land slides Zonal maps, Prevailing measures and awareness programs, Risk assessment in land slides.

Unit-II

Cyclones, structures of cyclones and damages, causes of cyclonic depression, parameters of reduce wind effects on structures, Mitigation and management Flood: Rivers, their behaviours and control, Estimation of flood management, Flood prediction and forecasting, Environmental effects, Flood water and Land management, Human responses to flood hazards.

Unit-III

Earthquake: Terminology, Occurrence of earthquakes and causes, prediction of earthquake, consequences of earthquake damage, Remedial measures, post earthquake studies.

Unit-IV

Industrial Disaster: Introduction, types of industrial disaster, hazard identification, Risk assessment, Action plan, safety devices, emergency planning for release of toxic chemical protective action and responses.

Unit-V

Statutory Regulation: Salient features of manufacture, storage and import of hazardous chemical rules – 1980, Insurance liability Act. – 1991, Biomedical waste disposal Act., Municipality solid waste disposal Act., 1999, 2000.

Books Recommended:

1. **Singh, Kundu and Singh**: Disaster Management, Mittal Publication.
2. **P.C.Sinha (Eds.):** Disaster Management, 10 Volumes, Anmol Publication.

LIFE SCIENCES

PAPER-I

Full Marks – 100 Duration 3 hours

Unit-I

Life, its origin and evolution, Diversity of life, outline survery of diversity; Plants, animal, Micro organisms (Pathogen, Parasite, Saprophytes, Chemotrophs, Symbniotics and commensals).

Unit-II

Cell as basic unit of life, structural organization of cell, Prokaryotes and Eukaryotes, cellular organelles (Nucleus, Mitochondria, Chloroplast, Endoplasmic reticulum, Golgi apparatus, Ribosomes), cell membrane, cell cycle and division.

Unit-III

Biophysical – Chemistry:

Interaction in biological system: Intra and inter molecular forces, Vanderwal force, hydrophilic interaction.

Water as universal solvent, properties of aqueous solution, pH, buffer.

Thermodynamics and its application to biological system.

Unit-IV

Bio-molecules in cell: Carbohydrate, Lipid, protein, Nucleic acid (RNA & DNA) with their structure. ATP, the energy rich compound in the cell.

Unit-V

DNA as genetic material, central Dogma & Reverse transcription, DNA replication, Transcription and Translation, Genetic code; Regulation of gene action.

PAPER-II

Full Marks – 100 Duration 3 hours

Unit-I Enzymes:

Properties, classification, Mechanism of enzyme action and regulation, Enzyme Kinetics and inhibition, cofactors.

Unit-II Biological Processes:

Photosynthesis, Respiration & Energy yielding mechanisms, Physiology of digestion and assimilation, Physiology of excretion, Basic concepts of transmission of impulse and hormonal integration.

Unit-III Basic concept of genetic engineering:

Concept of gene, Recombinant DNA technology: Concept, application in the field of Agriculture, Medicine, Food and Industrial production.

Unit-IV Organism and Environment:

Dynamics of environment, concept of Ecosystem, Population and Community, Energy flow and nutrient cycling, Food chain, Food web, population dynamics and regulation in nature, Ecosystem development and concept of climax in Ecological system, Biodiversity and its significance.

Unit-V Instrumentation for biological sciences:

Microscopy, Chromatogrpahy, Centrifugation, Spectorscopy & pH metry.

MATERIAL SCIENCES

PAPER-I

Full Marks – 100 Duration 3 hours

1. Characterisation of material according to crystal structure: different types of crysaal lattices, dislocations and defects in crystal structure, Schottky and Frenkel defects.

2. Mechanical properties of materials: Elastic-plastic and anelastic properties, relation between stress and strain, fatigue, creep and fracture, different uses.
3. Dielectric properties of materials: Polarisation and polarisability, di-electric constant, dielectric loss and dissipation, dielectric relaxation process, different uses of dielectric materials, Ferro and para electric materials.
4. Experimental techniques of material characterization: Diffraction methods: Using X-rays, electronand neutron diffraction from materials, Resonance methods: NMR and EPR, MASERS, Infrared and Raman scattering probe, Mossbaur technique and its uses.
5. Semiconductor technologies: Purification, crystal growth; doping, epitaxy (CVD and MBE).
6. Phase transitions in materials: Phase- diagrams at equilibrium, solid-solid and solid-liquid phase transitions, complete miscibility, partial miscibility examples of Cu-Ni and Pb-Sn systems, alloys and use, Nucleation and growth, metal insulator phase transition, Landau's theory of second order phase transition.

PAPER-II

Full Marks – 100 Duration 3 hours

1. Magnetic properties and magnetic materials: Classification, dia, para, ferro, antiferro and ferromagnetic materials, domains, soft and hard magnetic materials, magnetic induction, critical fields, hysteresis, hysteresis loss and methods of minimize the same, Langevin's Theory, Landaus' theory, Hall effect.
2. Optical materials: Lasers – principles and materials, uses, optical fibers: properties and characteristics, uses, Luminescence, absorption by crystal lattice, absorption, spectroscopy.
3. Electrical properties and material characteristic: Conductors, semi-conductors, insulators and their uses, Thermoelectric, mechanoelectric (piezo-electric) effects, photo electric effect and devices, thermionicern mission, field emission and uses in devices.
4. Super conducting materials: Zero resistance and transition temperature, Missner effect, crititica magnetic field, Type-I and Type-IOI super consudctors, tunneling and Jesephson effect, elementary discussion of BCS theory, elementary ideas about high Tc-super conductors, tullerenes and niclel – boro carbide compounds elementary discussion.
5. Polymers, ceramics and refractory materials: Concepts of polymeric materials, polymer synthesis and manufacture, principles of polymer processing (thermoplastic, elastomeric processes), preparation and purification of synthetic and natural surfactants, miscelle formation and structure, thermodynamic of miscemsation.
6. Elementary idea of mesoscopic systems and hetero structures: Nano material, clusters, quassi, srystals, quantum dots and quantum well systems.

Text Book:

1. **Anderson, Leaver, Rawlings and Alexander**: Material Science, Chapman Hall, 1994.

References:

1. **C. Kittel:** Introduction to Solid State Physics, 15th Edn.
2. **Lovell, Avery & Vernon:** Physical properties of materials, ELBS, 1981.
3. **L.H. Vanvleck:** Elements of material science, Addison – Wesley.
4. **Puri and Babar:** Introduction to Solid State Physics.
5. **H. Ibach & H. Luth:** Solid State Physics, Narosa, 1992.
6. **K.P. Jain:** Physics of Semiconductor nano structure, Narosa, 1997.

MATHEMATICS

(Students having Mathematics at the +2 stage are only eligible to take this elective)

PAPER-I

Full Marks – 100 Duration 3 hours

Unit-I Differential Calculus

Partial Differentiation, Maxima, Minima, Singularities, Tracing of curve, Curvature.

Unit-II Integral Calculus:

Definite Integral, Area, Length, Solution of differential equation of 1^{st} and 2^{nd} order by method of separation of variables and substitution method.

Unit-III Linear algebra:

Solution of linear equation, Homogeneous and Non homogeneous equation by Gauss Method, Matrix, Orthogonality, rank, eigen value

Unit-IV Probability:

Elementary concept of probability distribution, distribution function, finding the expectation, variance, standard deviation with special emphasis on Bionomial, Poisson and Normal Distribution.

Unit-V Statistical Methods:

Collection and Representation of Data, frequency distribution, measures of centraltendency, Measures of dispersions, co-relation and regression analysis, index number, time series analysis.

Book Prescribed:

1. **Gorakh Prasad:** Text Book of Differential Calculus, Pothisala Pvt. Ltd., Allahabad.
2. **Gorakh Prasad:** Text Book of Integral Calculus, Pothisala Pvt. Ltd., Allahabad.
3. **D. Pratihari, S.P. Mohanty:** Elements of Probability Theory, Kalyani Publishers, New Delhi.
4. **P. Mukherjee, K. Chatterjee:** Introduction to Numerical and Statistical Methods, Somnath Prakashan, Calcutta.

PAPER-II

Full Marks – 100 Duration 3 hours

Unit-I Algebra:

Group Theory: Definition of a Group, Some examples of Group, Sub-Groups and normal sub groups, Homomorphism, Ring Theory: Definition and examples of Ring, Some special classes of rings, Homomorphism.

Unit-II Programming in FORTRAN:

Algorithm & Flow Chart, Constants, Variables, Expression in FORTRAN, Control Statements, Programming of simple problems.

Unit-III Numerical Methods:

Approximation of numbers and errors, finite differences, interpolation, numerical integration, solution of systems of linear equations.

Unit-IV Operation Research:

Solution of linear Programming problem by graphical and simplex method.

Unit-V Mathematical Method:

Integral Transforms, Laplace Transform, Fourier Transforms.

Book Prescribed:

1. **I.N. Herstein:** Topics in Algebra, Vikash Publ. Pvt. Ltd., Ch.-2 (2.1-2.4, 2.6, 2.7), Ch.-3 (3.1-3.3).
2. **V. Rajaraman:** Programming in FORTRAN-77, PHI, New Delhi.
3. **P. Mukherjee & K. Chatterjee:** Introduction to Numerical & Statistical Methods, Somnath Prakashan, Calcutta, Ch.-1,2,3,5,7.
4. **B.S. Goel & S.K. Mittal**, Pragati Prakashini, Meerut.
5. **E. Krey & Zig:** Advanced Engineering Mathematics, Wiley Eastern Ltd., New Delhi.
6. **B.S. Grewal:** Advanced Engineering Mathematics, Khana Publisher, New Delhi.

NON-CONVENTIONAL ENERGY RESOURCES (I)

PAPER-I

Full Marks – 100 Duration 3 hours

Unit-I

Use of fire by primitive Man; Harnessing water and wind Power, Discovery of wheel; Industrial revolution and use of fossil fuels; Faraday's discovery of electromagnetic induction and use of electrical energy.

Unit-II

Definition of energy units, Joule, BTU, calorie, Kilowatt and Electron volt; Forms of energy; mechanical, thermal, electrical, sound, atomic (with example).

Unit-III

Conversion of energy from one from to another form; Laws of thermodynamics (1^{st} and 2^{nd} laws), Application of energy: Domestic, transport, Industry, defence, space science and agriculture.

Unit-IV

Calorific value of fuels like wood, charcoal biogas etc., proximate and ultimate analysis, Caking and cooking properties, Low and high temperature combustion.

Unit-V

Natural energy sources in India, Non conventional energy Vs. conventional energy scenario at national and international level.

PAPER-II

Full Marks – 100 Duration 3 hours

Unit-I

Energy from wind: Windmill, aeroturbine, Hydro energy: Hydroelectricity, Turbine, Tidal power, Hydraulic power.

Unit-II

Geothermal energy: Origin, heat exchange, Vapour cycle turbine, Solar energy, Solar cell and application, Preservation of solar energy, Energy generation in sun.

Unit-III

Nuclear Energy: Different stages of development, Nuclear fuels – uranium, thorium.

Unit-IV

Nuclear energy: Fission energy: Principles of fission, reactor design, reactors in India; Fission material reserve in India, Principle of thermonuclear reactions; Microwave for heating appliances.

Unit-V

Explorations of non-conventional energy sources in India prospects and problems.

PISCICULTURE

PAPER-I

Full Marks – 100 Duration 3 hours

Unit-I

1. History of Ichthyology in India.
2. Classification of fishees with distinguishing characters and examples of the major sub-divisions.
3. Labeo rohita: Systematic position; external features; digestive, circulatory and nervous systems; lateral line organs, air-bladder, webberian ossicies.

Unit-II

1. Physico-chemical characteristics of pond water affecting fish productions: turbidity, temperature, dissolved oxygen content, depth of water, acidity & alkalinity, dissolved nutrient, weed control, planktons etc.
2. Collection of spawn: Natural breeding grounds in Indian major carps, some important breeding grounds in the Ganges and the Bramhaputra river system.

Unit-III

1. Collection of eggs, fish seed (tries & fingerlings) from breeding grounds.
2. Wet and dry bundh breeding.

3. Induced breeding of Indian major carps. Agents used. Principle, technique and advantages of hypoplysation Response time.

Unit-IV

1. Hatchery and its management.
2. Preparation and management of nursery and rearing ponds. Fertilization of ponds.
3. Preparation and management of stocking ponds, supplementary feeding, carrying capacity.

Unit-V

1. Predatory and weed fishes, common predatory and weed fresh water fishes, examples with systematic position. (at least 5 fishes each).
2. Common fresh water weeds & their control.
3. Composite fish culture, composite culture of Indian and exotic fishes, Intensive fish culture, Fish-cum-duck culture, fish-cum-paddy culture.

PAPER-II

Full Marks – 100 Duration 3 hours

Unit-I

1. Fisheries of some important reservoirs of India, conservation and management of reservoir.
2. Fish Pathology: Diseases caused by infection of fungi, bacteria, protozoa, worms and crustacean.
3. Control of fish diseases.

Unit-II

1. Harvesting of fish: Craft and gears used in inland fresh, water fish culture.
2. Fish preservation methods: Handling and Cleaning of fresh fish, chilling, freezing, salting, sun-drying and smoking methods of preservation for both inland and marine catches.
3. Transport of fresh catch and its marketing. Transport of fish seeds/fry/fingerlings, Role of fish co-operative societies.

Unit-III

1. Fishery resources of Orissa.
2. Fisher extension education.
3. Biochemical composition and Nutritional value of raw fish.

Unit-IV

1. Prawn culture in India.
2. Elementary idea of fisheries in Chilika lake.
3. Larvicidal fishes & their importance.

Unit-V

1. Aquaculture, pearl culture.
2. Fishery products of commerce: Inland and marine.
3. Aquatic pollution and fisheres: types, sources & effects of pollution; preventive measures and recommended limit.

POLYMER SCIENCES

(There shall be two theory papers each carrying 100 marks and each of 3 hours duration.)

PAPER-I

Full Marks – 100 Duration 3 hours

Unit-I

a. Introduction, classification, molecule weight distribution, Degree of polymerization.
b. Step (condensation) Polymerisation: Introduction, Types of condensation polymers Mechanisms, Kinetics, polyfunctional step reaction polymerization, Three dimensional polymers, Inorganic polymers, Ring opening polymerization.

Unit-II

Radical chain (addition) Polymerization: Introduction Addition polymerization, Kinetics and Mechanism, Factors affecting chain polymers, (Initiator, monomer, temperature, pressure etc.), Ionic & Co-ordination chain polymerization.

Unit-III

a. Co-polymerization: Kinetics, Composition, Mechanism, Block & Graft Co-polymer, Polymer blends, Step co-polymerization.
b. Polymerization conditions and Polymer reactions: Polymerisation in Homogeneous and Hetereogeneous systems, Polymerisation reaction engineering, Chemical reactions of polymers.

Unit-IV

a. Polymer Solutions: Criteria, Conformations of dissolved polymer, thermodynamics and phase equilibrium of polymer solution, Fractionation of polymers.
b. Molecular weight and size: Average Molecular weight, Molecular weight distribution, Polydispersity and molecular weight, End group analysis, Colligative viscosity and Molecular size, Gel Permeation Chromatography.

Unit-V

Analysis and Testing of Polymers: Chemical analysis of polymers, Spectroscopic methods, X-ray diffraction analysis, Microscopy, Thermal analysis, Physical testing.

PAPER-II

Full Marks – 100 Duration 3 hours

Unit-I

Polymer structure and properties: Configurations of polymer chains, Crystal structures of polymers, Morphology of Crystalline Polymers, The crystalline melting point, The glass state and the glass transition, Viscous flow, Viscoelasticity, Large and small deformations.

Unit-II

a. Hydrocarbon Plastics and Elastomers: Polyethylene, Polypropylene, Other Olefin-Based Polymers and Co-Polymerrs, Natural Rubber, Rubber from butadiene, Other synthetic elastomers.
b. Other Carbon Chain Polymers: Polystyrene & related Polymers, Acrylic polymers, Polyvinyl esters, Chlorine & Fluorine containing polymers.

Unit-III

a. Heterochain Thermoplastics: Polyamides and Polypeptides, Polyesters, Polyethers and related polymers, Cellulosic Polymers, High-Temperature and Inorganic Polymers.
b. Thermosetting Resins: Phenolic and Amino Resins, Unsaturated Polyesters Resins, Epoxy Resins & Polyurethanes, Sillicope Polymers, Miscellaneous Thermosetting Resins.

Unit-IV

Polymer Degradations: Introduction, Types of degradations, Thermal, Mechanical and Photo degradation, Degradation by Ultrasonic waves and High Energy Radiations, Oxidative and Hydrolytic Degradations.

Unit-V

Plastic, Fiber forming and Elastomeric materials, Rheology and polymer materials:

a. Plastic materials, Moulding, Extrustion, Other processing methods, Multipolymer systems and composites, Additives and Compounding.
b. Fiber forming materials, textile and fiber properties, Spinning, Fiber after-treatments.
c. Elastomeric materials, Volcanisation, Reinforcement, Elastomer properties and compounding.

Book Prescribed:

1. **Fred W. Bilieyer:** Text Book of Polymer Science, John Wiley & Sons.
2. **V.R. Gowariker, N.V. Viswanathan & J. Sreedhar:** Polymer Science.
3. **M.G. Arora & M.Sing:** Polymer Chemistry, Anmol Publications.
4. **G.S. Mishra**: Introductory Polymer Chemistry, New Age International (P) Ltd.

REMOTE SENSING

PAPER-I Basic Principles of Remote Sensing and Aerial Remote Sensing.

Full Marks – 100 Duration 3 hours

Unit-I Basic Principles of Remote Sensing:

History of Remote Sensing, Benefits of Remote Sensing over conventional method of resource survey, Components of Remote Sensing System.

Electromagnetic Radiation (EMR), Nature and generation of EMR: Effect of atmosphere on EMR: EMR and their interaction with rocks, minerals, vegetation, water, soil etc.

Unit-II Basic Principles of Remote Sensing:

Platform, Role of platform in Remote Sensing: Types of platform and their specific uses, Sensor, Fundamental properties of sensors and their functions: Different types of sensors.

Unit-III Aerial Remote Sensing:

Uses of aerial photographs in different fields of science and for earth features: Aerial photography: Fundamentals of aerial photography: Instruments used for aerial photography.

Unit-IV Aerial Remote Sensing:

Types of aerial photographs, Characteristic features of aerial photographs-scale, overlap, sidelap, vertical exaggeration etc., Photo features-form, shape, texture, tone, drainage pattern etc.

Unit-V Photo Interpretation:

Instruments used for aerial photo interpretation – stereoscopes, Mosaics and mosaic preparation, Advantages of aerial photographs.

PAPER-II Satellite Remote Sensing and Application RS to Various Fields.

Full Marks – 100 Duration 3 hours

Unit-I Satellite Remote Sensing:

Fundamentals of Satellite Remote Sensing: Types of RS Satellites; Indian satellites used for RS.

Unit-II Sensor:

Sensor types – Return beam Vidicon Camera, Multispectral Sensors, Thematic Mapper, Pushbroom scanners, Line Imaging Self scanning Sensors (LISS), Very High Resolution Radiometers (VHRR), Advanced Very High Resolution Radiometers (ADHRR), WIFS, Microwave radars.

Unit-III R.S. Data and Processing Sensor:

Fundamentals of data acquisition by sensors, Data transmissions and recording. Data Processiing. Remote Sensing data products, Data interpretation, Suprvised and unsupervised classification, Preliminary idea about Geographic Information System.

Unit-IV Application of RS.

Application of Remote Sensing techniques in Mineal resource investigation, Forest Mapping and management, Ground-water investigation, irrigation and Water shed Management.

Unit-V Application of RS

Soil mapping, waste land mapping, Sustainable development Studies, Crop Acreage and Production forecasting, Flood studies, Environmental Hazard assessment.

STATISTICS

(There shall be two theory papers each carrying 100 marks and each of 3 hours duration.)

Paper-I	**100 Marks**	**3 Hours**
a. Probability Theory	20 Marks	
b. Statistical Methods	60 Marks	
c. Time Series Analysis	20 Marks	

Paper-II **100 Marks** **3 Hours.**

a. Design and Analysis of Experiments. 30 Marks
b. Sampling Techniques 30 Marks
c. Vital Statistics 20 Marks
d. Statistical Quality Control 20 Marks

PAPER-I Statistics-I

Full Marks – 100 Duration 3 hours

a. Probability Theory **20 Marks**

Unit-I

Definition of Probability, Classical and axiomatic approach, laws of addition and multiplication of probability, conditional probability, Independent events, pair wise independence, Random varialble, distribution function, mathematical expectation, addition and multiplication, theorem of expectation, moment generating function, Standard univariate distribution and properties.

Discrete: Binomial and poisson distribution and their properties.

Continuous: Normal distribution and its properties.

Books Recommended:

1. **S.C. Gupta & V.K. Kapoor:** Fundamental of Mathematical Statistics.
2. **K.L. Chung:** Elementary Probability Theory with Stochastic Processes, Springer International Student Edn.

b. Statistical Methods **60 Marks**

Unit-II

Idea of population and sample, measures of central tendency, mean, median, mode, partition values, measures of dispersion, moments, skewness and kurtosis. Bivariate distribution, scatter diagram, regression lines, regression coefficients, fitting of curves by least square principle (Polynomial, Exponential and Logarithmic).

Unit-III

Correlation Coefficient, rank correlation, correlation ratio, intra class correlation coefficient, partial and multiple correlations, Regression plane (three variables only). Theory of attributes: Consistency of data, interdependence of attributes, measures of association.

Unit-IV

Test of Significance: Null and Alternative hypotheses, level of significance, Type-I error Type-II error, Description of chi-square, t and F statistics, test of mean and variance of normal population, test of equality of two means and test of equality of two variances of two normal populations, other uses of chi-square, t and F statistics, large sample tests.

Books Recommended:

1. **S.C. Gupta & V.K. Kapoor:** Fundamental of Mathematical Statistics.
2. **C.B. Gupta:** Fundamental of Statistical Methods.

c. Time Series Analysis: **20 Marks**

Unit-V

Meaning and uses of Time Series components of Time Series, Measurement of Trend Graphic method, Method of semi-average, method of moving averages, Method of least squares – Linear and parabolic trend, variate difference method. Merits and Demerits of different methods of trend elimination.

Method of interacted averages, Approximation moving averages, Measurement of seasonal indices - methods of simple averages, Ratio to trend and link relatives, method of trend elimination by fitting mathematical curves, determination of cyclical component.

Books Recommended:

1. **Primal Mukhopadhyaya:** Applied Statistics.
2. **S.C. Gupta & V.K. Kapoor:** Applied Statistics.

PAPER-II Statistics -II

Full Marks – 100 Duration 3 hours

a. Design and Analysis of Experiments: 30 Marks.

Unit-I

Analysis of Variance: One way and Two way Classification for one observation per cell and more than one observation per cell for fixed effect model Analysis.

Unit-II

Basic principle of design of experiments Randomisation, replication and local control, CRD, RBD, LSD, missing plot technique in RBD and LSD, efficiency of the designs.

b. Sampling Techniques: 30 Marks

Unit-III

Concepts of population and samples, need for sampling, complete survey and sample survey, Basic concepts of sampling, organizational aspect of survey sampling. Samples selection and sample size, basic sampling methods, simple random sampling (SRS) with and without replacement.

Unit-IV

Startified random sampling, proportional and optimal allocation, systematic sampling.

c. Vital Statistics: 20 Marks

Unit-V

Vital Statistics: Vital rates and ratios crude death rate, infant mortality rate, specific death rate, standardized death rates, crude and specific birth rates, general fertility rate, Total fertility rate, gross and net reproduction rates, elements of life table and uses.

d. Statistical Quality Control 20 Marks

Unit-VI

Basic Concept of Quality Control, Different types of control charts, control charts of variables, mean and Range, mean and standard deviation, control chart for attributes: P-Chart, C-Chart, Producer and Consumer risks, Description of single and double sampling plans OC and AOO curves.

Book Recommended:

1. **S.C. Gupta & V.K. Kapoor:** Applied Statistics.
2. **K. Srinivasan:** Basic Demographic Techniques and Applications.

Books for Reference:

1. **M.N. Das and N.C. Giri:** Design of Experiments.
2. **Parimal Mukhopadhyaya:** Applied Statistics.
3. **P.V. Sukhatma & B.V. Sukhatma:** Sample Surveys Methods and its applications.

SUSTAINABLE AGRICULTURAL PRACTICES

PAPER-I

Full Marks – 100 Duration 3 hours

Unit-I

Sustainable development, definition, conditions for sustainability; Ecological conservation and economic development, green Vs Greed Revolution.

Unit-II

Ecological Paradigms and agricultural principles, understanding the integrative science (Ecology), Agricultural developments and consequences, Diversity and stability.

Unit-III

Traditional verses modern agriculture, Biodiversity and sustainability, Agriculture and its commercialization, WTO, Patent and Intellectual Property Rights (IPR), GAT, liberalization policy and sustainability.

Unit-IV

Indian scenario in agriculture and sustainability, Trends in production, Linkage to deforestation and climate change, Environment and health, Consumer consciousness.

PAPER-II

Full Marks – 100 Duration 3 hours

Unit-I

Indicaors of sustainable agricultural practices, soil quality, biological indicators, trend in productivity and product quality; Biofertilizer Vs. Chemical fertilizers.

Unit-II

Policy and action plan: National agricultural policies and action plan, Introspection of agricultural developments and environmental impacts, Human consciousness and present developments.

Unit-III

Examples of sustainable agriculture, shifting cultivation, one straw revo0lution, organic farming, Ximbu system model (Integration of energy in agriculture), Use of local resources and importance of biodiversity in sustainable agriculture.

Unit-IV

Low External Input Sustainable Agriculture (LEISA) Salient features and networks concept of seed bank, water harvesting technology, professional knowledge transfers through generations.

Unit-V

Parma culture concept and processes, Bio intensive agriculture (BIA) M.K. Gandhian concepts of agriculture and conservation.

GEOGRAPHY

PAPER-I Physial Aspect of Indian Geography

Full Marks – 100 Duration 3 hours

Unit-I

i. Introduction: Kaleidoscope of time, India's relations in space, India and Oriental World, Our behavior.
ii. Evolution of Surface features: Relief features and Physical division, The political map of India, India A-well-knit Geographical unit, Evolution of Indian subcontinent.
iii. Drainage system:
    a. Indus system
    b. Gang-Brahmaputra System
    c. Pan insular drainage system

Unit-II Studying climatic Contrasts in India:

i. Factors influencing the climate of India.
ii. Themechanism of Indian Weather.
iii. The Four Seasons – The cold dry season of N.E. Monsoon, Hot and Dry summer season, Hot and wet summer season (Monsoon Rainy season) Retreating S.W. Monsson, Mechanism of Indian Monsoon, Monosoonal Unity of India.

Unit-III Soil and Natural Vegetation:

i. Soils of India – Classification of soils of India. Their characteristics and distribution.
ii. Ecological Regions of India:

The tropical wete green and semi-ever green forests. The tropical deciduous forests, The thorn forests, The Tidal forests, The Vegetation in Himalayan Region, Forestry and forest management – History of forestry and forest Management.

Unit-IV

i. Agro-climatic regions of India.
ii. Agro-climatic regionalization and development.

PAPER-II Human and Economic Geography of India

Full Marks – 100 Duration 3 hours

Unit-I

i. Human diversity in India, Races and Tribes – Their types, characteristics and spatial distribution in India.

ii. Population growth and migrations – Growth of population, spatial patterns, sex composition, Age structures, Trend and Pattern of migration, population projection (2001-220) population problems, population resource and environment. Effect of rural migration on cities.

Settlements: Rural and Urban Settlement pattern in India, Problems of rural urban fringe, problems of small towns housing problems within the cities, Problems of slum areas, Trend of urbanization in India.

Unit-II Irrigation and Agriculture:

Sources of Irrigation, Irrigation potential, present Exploitation, Irrigated areas, Regional verifications in the irrigated lands, problems facing the un-irrigated areas. Effects of irrigation on the crop production.

Agriculture – Agricultural efficiency and productivity: Cropping intensity, crop rotation and crop combination, Regional distribution of Major crops – Rice, Wheat, Cotton, tea, Sugarcane, Jowar, Bajra, Problems of agriculture in India, Green revolution.

Unit-III Mineral and power resources

Mineral – Iron, Manganese, Mica, Bauxite, Copper, Power resources – coal, petroleum, Automic Minerals and energy, Power production in India, Role of coal and petroleum on Industrial development of India.

Unit-IV Transport and Development of following Mode of Transport under five year plans:

1. Railway, Roadways, Inland water ways, Airways.
2. Role of transport in the regional development, Region to emphasized are – Northern plain, Nort-east region, Peninsular India.

Books Recommended:

1. **NCERT Publication:** Geography of India – Resource and Regional Development.
2. **NCERT Publication:** India on the move
3. **NCERT, New Delhi:** General Geography of India – Monsoon.
4. **Saroj K. Pal:** Physical Geography of India – A study of Regional Earth Science, Orient Longman Limited, New Delhi, 1998.
5. **C.B. Mamoria:** Economic and Commercial Geography of India.

PHYSICS

PAPER-I

Full Marks – 100 Duration 3 hours

A. **Mechanics:** Conservation of linear and angular momentum, Moment of inertia, Parallel and Perpendicular axes theorem, Moment of inertia of a ring and circular disc, Newton's law of gravitation, Kepeler's laws.

B. **Properties of Matter:** Elastic constants, Poisson's ratio, Surface tension and surface energy, Pressure difference in a curved surface, Viscous motion and viscosity, Determination of surface tension by capillary rise method.

C. **Thermal Physics:** Kinetic theory of gases: Postulates and calculation of pressure, Van der wall's equation, Specific heat of gas, Definition of C and C, Derivation of the relation C-C=R, Carnot cycle and Carnot engine, Derivation of it's efficiency.

D. **Waves and Oscillations:** Simple Harmonic Motion(Equation, Amplitute, Velocity, Acceleration and Energy),Equation of wave motion and solution, Velocity of elastic and transverse wave, progressive and stationary waves.

E. Special Theory of Relativity: Michelson-Morley experiment, Postulates of special theory of relativity, Lorentz transformations, Length contraction and Time dilation, Variation of Mass with velocity, Equivalence of mass and energy.

Books Recommended:-

1. **D.S.Mathur:** Elements Of Properties Of Matter
2. **K.N.Sharma:** B.Sc.Physics Part I
3. **Samal Mishra & Mohanty:** Text Book Of +3 Physics Vol.I & II

PAPER-II

Full Marks – 100 Duration 3 hours

A. Optics: Chromatic and spherical aberration, Ramsden and Huygen's eyepieces, Compound microscope, Telescope, Huygen's principle, Principle of interference, Interference due to biprism, Newton's ring, Fraunhoffer and Fresnel's diffraction, Polarisation of light by reflection ,Brewster's law, double rfraction, Nicol prism.

B. Electricity and Magnetism: Magnetic effect of electric current, Biot-Savart's law, magnetic field due to a long straight current carrying conductor, Magnetic field at the centre of a current carrying coil, Electromagnetic induction, Faraday's laws, Lenz's law, Alternating current, average and rms value, AC through RL,RC and RLC circuit, properties of magnetic materials(Dia, Para and Ferro).

C. Atomic and Modern Physics: Measurement of charge and mass of electron: Thomson and Millikan experiments, Discovery of nucleus, Bohr's theory of H-atom, energy levels, Photoelectric effect, Einstein equation, X-rays: Production, properties, and applications. Size, Mass, Charge of nucleus, nuclear force, binding energy and mass defect, nuclear fission and fusion, Radioactivity, rays.

D. Electronics: Semiconductors, P-type and N-type, P-N junction diode, Rectifier, PNP and NPN transistor and their use as amplifier in CE mode, Principle of oscillation and Hartley oscillator.

E. Quantum Mechanics: Wave particle duality, Matter waves, de-Broglie wave length, wave packets, Heisenberg uncertainty principle, wave function and it's physical concept, Schrödinger equation(both time independent and time dependent)Lasers: characteristic properties and uses.

Books Recommended:

1. **B.K. Mathur:** Principle of Optics.
2. **K.N. Sharma & S. Kalia:** Text Book of B.Sc. Physics.
3. **Samal, Mishra & Mohanty:** Text Book of +3 Physics Vol.-II.
4. **Page & Adams:** Principle of Electricity & Magnetism.
5. **H.B. Rajam:** Atomic Physics.

INDUSTRIAL CHEMISTRY

PAPER-I

Full Marks – 100 Duration 3 hours

Group-A Industrial Aspects of Chemistry

1. Chemical Process: Unit operation, Physical Principles, Chemical conversions, Basic Chemical batch, Batch Process, Continuous Process, Chemical Process, Selection, Design, Operation, Chemical Process control, Instrumentation, Market evaluation, Safety, Patent.
2. Raw Materials for Organic compounds:
   a. Petroleum: Natural Gas, Fractionation of Crude oil, Cracking, Reforming and hydroforming.
   b. Coal: Types, Structure, Properties, Distribution of Coal and Chemical derived.
   c. Renewable Natural Resources: Cellulose Starch their properties, Modification, Important Industrial Chemical derived from them, Alcohol and alcohol, based chemicals, Oxalif acid, Furtural.
3. Basic Metallurgical Operations:

a. Concentration of Ore, Calcination, roasting, Smelting, reduction, Purification.

b. Inorganic Materials of Industrial importance – Alumina, Silica, Silicates, Clays, Mica, Carbon, Zoolite, their availability, forms, structure and modification.

4.

a. Surface Chemistry and Interfacial Phenomena: Adsorption isotherm, Sol, Gel, Emulson, Micro emulsion, Micelles, Aerosols, Hydrotopes, Effect of Surfactants.

b. Catalyst: Types, Homogeneous and Heterogeneous, Basic Principles and mechanisms, Factors effecting the performance, Phase transfer catalysis, Enzyme catalysed reaction, Rae, Model, Industrially important reactions, Nitric Acid.

Group-B Unit operations in Chemical Industries

5. Distillation: Batch and Continuous distillation, Separation of azeotropes.
6. Absorption: Equipments – Packed columns, Spray columns, bubble columns, packed bubble columns.
7. Evaporation: Introduction, equipments, Short tubes, Forced circulation, falling fil, Climbing (upward) fil and wiped film (agitated) evaporators.
8. Drying: Introduction, Free moisture, bound moisture, drying curve, Equipments – Tray, rotary, flash fluid bed, drum and spray driers.
9. Crystallisation, nucleation, Crystal Growth, Equipment Tank, agitated, Evaporator and draft tube Crystalliser.

Group-C Utilities, Fluid Flow and Heat transport in Industries:

10. Utilities: Fuel – Types of fuels, Calorific values of fuel Specification for fuel oil.
    Boilers: Types of Boilers and their functioning.
    Water: Specification for Industrial use, Water treatment, Steam: Generation and Use.
    Air: Processing of air, Specification for Industrial use.
11. Fluid Flow: Fans, Blowers, Compressors, Vaccum Pumps, Ejector Pumps, Reciprocating Pumps, Gear Pumps.
12. Heat Transport: Heat exchangers, finned tubes and refrigeration cycle.

Group-D Materials and Energy Balance:

13. Dimensions and Units; Basic Chemical calculation, Atomic weight, molecular weight and equivalent weight. Mole, composition of liquid and gaseous mixtures.
14. Materials balance without chemical reaction, Flow diagram for material balance, Simple material balance with or without recycle or bypass for Chemical Engineering operation such as distillation and Crystallization.
15. Material Balance involving chemical reactions – Concept of limiting reactant, conversion and yield, Gas phase reaction with/without recycle of bypass.
16. Energy balance: Heat capacity of pure gases and gaseous mixtures at constant pressure, sensible heat exchange in liquids.

Group-E Bio-Technology:

17. Introduction: Fundamental bioscience, applied bio-science, Advent of Biotechnology, Biotechnology through ages.
18. Fermentation: Biochemical process, microbial processing, production of ethanol, acetone and butanol.
19. Microbial Energy: Biogas and Methanogenic Microbes.
20. Microbial Food Production, Single Cell protein, Algal Biotechnology, Microbial production of flavours, other products like poly saccarides, pharmaceuticals, Vitamins, enzymes.
21. Mining and Metal Biotechnology: Mineral Cycling, Microbial transformation of metal, Leaching and extraction

Books Recommended:

1. **H. Steiner:** Introduction to Petroleum Chemicals, Pergamon Press.
2. **A.G. Hall:** Chemistry and Technology of Cellulose
3. **O.B. Wuizburg:** Modified Starches, Properties and Uses.
4. **A.R. Baiky:** Text Book of Metallurgy
5. **Reigal:** Industrial Chemistry, Reinhold Publication.

6. **H.R. Sepherd:** Acrosol Science & Technology
7. **D.O. Kele:** Unit Operations – I & II, Pune Vidyarthi Griha Prakashan.
8. **E.N. Hempel:** Economics of Chemical Industry
9. **R.D. Brun:** Introduction to Instrumental Analysis, McGraw Hills.

PAPER-II

Full Marks – 100 Duration 3 hours

Group-A Inorganic Chemical Industries

1. Sulphur and Sulphuric acid.
2. Nitrogen Industries: Ammonia, nitric acid.
3. Phospherous Indistries: Phospherous, Phospheric acid.
4. Chlor – alkali Industries: Soda ash, Chlorine, caustic soda.
5. Fertiliser: Type, need, classification, soure, manufacture of ammonium nitrate, ammonium sulphate, Urea, Calcium, Cyanamide, Superphosphate, Triple –Super-Phosphate.
6. Types of cements, composition, manufacturing process, setting of cement.
7. Ceramics: Introduction, Types, manufacturing process, application of refractories.
8. Glass: Types, Composition, Manufacturing process, physical and chemical properties, application.

Group-B Unit operations in Chemical Industries

9. Iron and Steel: Manufacture of cast iron, properties, effect of impurities, Modern trend in blast furnance varities, manufacture of steel, Heat treatment, Vaccum treatment, Chemical treatment, classification, Ferroalloys.
10. Copper: Extraction, Properties, alloys, uses.
11. Nickel: Extraction, Properties, alloys, uses.
12. Zinc: Extraction, Properties, alloys, uses.
13. Lead: Extraction, Properties, alloys, uses.
14. Alloys: Theory, Types, Modes of formation, Heat Treatment.
15. Corrosion: Types, Mechanism, Preventive methods.

Group-C Utilities, Fluid Flow and Heat transport in Industries:

16. Nitrating agent: Kintetics and Mechanism of continuous and batch nitrations of benzene to nitro benzene.
17. Chlorinating agents, Kinetics and Mechanism for Commercial manufacture of chlorobenzene, chloral dichlorofluoro methane.
18. Oxidation: Types of Oxidation, oxidizing agents, Liquid and gas phase oxidation, Manufacture of benzoic acid, Phthalic anhydride, ocetaldehyde.
19. Hydrogenetaion: Kinetic and Thermodynamics and mechanism of alkylation reactions, catalysts for hydrogenation, hydrogenation of vegetable oil.
20. Alkylation: Types of alkylation, Thermodynamics and mechanism of alkylation reactions, manufacture of alkyl benzenes.

Group-D Materials and Energy Balance:

21. Oil, Fats, Wax and Soap, refining of Crude vegetable oil, hydrogenation of oil, manufacture of soap, Types, Cleansing action, recovery of glycerine, manufacture of detergent, specific actions of soap and detergents.
22. Sugar, manufacture of sugar from sugar cane.
23. Pulp and Paper: Manufacture of pulp and paper.
24. Rubber: Types, refining, vulcanization, properties, synthetics rubber.
25. Adhesives: Bonding process, classification, Preparation and use of different types of adhesives, natural and synthetic.

Group-E Bio-Technology:

26. Petrochemicals: Chemicals from C1 methane and synthetic gas, C2 ethylene and acetylene, chemicals from aromatic compounds.

27. Pesticides: Classification, manufacture of insecticides.
28. Dyes: Colour constituents, fibers, dying, classification, synthesis of nitrosodyes, nitrodyes, azodyes, triphenyl, methane dyes.
29. Perfumes: Introduction, Preparation of citronellol, vanillin cinamic aldahyde, natural perfumes.
30. Pharmaceuticals: Introduction, Important drugs, sulfadrugs, antipyretics, analgesis, antimalazial, antibi.
31. Polymer: Synthetic fiber, Rayen, Manufacture, Production of Cellulose from wood, classification of Polymer, Properties and formation of Plastic, Flow Chart of formal dehydration.

Group-F Pollution and Waste Management

32. Sources of Pollution, Air; Oxygen, Nitrogen, Cycle, water, Biosphere, Flora and Fauna and Soil.
33. Pollutants and their statutary limits, Pollution evaluation Methods.
34. Pollutants of air, water (Organic & Inorganic) soil, (Pesticides), radiation pollution.
35. Green House effect, Ozone hole.
36. Effluent Treatment and Waste Management: Principles and equipments for aerobic treatment, adsorption, filtration, sedimentation, Bag filters, electrostatic precipitator, absorbers, solid waste management.

Books Recommended:

1. **L.L. Hench:** Science of Ceramic Chemical Processing.
2. **A. Paul:** Chemistry of Glasses.
3. **G.H. Streewart:** Science of Ceramics
4. **M.G. Gopalrao:** Outlines of Chemical Technology, Marshall Sitting, East West Press.
5. **D.K. Sharma:** Industrial Chemistry, Goel Publishing House, Meerut.
6. **PH Groggins:** Unit Process of Organic Synthesis, McGraw Hill.
7. **M.G. Fontana & N.D. Green:** Corrosion and Corrosion Engineering, McGraw Hill Book
8. **O.A. Hougen:** Chemical Process Principles, Part-I
9. **H.R. Jones:** Pollution Control in Industries
10. Effluent Treatment and Waste disposal: Inst. Of Chemistry Engineering.

COMPUTER APPLICATION

PAPER-I

Full Marks – 100 Duration 3 hours

i. Logic gates, Principles of Boolean Algebra, SR and JK flip Flops, Half address and Full address, Register Counter

ii. Binary, Octal, Hexadecimal number systems, Binary coded octal and Binary coded Hexa decimal, Addition, substraction, multiplication and division of Binary numbers, Conversion of one number system to another system.

iii. Computer Fundamentals, Characteristics, generation, classification and general applications commonly used in computer oriented methods.

iv. Basic ideas about integrated circuits, microprocessor, elements of computer – Input/Output/CPU/ ALU, ideas about software and hardware.

v. Computer Language: General characteristics of higher Level programme language with special and writing programme on small and fundamental problems.

PAPER-II

Full Marks – 100 Duration 3 hours

i. Operating Systems: MS Dos latest version, Principles of Disc operating system, Commands, Directory and File Management Commands, Copy and Edit Commands, simple idea about UNIX.

ii. Window 98 – General features, My Computer, Recycle Bin, Title, Menu Option, Mouse and Key Boards.

iii. MS Word – Word Processing, general features, creating table, file open and storage, copy, Editing Process, Spell check and ideas about other provisions, MS-Excel: Introduction, Drawing of graph and figure, functions of MS-Excel, Charts.

iv. Machine Language, Assembly language, Data processing, General features of Foxpro: PBMS, Data structure idea only.

v. Application of Computer: Virus, Internet, E-commerce.

PSYCHOLOGY

PAPER-I Industrial Psychology

Full Marks – 100 Duration 3 hours

Unit-I

1. Concept of Organisational and Industrial Psychology.

Unit-II

2. Scientific Management and Hawthorn studies.

Unit-III

3. Industrial Incentives: Financial and Non-financial
4. Industrial morale: Meaning, methods of improving morale.

Unit-IV

5. Work environment: Air, illumination and noise.
6. Fatigue: Causes and reduction of Industrial fatigue.

Unit-V

7. Industrial Accidents: Causes and prevention, Accident proneness, Tests to measure accident proneness.
8. Selection and Training of Personnel.

Books Recommended:

1. **Berry, L.M.:** Psychology at Work; An Introduction to Industrial and Organisational Psychology, McGraw Hill, New York.
2. **Blum & Naylor:** Industrial Psychology, CBS Publishers.
3. **Ghiselli & Brown:** Personnel & Industrial Psychology.
4. **Luthans:** Organisational Behaviour, McGraw Hill, New York
5. **Mohanty, G.B.:** Industrial Psychology & Organisational Behaviour, Kalyani Publishers, New Delhi.
6. **Tiffin & McCormick:** Industrial Psychology, Prentice Hall of India, New Delhi.
7. **Viteles:** Industrial Psychology.

PAPER-II Psychology of Violence and Crime

Full Marks – 100 Duration 3 hours

Unit-I

1. Introduction: Concepts and operational definitions of aggression, violence and crime.
2. Theories of aggression: Instinct theories of aggression; Frustration – Aggression hypothesis, Social Learning Theory.

Unit-II

3. Crime – Psychological, social and economic factors of crime, control of crime.

Unit-III

4. Juvenile delinquency: Causes and prevention.
5. Gender discrimination, Crimes against women and its prevention.

Unit-IV

6. Role of the electronic and Print media in the facilitation and control of violence and crime, Cyber crimes.

Unit-V

7. Counselling individuals and groups for prevention of crimes, Rehabilittation of the victims of crime, Moral education, Yoga and Transcendental meditation, Non aggression.

Books Recommended:

1. **Bakowitz, L:** Aggression: A Social Psychology Analysis, McGraw Hill, New York
2. **Baron, R.A.:** Psychology, Prentice Hall of India, New Delhi
3. **Baron R.A. & Richardson, D.:** Human Aggression, Plenum, New York
4. **Bass, A.H.:** The Psychology of Aggression, Willey, New York.
5. **Brammer, L.M. & Shostram, E.K.:** Therapeutic Psychology: Fundamentals of Counselling and Psychology, Prentice Hall, New Jersy.
6. **Goldstein, J.H.:** Aggression, Crime and Violence, Oxford University Press.
7. **Hetherington, E., Mavis, E. and Parke, D.:** Child Psychology: A Contemporary view point, McGraw Hill.
8. **Pande, J.:** Psychology in India Revisited – Developments in the Discipline (Vol.-II), Sage Publication, New Delhi.