UNIVERSITY OF RAJASTHAN
JAIPUR
SYLLABUS
B.Sc. (Hons.)
Part-I
EXAMINATIONS – 2017
CONTENTS

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Scheme of Examination
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(Same Courses of Study as prescribed for
First Year Pass Course)

Compulsory Subjects (Four)
1. General Hindi
2. General English
3. Environmental Studies
4. Elementary Computer Applications
5. Elementary Hindi

Subjects (Honours Subjects)
1. Physics
2. Chemistry
3. Zoology
4. Botany
5. Geology
6. Mathematics
7. Psychology
8. Geography
SCHEME OF EXAMINATION

B.Sc. (Honours) Part-I
(10+2+3 Pattern)

For a pass at each examination, a candidate shall be required to obtain a minimum of 36% marks in each subsidiary subject and 40% marks in the Honours subjects, passing separately in the practicals, wherever prescribed.

Successful candidates will be classified as under:

First Division 60% of the aggregate marks prescribed both in Honours and subsidiary subject of Part-I, Part-II, and Part III Examinations taken together.
Second Division 50%

All the rest shall be declared as not passed the examination if they obtain a minimum of 40% marks in the aggregate.

No division shall be awarded at the Honours Part I.

The number of papers and practicals, wherever prescribed the duration of examination, maximum marks and minimum pass marks shall be shown in the relevant syllabus.

A candidate shall be required to offer one Honours subject and one subsidiary subject out of the following subjects to the condition that the same were offered by him as optional subjects at the First Year T.D.C. Examinations of the University or an examination recognised by the Universities equivalent thereto:

Honours Subjects:
1. Physics
2. Chemistry
3. Zoology
4. Botany
5. Geology
6. Mathematics
7. Statistics
8. Psychology
9. Geography

N.B.: Candidates shall be required to offer Four papers and practical (wherever prescribed) of the Honours subject offered by him.
B.Sc. (Hons.) Part-I Examination
DISTRIBUTION OF MARKS

<table>
<thead>
<tr>
<th>S. No.</th>
<th>Name of the Subject/Paper</th>
<th>No. of Papers to be offered</th>
<th>Duration Hours</th>
<th>Max. Marks</th>
<th>Min. Pass Marks</th>
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Syllabus (Subsidiary Subjects)  
(Same Courses of Study as prescribed for First Year Pass Course)

Compulsory Subjects (Four)

1. General Hindi One Paper 3 hrs. 100 36
2. General English One Paper 3 hrs. 100 36
3. Environment Studies One Paper 3 hrs. 100 36
4. Elementary Computer Studies One Paper 3 hrs. 100 36
5. Elementary Hindi (For Foreign Students or student from non-hindi speaking students)

Subjects (Honours):

1. Physics
   - Paper-I 3 hrs. 75
   - Paper-II 3 hrs. 75
   - Paper-III 3 hrs. 75
   - Paper-IV 3 hrs. 75
   - Practical 100 40

2. Chemistry
   - Paper-I 3 hrs. 75
   - Paper-II 3 hrs. 75
   - Paper-III 3 hrs. 75
   - Paper-IV 3 hrs. 75
   - Practical 100 40

3. Zoology
   - Paper-I 3 hrs. 50

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<td>Paper-II</td>
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<td>Paper-III</td>
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<td>Paper-V</td>
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<td>Paper-VI</td>
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<td>Practical</td>
<td>100</td>
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4. Botany

|   |   | Paper-I   | 3 hrs. 75  |   |           |
|   |   | Paper-II  | 3 hrs. 75  |   |           |
|   |   | Paper-III | 3 hrs. 75  |   |           |
|   |   | Paper-IV  | 3 hrs. 75  |   |           |
|   |   | Practical | 100         |   | 40        |

5. Geology

|   |   | Paper-I   | 3 hrs. 75  |   |           |
|   |   | Paper-II  | 3 hrs. 75  |   |           |
|   |   | Paper-III | 3 hrs. 75  |   |           |
|   |   | Paper-IV  | 3 hrs. 75  |   |           |
|   |   | Practical | 100         |   | 40        |

6. Mathematics

|   |   | Paper-I   | 3 hrs. 100 |   |           |
|   |   | Paper-II  | 3 hrs. 100 |   |           |
|   |   | Paper-III | 3 hrs. 100 |   | 160       |
|   |   | Paper-IV  | 3 hrs. 100 |   |           |

7. Psychology

|   |   | Paper-I   | 3 hrs. 75  |   |           |
|   |   | Paper-II  | 3 hrs. 75  |   |           |
|   |   | Paper-III | 3 hrs. 75  |   |           |
|   |   | Paper-IV  | 3 hrs. 75  |   |           |
|   |   | Practical | 100         |   | 40        |

8. Geography

|   |   | Paper-I   | 3 hrs. 80  |   |           |
|   |   | Paper-II  | 3 hrs. 80  |   |           |
|   |   | Paper-III | 3 hrs. 80  |   | 160       |
|   |   | Paper-IV  | 3 hrs. 80  |   |           |
|   |   | Practical | 80          |   |           |
पृष्ठ 100  
समय 3 घण्टे  

नोट : 36 से कम अंक अने पर छात्रों को उत्तीर्ण नहीं किया जायेगा। इस प्रश्न-पत्र में प्राप्त अंकों को श्रेणी निर्धारण हेतु नहीं जोड़ा जायेगा।
अंक विभाजन – प्रश्न पत्र में दो भाग होंगे – 1. साहित्य खण्ड एवं 2. व्यक्तिक खण्ड। साहित्य खण्ड में दो भाग होंगे– गद्द भाग एवं पद्ध भाग। प्रत्येक भाग के लिए 25 अंक निर्धारित हैं।

क  
दो व्याख्या पद्ध से (प्रश्नक में विकल्प देना है)  
ख  
दो व्याख्या गद्ध से (प्रश्नक में विकल्प देना है)  
ग  
आलोचनात्मक प्रश्न पद्ध से (विकल्प देना है)  
घ  
आलोचनात्मक प्रश्न गद्ध से (विकल्प देना है)  

व्यक्तिक / व्यावहारिक हिंदी खण्ड  

i. निर्माण लेखन – शब्द सीमा 300 शब्द  
ii. कार्यायोगी लेख – राजस्थानी-अग्ररशास्त्रीय पत्र, परिपत्र, अविष्कृत, कार्यायोगी जानप, विज्ञानकील, कार्यायोगी आदेश।  
iii. संक्षेपण (विकल्प देना है)  
iv. पत्रनिर्माण (विकल्प देना है)  
v. शब्द निर्माण की प्रविधि – उपसर्ग, प्रत्यय, संधि, समास  
vi. शब्द सूचिक / शब्द गुणवत्ता  
vii. सूचनांक / पुस्तक  
viii. पारंपरिक कार्यालय  
ix. व्याकरणिक कोटियाँ –संज्ञा, सर्वनाम, विशेषण, क्रिया, क्रिया विशेषण  

साहित्य खण्ड : गद्द–पद्ध की निर्धारित रचनाएँ

गद्द भाग – निर्माणित पत्र निर्धारित हैं –

1. कहानी : बड़ी घर की बेटी (प्रेमचंद)  
2. सामर्थ्य : प्रणाम (महादेवी वर्मा)  
3. रेखाबिन्दु : बाईसंच वर्ष बाद (वनराजसाह चुरूवर्द्दी)  
4. विवाह : शाने सबसे सुन्दर गद (पुणाकार मुले)  
5. निकाह : गेहूँ और गुलाब (पांडुसुबस वेनीपुरी)  
6. निकाह : सूखे चेहरे का गुरूल (गणेश मुकुर)  
7. निकाह : मजदूरी और प्रेम (सरदार पुरोहित सिद्द)  
8. निकाह : राजस्थान की सांस्कृतिक धरोहर (अग्निचंद नाहटा)  
9. निकाह : राष्ट्र का स्वरूप (बासुदेव शरण अग्रवाल)  
10. वांछ : निदुरता हुआ गणंत्र (हरिशंकर परशार)  

पद्ध भाग –

1. कबीर– 1. मन रे ! जागत रहिये भाई।  
2. हमारे राम सहेल कसम किसी, अलह राम सति सोइ।  
3. काजी कौन कवि बताने।  
4. मन रे ! हरि मनि, हरि मनि हरि मनि भाई।  
5. है मो मन भजन को प्रश्न  

संदर्भ : कबीर कथावली-स्थानमुद्रादास  

2. सूरदास 1. किरकबत काँथ हरि कपड़े आलत  
2. मुरली तक गोपालों हें भावत  
3. देशी माई सुन्दरता की सागर  

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3. तुलसीदास
   1. कबहुँक अंब अवसर पाई
   2. अबलों नसानी अब न नसेहों
   3. मोहि मूढ मन बहुत वियोगो
   4. ऐसी तौं उदार जग माही
   5. मन परिचितिहृ अवसर बीते

संदर्भ: विनय पत्रिका, गीता प्रेस गोरखपुर

4. रहीम

पद
1. छवि भावन मोहनलाल की
2. कमल दल नैनि की उनमानि
   दोहा
1. प्रीतम छवि नैनि बरसी
2. वसि कुलाम चाहि कुलत
3. रहिमन असुआ नैन बौरी
4. रहिमन ओछे नरन विन बौर मली ना प्रीति
5. रहिमन निज मन की विभा
6. काज परे कछु और है
7. खेड़ खूँर खोसी, खुसी बौर प्रीति मदपान
8. दादुर मोर किसान मन लगयो रहे घन मोहि
9. पावस देखि रहीम मन कोईल साधे मीन
10. रहिमन बिगरी आदि को बदन न खरचे दाम।

संदर्भ: रहीम ग्रन्थावली, विद्याधरविद्या मिश्र

5. पदमकर कविता
1. कुजन में केलिन में काँगर में कुजन में
2. और मोहि कुजन में गुजरति भीर भीर
3. पति बिनु कीन्हे ऐसी माति गुन बेलिन के
4. चितिय चिति चारों और चितिय चिति परे त्योहों सबविया
5. या अनुगाम की लखूँ जहाँ...........................
6. काज के भीर अभीन में गई गोविन्द ले गई भीतर गोरी।

6. मैथिलीशरण गुप्त
साकेल — अत्यंतार्क से
कैकेयी का अनुभाग
tदननार बैटी अभा उत्तज के आगे ...............
सी बार घन वह एक लाल की माई।

7. प्रसाद: कामायनी, अभावायन — कहा आगानुक ने सस्तेह...विजयिनी मानवता हो जाय।
8. पंत: 1. प्रथम रंग छन्द 1-13
2. भारत माता
9. निरंजः 1. भारती जय जय करे
2. बादल रंग -1
3. दलित जन पर करें करणा
4. किर नम घन घुरायें
10. रामगणी सिंह दिनकर —सरस्वती-श्रीती रंग —आर्यनिक अंस

सच है विपवति जब आली है ...... क्या कर सकती विनयही है।

[Signature]
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2. GENERAL ENGLISH

Duration: 3 hrs.          Max. Marks: 100
Min. Pass Marks: 36

The syllabus aims at achieving the following objectives:

1. Introducing students to phonetics and enabling them to consult
dictionaries for correct pronunciation (sounds and word stress)
2. Reinforcing selected components of grammar and usage
3. Strengthening comprehension of poetry, prose and short-stories
4. Strengthening compositional skills in English for paragraph
   writing, CVs and job applications.

The Pattern of the Question Paper will be as follows:

Unit A: Phonetics and Translation (20 marks)
(10 periods)

I Transcription of Phonetic Symbols (05)
II Word Stress (05)
III Translation of 5 sentences from Hindi to English (05)
IV Translation of 10 Words from Hindi to English (05)

Unit B: Grammar and Usage (20 marks)
(10 periods)

I Transformation of Sentences (05)
   a. Direct and Indirect Narration
   b. Active and Passive Voice

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c. Interchange of Degrees of Comparison

II Modals (05)
III Sequence of Tenses (05)
IV Punctuation of a Short Passage with 10 Punctuation Marks (05)

Unit C: Comprehension (30 marks)
(25 periods)

Following Essays and Stories in Essential Language Skills revised edition compiled by Macmillan for University of Rajasthan General English B. A./B. Com./B. Sc.

William Blake
Sujata Bhatt
Ruskin Bond
M.K. Gandhi
J.L. Nehru
A.P.J. Abdul Kalam
The Little Black Boy
Voice of the Unwanted Girl
Night Train for Deoli
The Birth of Khadi
A Tryst with Destiny
Vision for 2020

Five questions to be answered out of eight questions Two marks each based on 6 units of the prescribed texts

Five questions of 3 marks each to be answered from the given passage:
15 marks
1 Vocabulary question from the given passage (at least 10 words) : 5 Marks
Unit D: Compositional Skills (30 marks)
(15 periods)

I Letters-Formal and Informal (10)
II CVs and Job Applications (10)
III Paragraph Writing (10)

Recommended Reading:

4. Judith Leigh. CVs and Job Applications. OUP. 2004
COMPULSORY PAPER OF ENVIRONMENTAL STUDIES

Compulsory in 1 Year for all streams at undergraduate level

Scheme of examination

<table>
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<tr>
<th>Time</th>
<th>Min Marks</th>
<th>Max. Marks</th>
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<td>3 hrs</td>
<td>36</td>
<td>100</td>
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This paper will contain 100 multiple choice questions. Each question will carry 1 mark.

Students should be encouraged to visit places of Environmental Importance including Natural and Manmade Habitat.

Note:
1. The marks secured in this paper shall not be counted in awarding the division to a candidate.
2. The candidates will have to clear this compulsory paper in three chances.
3. Non-appearing or absence in the examination of compulsory paper will be counted as a chance.

Unit.1: The Multidisciplinary nature of environmental studies

Definition, scope and importance - Relationship between Environmental Studies and other branches of science and social sciences.

Need for Environmental awareness, Environmental education in present day context.

Unit.2: Natural Resources and Challenges

a. Natural resources and associated problems, Classification of resources: renewable resources, non renewable resources, classes of earth resources, resources regions: Definition and criteria, resource conservation.

b. Forest resources: Use and over-exploitation, deforestation, case studies. Timber extraction, mining, dams and their effects on forest and tribal people.

c. Water resources: Use and over-utilization of surface and groundwater, floods, drought conflicts over water, dams-benefits and problems.

d. Mineral resources: Use and exploitation, environmental effects of extracting and using mineral resources, case studies.

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e. Food resources: World food problems, changes caused by agriculture and overgrazing, effects of modern agriculture, fertilizer-pesticides problems, water logging, salinity, case studies.

f. Energy resources: Growing energy need, renewable and nonrenewable energy sources, use of alternate energy sources. Case studies.

g. Land resources: Land as a resource, Land degradation man induced Landslides, soil erosion and desertification.
   - Role of an individual in conservation of natural resources.
   - Equitable use of resources for sustainable lifestyles.

Unit 3: Ecosystems, Concepts, Structure, Functions and Types
   - Concept of an ecosystem
   - Structure and function of an ecosystem
   - Producers, consumers and decomposers
   - Energy flow in the ecosystem
   - Ecological succession
   - Food chains, food webs and ecological pyramids
   - Introduction, types characteristics features, structure and function of the following ecosystem:
     a. Forest ecosystem, Tropical Temperate and Alpine Ecosystem
     b. Grassland ecosystem and Their Types
     c. Desert ecosystem with emphasis on Thar Desert
     d. Aquatic ecosystems(ponds, streams, lakes, rivers, oceans, estuaries) and Wet Lands

Unit 4: Biodiversity and its conservation
   - Introduction –Definition, genetic, species and ecosystem diversity
   - Biogeographically classification of India
   - Value of biodiversity: consumptive use, productive use, social ethical, aesthetic and option values
   - Biodiversity at global, National and local level
   - India as a mega-diversity nation
   - Hot-sport of biodiversity
   - Threats to biodiversity: habitat loss, poaching of wildlife, man-wildlife conflicts
   - Endangered, Threatened and endemic species of India
   - Conservation of biodiversity: In-situ and Ex-situ conservation of biodiversity
   - Red Data Book

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Unit 5: Environmental Pollution and Control Measures

Definition
- Causes, effects and control measures of:
  a) Air Pollution
  b) Water Pollution
  c) Soil Pollution
  d) Marine Pollution
  e) Noise Pollution
  f) Thermal Pollution
  g) Nuclear Hazards

- Solid waste management. Causes, effects and control measures of urban and industrial wastes
- Role of an individual in prevention of pollution
- Pollution case studies
- Disaster management: floods, earthquake, cyclone and landslides

Unit 6: Social issues, Environment, Laws and Sustainability

- From Unsustainable to Sustainable development
- Urban problems related to energy
- Water conservation, rain water harvesting, watershed management
- Resettlement and rehabilitation of people; its problems and concerns. Case studies
- Environmental ethics: Issues and possible solution.
- Climate change, global warming, acid rain, ozone layer depletion, nuclear accidents and holocaust. Case studies
- Wasteland reclamation.
- Consumerism and waste product.
- Environmental Protection Act.
- Air (Prevention and Control of Pollution) Act
- Wild life protection Act
- Forest Conservation Act
- Biological Diversity Act
- Issues involved in enforcement of environmental legislation
- Public Awareness.

Unit 7: Human Population and the Environment

- Population growth, variation among nations
- Population explosion-Family Welfare Programme
- Environment and Human health
- Human Rights
- Value Education
- HIV/AIDS
- Women and Child Welfare
- Role of Information Technology in Environment and human health
- Case Studies

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Suggested Readings:-

5. Goudie, Andrew. The Human Impact.
Elementary Computer Applications

Work load: Teaching 2 hours per week  
Practical 2 hours per week

Max Marks: 100 (Main University Exam: Theory -60 Marks, Practical- 40 Marks )

Each candidate has to pass in Theory and Practical Examinations separately.

Main University Examination : Question pattern for Theory Paper  Max Marks: 60

Part – I (very short answer) consists 10 questions of one marks each with two questions from each unit. Maximum limit for each question is up to 20 words.

Part – II (short answer) consists 5 questions of two marks each with one question from each unit. Maximum limit for each question is up to 40 words.

Part – III (Long answer) consists 5 questions of eight marks each with one question from each unit with internal choice. Maximum limit for each question is up to 400 words.

Unit – I

Introduction to Information Technology, evolution and generation of computers, type of computers, micro, mini, mainframe and super computer. Architecture of a computer system: CPU, ALU. Memory (RAM, ROM families) cache memory, input/output devices, pointing devices.

Concept of Operating system, need types of operating systems, batch, single user, multi-processing, distributed and timeshared operating systems, Introduction to Unix, Linux, Windows, Windows NT. Programming languages: Low level and high level languages, generation of languages, 3 GL and 4 GL languages, Graphic User Interfaces.

Unit – II

Word Processing Tool - Introduction, Creating, Saving, Copy, Move and Delete, Checking Spelling and Grammar. Page Layout, interface, toolbars, ruler, menus, keyboard shortcut, editing, Text Formatting, insert headers and footers, Bullets and Numbering, Find and Replace etc., Insert Table and Picture, Macro, Mail Merge.

Power Point: Creating and viewing a presentation, managing Slide Shows, navigating through a presentation, using hyperlinks, advanced navigation with action setting and action buttons, organizing formats with Master Slides, applying and modifying designs, adding graphics, multimedia and special effects.

Unit – III

Electronic Spreadsheet - Worksheet basics, Create, save and open a worksheet, Entering data text, numbers and formula in a worksheet, Inserting and deleting cells, cell formatting, inserting rows and columns in a worksheet, Formatting worksheets, Using various formulae and inbuilt functions. Update worksheets using special tools like spell check and auto correct. Setup the page
and margins of worksheets for printing. Format the data in the worksheet globally or selectively, creating charts. Enhance worksheets using charts, multiple worksheets-concepts

Unit - IV

The Internet - History and Functions of the Internet, Working with Internet, Web Browsers, World Wide Web, Uniform Resource Locator and Domain Names, Uses of Internet, Search for Information, Email, Chatting, Instant messenger services, News, Group, Teleconferencing, Video-Conferencing, E-Commerce and M-Commerce.

Manage an E-mail Account, E-mail Address, configure E-mail Account, log to an E-mail, Receive E-mail, Sending mails, sending files an attachments and Address Book, Downloading Files, online form filling. E-Services - E-Banking and E-Learning.

Unit - V


Network Security - Risk assessment and security measures, Assets and types (data, applications, system and network), Security threats and attacks (passive, active): types and effects (e.g. Identity theft, denial of services, computer virus etc.), Security issues and security measures (Firewalls, encryption/decryption). Prevention.

Question Paper pattern for Main University Practical Examination

Practical

The practical exercises will be designed to help in the understanding of concepts of computer and the utilization in the areas outlined in the theory syllabus. The emphasis should be on practical usage rather than on theoretical concepts only.

The practical examination scheme should be as follows –

- Three Practical Exercise (including Attendance & Record performance) 30 marks
  - Operating system
  - MS Word
  - MS Excel
  - MS Power Point
  - Internet
- Viva-voce 10 marks

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(15)
5. वी.ए. प्रथम वर्ष : प्रारम्भिक हिंदी

पूर्वांक : 100
अवधि : 3 घंटे

अंकों का विभाजन
1. पुस्तकों पर आधारित प्रश्न 50 अंक
2. व्याकरण से संबंधित प्रश्न 24 अंक
3. रचना से संबंधित प्रश्न 26 अंक

(क) लोकोक्तियों मुहावरे
(ख) पत्र लेखन अथवा निकंब

पाठ्यक्रम
1. गद्ध संग्रह
2. व्याकरण : शब्द विचार, वाक्य विन्यास, वाक्य खण्ड, पद क्रम का ज्ञान तथा इनमें होने वाली सामान्य तुटियों का ज्ञान।
3. (क) मुहावरों एवं लोकोक्तियों का प्रयोग, बालकों में रिक्त स्थानों की पूर्ति, समान दिखावे वाले शब्दों का अर्थ नेद अथवा बालकों में प्रयोग
(ख) पत्र लेखन अथवा निकंब

पाठ्य पुस्तकें
1. गद्ध-संग्रह-राष्ट्रीय गोरख के चिन्ह—डॉ. हरिकृष्ण देवसरे
2. प्रकाशक—नेशनल पुब्लिशिंग हाउस, नई दिल्ली

व्याकरण एवं रचना
1. आधुनिक हिंदी व्याकरण तथा रचना—लेखक कृष्ण विकल
2. प्रकाशक—नेशनल पुब्लिशिंग हाउस, नई दिल्ली

2. सुबोध व्याकरण एवं रचना-समापदक—व्याख्या हारदय—संशोधनकर्ता—डॉ. अम्बा प्रसाद सुमन
3. प्रकाशक—श्रीराम मेहरा एण्ड कंपनी, आगरा

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SUBJECTS (HONOURS SUBJECTS)

1. PHYSICS

Paper-1: Mechanics

Note: Five questions are to be set taking one from each unit (each question will have an internal choice). Student will attempt all the five questions. 40% weightage will be given to problems and numericals.

**Unit-I**

Inertial and Non-Inertial Frames:

(i) Inertial and non-inertial frames of reference, examples.
   Transformation of displacement, velocity and acceleration between different frames of reference involving translation. Invariance of Newton’s Laws and energy conservation in a collision process.

(ii) Postulates of special theory of relativity, Lorentz transformations of velocity and acceleration, time dilation and length contraction.
   Lorentz transformations as rotation in space-time, world line and Minkowski space, time-like and space-like vectors, Macro causality, Light cone and past, present and future.

(iii) Transformation of displacement, velocity and acceleration between different frames rotating with respect to each other pseudo forces, centrifugal and coriolis forces, Motion relative to earth (in northern and southern hemispheres), variation with latitude, Effect of coriolis force on various bodies in motion on earth, Foucault’s pendulum.

**Unit-II**

Conservation laws: Conservative forces, Potential energy in gravitational and electrostatic field. Rectilinear motion under conservative forces, Discussion of potential energy curves and motion of a particle. Centre of mass, two particle system: Motion of the CM and motion of one particle relative to another. Reduced mass, Conservation of linear momentum, Collison of two particles in one and two dimensions (elastic and inelastic).

Slowing down of neutrons in a moderator. Motion of a system with varying mass. Angular momentum conservation and charged particle scattering by a nucleus. Mechanics of system of particles: Motion of the centre of mass of a system of particles. Motion relative to C.M., Relationship for kinetic energy and angular
momentum of a system of particles in the lab frame and the CM frame. Conservation of energy, Equation of rotational motion of a system of particles, Conservation of angular momentum.

**Unit-III**

Gravitation and Motion under Central forces: Law of gravitation, Gravitational and inertial mass, Gravitational potential energy and gravitational field, Principle of superposition, Gravitational field due to a large plate. Spherical shell and sphere.

General motion under central forces, general solution and discussion of trajectories, Rutherford scattering case of elliptical and circular orbits, Kepler's Laws.

**Unit-IV**

Relativistic Kinetic Energy: Four vectors, Transformation of energy and momentum, Transformation between Lab and the CM frames, Transformation of four-frequency vector, longitudinal and transverse Doppler effect, Four momentum conservation, Elastic and inelastic collision of particles of two particles, Kinematics of decay products of an unstable particle, reaction threshold energy, Pair production, Compton effect.

**Unit-V**

(i) Rigid Body Dynamics: Equation of motion of a rotating body, Inertial coefficients, Moment of inertia of a disc, cylinder, spherical shell, sphere and rods of rectangular and circular cross section; Case of J not parallel to 0; Kinetic energy of rotation and principal axes, Precessional motion of spinning top, Gyroscope, spin precession in constant magnetic field.

(ii) Elastic Properties of Matter: Elasticity, Young's modulus, Bulk modulus, Modulus of Rigidity, Poisson's ratio and derivation of relations between various elastic constants, Bending of a beam, Torsion of a cylinder, Experimental determination of elastic constants by static and dynamical methods.

*Books Recommended:*

2. Fundamental University Physics Vol-I, Mechanics by Alonso and Finn.

*Paper-II: Oscillations and Waves*

Note: Five questions are to be set taking one from each unit (each question will have an internal choice). Student will attempt all
the five questions. 40% weightage will be given to problems and
numericals.

Unit-I
Free oscillations of systems with one degree of freedom;
oscillations in an arbitrary potential well, Simple harmonic motion-
solution using complex exponentials. Examples of mechanical and
electrical system, Energy of the oscillator, Power Dissipation and
damping of the oscillator under viscous and solid friction.
Superposition of (i) two and (ii) N-linear undamped harmonic
oscillations, beats. Combination of two oscillations at right angles.
Anharmonic Oscillators-pendulum as an example.

Unit-II
Undamped Oscillator with harmonic force, forced oscillations
with damping. Effect of varying the resistive term, Transient
phenomenon, power absorbed by a driven oscillator, Frequency
response, phase relations, quality factor, Resonance : Electrical
Oscillations, Series and parallel LCR circuit.
Electromechanical System—ballistic galvanometer, effect of
damping. Optical Thermal expansion of a crystal. Non-linear effects

Unit-III
Motion of two coupled simple harmonic oscillators. Differential
equation for stiffness or capacitance coupled oscillators. Normal
modes, Motion in mixed modes, transient behaviour. Effect of
coupling. Normal modes of vibration for CO₂ and H₂O molecules.
Calculation of normal mode frequencies. Forces oscillations and
resonance for two coupled oscillators. Electrically coupled circuit,
frequency response, Reflected impedance effect of coupling (inductive
case) and resistive load.

Unit-IV
Many coupled Oscillators : N-coupled oscillators, Normal modes
and their properties, Longitudinal Oscillators. Equation of motion for
one-dimensional monoatomic and diatomic lattices, acoustic and
optical modes, dispersion relations, concept of group and phase
velocities. Electrical transmission line, propagation velocity, losses,
characteristic impedance, standing waves, effect of termination.

Unit-V
Wave equation in one dimension and its solution for elastic
waves in : Solid rod, Gas column, transverse waves on a string.
Normal modes of a two-dimensional system. Waves in two and three dimensions, Spherical waves.

Reflection and transmission of waves on a string at a boundary. Reflection and transmission of energy. Matching of impedances. Standing waves on a string of fixed length—Energy of a vibrating string, energy in each normal mode of a vibrating string. Standing Wave Ratio. Fourier series and Analysis of triangular sawtooth and square functions. Plane Electromagnetic waves, wave equation and its plane wave solution, energy and momentum, Radiation pressure, Radiation resistance of free space. EM wave in dispersive media (normal case). Spectrum of electromagnetic radiations.

Recommended Books:
3. Waves and Oscillation, Berkeley Physics Course—Vol 3.

Paper-III: Electricity and Magnetism

Note: Five questions are to be set taking one from each unit (each question will have an internal choice). Student will attempt all the five questions. 40% weightage will be given to problems and numericals.

Unit-I


Unit-II

The field of Moving Charges: Concept of Electrostatic field and potential due to discrete charges and continuous charge distribution. Potential energy of a system of charges. Application: Energy required to build a uniformly charged sphere, classical radius of an electron. The potential and field due to short dipole (in polar and three-dimensional Cartesian coordinates), the torque and force on a dipole in an external field.
Syllabus: B.Sc. (Hons.) Pt-I • 21

Magnetic forces, measurement of charge in motion, invariance of charge. Electric field measured in different frames of reference, field of a point charge moving with constant velocity. Force on a moving charge. Interaction between moving charge and other moving charges.

Unit-III

The magnetic field in free space and matter: The definition of magnetic field, properties of the magnetic field. Ampère's circuital law with applications. Ampère's law in differential form. Vector potential. Poisson's equation for vector potential, Vector potential and evaluation of B for (i) a current in an infinite solenoid (ii) outside a current carrying long straight wire (iii) Inside a long straight wire carrying uniform current. Field of any current carrying wire and deduction of Biot-Savart law.

Transformation relations for different components of electric and magnetic fields between two inertial frames.


Unit-IV


Unit-V

Electromagnetic Induction and Maxwell's Equation: Faraday's law of electromagnetic induction, a conducting rod moving through a uniform magnetic field, a loop move through a non-uniform magnetic field, a loop with the field source moving, Betatron. Differential form of Faraday's law, Inductance, self-inductance of a
solenoid of finite length, Mutual inductance, mutual inductance between two coils, self-inductance of a straight conductor. Energy stored in an inductor and in the magnetic field. Displacement current, Modified Ampere's law, Maxwell's equations in differential and integral form. Maxwell's equations in material media, Boundary conditions for electric and magnetic fields at vacuum-dielectric and vacuum-metal boundaries.

Books Recommended:
1. Berkeley Physics Course, Vol. 2; Electricity and Magnetism.
3. An Introduction to Electrodynamics by Griffiths
4. Fundamental University Physics, Vol. 2, Fields Alonso & Finn

Paper-IV.: Thermal and Statistical Physics

Note: Five questions are to be set taking one from each unit (each question will have an internal choice). Student will attempt all the five questions. 40% weightage will be given to problems and numericals.

Unit-I
Thermal and adiabatic interactions: Thermal interaction, Zeroth law of thermodynamics, system in thermal contact with a heat reservoir (canonical distribution), Energy fluctuations, Entropy of a system in a heat bath, Helmholtz free-energy, Adiabatic interaction and enthalpy, General interaction and first law of thermodynamics, Infinitesimal general interaction, Gibbs' free-energy, Phase transitions, Triple point, First and second order phase transition, Clausius-Clapeyron equation, Vapour pressure curve, transformation of disorder into order, Heat engine and efficiency of engine, Carnot's cycle, Thermodynamic scale as an absolute scale, Maxwell relations and their applications.

Unit-II

Transport Phenomenon: Mean free path, Distribution of free path, Coefficients of viscosity, thermal conductivity and diffusion. Brownian motion, Langevin's and Einstein's theories, Experimental determination of Avogadro number.
Unit-III


Unit-IV

Classical Statistics: Validity of classical approximation; Phase space, Micro and Macro states, Thermodynamic probability, Entropy and probability, Monatomic ideal gas Barometric equation; Specific heat of diatomic gas, Ortho and para hydrogen, Specific heat capacity of solids, Langevin's theory of Paramagnetism.

Unit-V


Reference Books:
2. Reif—Thermodynamics and Statistical Physics.

PRACTICAL

Max. Marks 100 Duration: 2 Practicals in two days Min. Pass: (5 hrs. duration each day) Marks 40

Students are expected to perform at least 15 experiments in the academic session. The suggestive list of experiments is given below.
The institution if necessary may introduce new experiments of the same standard and communicate the list to the Convener, Board of Studies.

**Experiments on Linear Track:**
1. Constant velocity motion.
2. Accelerated motion.
3. Harmonic motion.
4. Anharmonic motion.
5. Potential energy curves and energy conservation.

**Experiments with simple oscillator:**
7. Inelastic collisions.
8. Variation of time period with amplitude.
9. Composition of two perpendicular S.H.Ms.
10. Frequency response.
11. Damping and 'O' value.
12. Phase curves.

**Experiments with coupled oscillator:**
13. Excitation of normal modes and frequency measurement.
14. Period of energy transfer as a function of coupling strength.

**Experiments with Torsional wave apparatus:**
15. Velocity of wave propagation.
16. Excitation of normal modes: both ends open, one end open.
17. Impedance matching.

**Experiments with Electricity Board:**
18. Study of R.C. circuit with D.C.
19. Study of source impedance.

**Other Experiments:**
22. Study of interference pattern by 1, 2, 3, 4, 5 ... slits.
23. Study of Fresnel's diffraction pattern. (a) Circular hole (b) Single slit.
24. Study of Fraunhofer diffraction.
25. Michelson's interferometer.
26. Study of thermo e.m.f.
27. Change of B.P. of a liquid with pressure.
28. Rydberg constant from a given spectrum of hydrogen.
29. Experiment for displacement current.
30. Study of Radiation patterns from dipole, quadruple.
2. CHEMISTRY

CHEMISTRY Scheme

<table>
<thead>
<tr>
<th>Paper I</th>
<th>Max. Marks</th>
<th>Min. Pass Marks</th>
</tr>
</thead>
<tbody>
<tr>
<td>3</td>
<td>75</td>
<td>120</td>
</tr>
<tr>
<td>Paper-II</td>
<td>3</td>
<td>75</td>
</tr>
<tr>
<td>Paper-III</td>
<td>3</td>
<td>75</td>
</tr>
<tr>
<td>Paper-IV</td>
<td>3</td>
<td>75</td>
</tr>
<tr>
<td>Practical</td>
<td>7</td>
<td>100</td>
</tr>
</tbody>
</table>

(Complete in One day)

Notes:
1. There shall be four theory papers for Part-I Examination. The duration of examination for each paper shall be three hours and the maximum marks shall be 75.
2. Each paper will contain ten (10) questions having two (02) questions from each unit. Candidates are required to attempt five questions in all selecting atleast one questions from each unit.

Paper-I: Inorganic Chemistry
(4 hrs/week)

Unit-I

Ionic Bond:
General characteristics, types of ions, size effects, radius ratio and coordination number, Madelung-constant, Born-Haber cycle, Applications of lattice energy, polarizing power, polarizability, Fajan's rules, hydration energy, solubility of ionic-compounds, defects in structures, Frankel and Schottky defects, Non-stoichiometric compounds.

Solids:
Metallic bond: Qualitative idea of free electron, valence bond and band theories, semiconductors and insulators, conduction in ionic solids, electrical and magnetic properties of solids, introduction to superconductors and super-conductivity.

Unit-II

Covalent bond: General characteristics, Valence bond theory and its limitations. Directional characteristics of covalent bond, Resonance and resonance energy, Hybridisation involving s, p and d-orbitals.

Valence Shell Electron Pair Repulsion (VSEPR) Theory to NH₃, H₂O, H₃O⁺, SF₄, CIF₃, IC₁₃, shapes of simple inorganic molecules and ions. Dipole moment, percentage ionic-character from dipole moment and electronegativity difference.

Molecular Orbital Theory: Detailed description of linear combination of atomic orbital (LCAO), Homonuclear (H₂, He₂, B₂,C₂,N₂,O₂,F₂) and heteronuclear diatomic molecules (CO, NO) and their ions, comparison of valence bond and molecular orbital theories, multicentre bonding in electron deficient molecules, bond strength and bond energy.
Unit-III
Weak Interactions:
Hydrogen bond, theories of hydrogen bonding: Valence bond treatment, weak intermolecular forces of attraction, van der Waals forces.

Chemistry of Noble Gases:
Position in the periodic table, discovery, Isolation, important compounds of noble gases with special references to xenon compounds: Synthesis, bonding and their stereochemistry.

s-Block elements:
Comparative study, diagonal relationship, salient features of hydrides, solvation and complexation tendencies including their functions in biosystems, an introduction to alkyls and aryls.

Unit-IV

p-Block elements:
Comparative study of the p-block elements and group trends, electronic configuration, physical and chemical properties, diagonal relationship, atomic and ionic radii, ionization potentials, electron affinity, electronegativity and oxidation states, oxidation state diagrams on the basis of redox potentials, inert pair effect, catenation.

Compounds of p-block elements:
Hydrides of boron, diborane and higher boranes, borazine, borohydrides, fullerenes, carbides, fluorocarbons, silicates (structural principle), silicones, oxygen fluorides, peracids of sulphur, tetrasulphurtetranitride, basic properties of halogens, interhalogen compounds and polyhalides.

Unit-V
d-Block elements:
Chemistry of the elements of first transition series: Electronic configuration and comparative study with respect to atomic and ionic radii, oxidation states and ionization potentials. Redox potentials, oxidation state diagrams on the basis of redox potentials, binary compounds and complexes illustrating relative stability of their oxidation states, coordination number and geometry, metallic nature, magnetic properties, catalytic activity, colour and spectral properties of transition metal ions.

Chemistry of the elements of second and third transition series: Electronic configuration, general characteristics, comparative treatment with their 3d-analogues in respect of ionic radii, oxidation states, magnetic behaviour, spectral properties and stereochemistry.

Paper-II: Organic Chemistry
(4 hrs/week)

Unit-I
Structure and Bonding: Hybridization, Inductive effect, hyperconjugation, resonance, van der Waals interactions, inclusion compounds, clatherates, charge transfer complexes, hydrogen bonding.

Mechanism of Organic Reactions: Free radical and ionic reactions, homolytic and heterolytic bond breaking, electrophiles and nucleophiles, types of organic reactions, energy considerations, transition state, reactive intermediates-carbocations, carbonions, free radicals, carbenes, arynes and nitrenes. Methods of determination of reaction mechanism.

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Unit-II
Cycloalkenes: Methods of formation, conformations and chemical reactions.
Dienes: Nomenclature and classification, isolated, conjugated and cumulated dienes. Structure of alkenes and butadiene, methods of formation, polymerization. Chemical reaction-1,2 and 1,4 additions. Diels-Alder reaction.

Unit-III
Aromaticity: The Hückel rule and its applications. Energy level, molecular orbital diagram (ethane, 1-3-butadiene, benzene). Aromatic electrophilic substitution: General pattern of the mechanism, role of sigma and pi-complexes, mechanism of nitration, halogenation, sulphonation, and Friedel-Crafts reaction. Effect of substituent groups (inductive, mesomeric and hyperconjugative effect), activating and deactivating groups, directive influence of groups, determination of orientation up to disubstituted derivatives, ortho/para ratio, Birch Reduction. Method of formation and chemical reactions of benzene, alkyl benzenes and biphenyl.
Methods of formation of ary halides, nuclear and side chain reactions. The addition-elimination and the elimination-addition mechanisms of nucleophilic aromatic substitution reactions. Relative reactivities of alkyl halides V/s allyl vinyl and aryl halides. Preparation and properties of vinly, allyl and benzyl halides. Synthesis and uses of DDT and BHC.

Unit-IV
Optical Isomerism: Elements of symmetry, molecular chirality, enantiomers, chiral and achiral molecules with two stereogenic centres, diastereomers, threo and erythro diastereomers, meso compounds resolution of enantiomers, inversion, retention and racemization, Asymmetric synthesis.
Relative and absolute configuration, sequence rule, D & L and R & S systems of nomenclature.
Geometric isomerism: Determination of configuration of geometrical isomers, E & Z system of nomenclature, geometric isomerism in oximes and alicyclic compounds.
Difference between configuration and conformation.

Unit-V
Electromagnetic Spectrum: Absorption Spectra
Ultraviolet (UV) absorption spectroscopy: Absorption laws (Beer-Lambert law), molar absorptivity, presentation and analysis of UV spectra, types of electronic transitions, effect of conjugation. Concept of chromophore and auxochrome. Bathochromic, hypsochromic, hyperchromic and hypochromic shifts. Absorption bands of simple molecules like alkenes, Conjugated dienes, carbonyl compounds, enones, acids and aromatic compounds.
Infrared (IR) absorption spectroscopy: Molecular vibrations, Hooke's law, selection rules, intensity and position of IR bands, measurement of IR spectrum, fingerprint region, characteristic absorptions of simple organic compounds, alkanes, alkenes, alkynes, alcohols, aldehydes, ketones, carboxylic acids and their derivatives.

Paper-III Physical Chemistry
(4 Hrs. /Week)

Unit I
States of matter:

Unit II
Liquid State:
Chemical Kinetics:
Rate, Initial rate, specific rate, rate constant and units. Method of determination of initial rate. Order, molecularity and stoichiometry of reaction. Methods of determination of order of reaction. Derivation of integrated rate equations: Zero order, first order, second order and third order. Graphical applications of these equations for the determinations of rate constant. Effect of temperature on rate constant, Arrhenius equation, energy of activation and its determination. Complex reactions and their nature. How do these reactions differ from simple reactions? Derivation of rate equation for the opposing reactions (A+B→C); Parallel reactions (P’s are products) and consecutive reactions (A→B→C) characteristics of consecutive reactions.

Thermodynamics:

Solutions:

Phase Equilibria:
Explanation of terms phase, component and degrees of freedom. Phase rule and its thermodynamic derivation. Restricted phase rule. Analysis of (a) One component system such as sulfur and water (b) two component system such as lead-silver system.

Paper-IV: Analytical Chemistry
(4 hrs/week)

Unit-I
Principle of Gravimetric analysis, precipitation methods, super saturation and precipitate formation, the purity of the precipitate, coprecipitation, post precipitation, conditions of precipitation, precipitation from homogeneous solution, washing of the precipitate. Ignition of the precipitate, masking and demasking agents.

Unit-II
Solvent extraction: Principles and process of solvent extraction, the distribution law and the partition coefficient, liquid-liquid extraction, factors favouring solvent extraction, choice of solvent for solvent extraction, stripping, solid liquid extraction, organic reagents used in solvent
Organic reagents in quantitative inorganic analysis. Application of the following organic reagents: DMG, Cupferron, 8-hydroxyquinoline, cupron, salicylaldehyde, oxime, 1-nitroso-2-naphthol, 4-bromoanedic acid, nitron, tannic acid, arsonic acids, pyridine, anthranilic acid, pyrogallol, ethylenediamine.

Unit-III
Completion of gravimetric results, compilation of results, reliability of results-accuracy and precision, cleaning and calibration of glassware, standard derivation, t, Q and F tests, correction, significant figures, errors in analysis.
Volumetric analysis: Principle and applications of Redox titrations, iodometry and iodimetry. Theory of complexation titrations. Methods of end point detection, EDTA as Titrant, types of EDTA titration of mixtures, selectivity masking and demasking agents, metal indicators.

Unit-IV
Distillation methods of organic solvents, steam, fractional, vacuum and molecular distillations, monomers and monostates. Analysis of oils and fats, saponification value, iodine value, RM value, acid value.
Quantitative estimation of following functional group: alcoholic phenolic, carboxylic acids and unsaturated groups (olefinic & acetylenic).
Polarimetry: Basic principle, instrumentation, experimental techniques, determination of (a) specific rotation of a substance (b) concentration of the substance & applications. An elementary idea of Refractometry, Interferometry-circular dichroism & optical rotatory dispersion.

Unit-V
Air pollution: General consideration types of air pollutants, unit of measurement sampling monitoring and analysis of CO and SO₂ in atmosphere effect of air pollutants on plants and human health method for pollution control, especially for pollution by automobiles.

B.Sc. (Hons.) PART-I CHEMISTRY PRACTICALS
(8 hrs or 12 periods / week) (Spread over four days)

INORGANIC CHEMISTRY
A. Qualitative: To analyze the given mixture containing six radicals (three acidic and three basic) including interfering acid radicals - fluoride, borate, oxalate, phosphate and excluding insolubles.
B. Quantitative:
1. Volumetric exercises—involving
   (i) Complexometric titrations (EDTA): Estimation of Ca²⁺ & Mg²⁺
   (ii) Iodometric and iodimetric titrations.
2. Determination of total hardness of water.
3. Determination of number of molecules of water of Crystallization in oxalic acid crystals.
4. Estimation of sodium carbonate and bicarbonate in mixed solution.

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5. Estimation of sodium carbonate and sodium hydroxide in a mixed solution.

ORGANIC CHEMISTRY
1. Identification of functional groups in organic compounds and preparation of suitable
derivative: unsaturation, alcoholic (–OH), phenolic (=C–OH), aldehydic, ketonic,
carboxylic, ester, carbohydrate, nitro, amido, amino, sulphonic acids and halogen
derivatives.
2. Purification of solid substance by recrystallization.
3. Separation of two miscible liquids by fractional distillation.
4. Preparation of acetonilide from aniline.
5. Preparation of an azo-dye.

PHYSICAL CHEMISTRY
1. To study the solubility curve of salts such as potassium nitrate, etc.
2. To study the solubility curve of phenol in water and hence study the effect of separate
addition of substances such as naphthalene, potassium chloride and acetic acid.
3. Determination of pH of different buffer solutions and evaluate the PKa of an acid by
   Henderson equation.
4. Determine the relative viscosity of a liquid by using viscometer.
5. Determine the relative surface tension of a liquid by using stalagnometer.
6. Determine the heat of neutralization of an acid by alkali.
7. Determine the molecular complexity of benzoic acid in benzene by Distribution Law.
8. Determine the heat of reaction and verify Hess's law.

(Instructions to the Examiner)
B.Sc.(HONS.) Pt-I CHEMISTRY PRACTICAL EXAMINATION

Max. Marks: 100 Duration of Exam: 7 hrs. (Complete in One day)

Inorganic Chemistry
Ex. 1 Qualitative: To analyze the given mixture containing six radicals (three acidic and three
basic) including interfering acid radicals - fluoride, borate, oxalate and phosphate.
No insolubles will be given. 18
Ex. 2 Quantitative: One of the exercises mentioned in the syllabus. 12

Organic Chemistry
Ex. 3 Identification of functional group of the given two compounds and preparation of their
suitable derivative, if feasible. 25

Physical Chemistry
Ex. 4 Perform one of the physical chemistry experiments given in the syllabus. 25
Ex. 5 Viva-voce 10
Ex. 6 Record 10

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[Signature]
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3. **Zoology**

**Scheme:**

<table>
<thead>
<tr>
<th>Paper I</th>
<th>Animal Diversity-1</th>
<th>Max. Marks: 50</th>
</tr>
</thead>
<tbody>
<tr>
<td>Paper II</td>
<td>Animal Diversity-2</td>
<td>Max. Marks: 50</td>
</tr>
<tr>
<td>Paper III</td>
<td>Biochemistry</td>
<td>Max. Marks: 50</td>
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<tr>
<td>Paper IV</td>
<td>Cell Biology</td>
<td>Max. Marks: 50</td>
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<tr>
<td>Paper V</td>
<td>Molecular Biology</td>
<td>Max. Marks: 50</td>
</tr>
<tr>
<td>Paper VI</td>
<td>Genetics and Biostatistics</td>
<td>Max. Marks: 50</td>
</tr>
<tr>
<td>Practicals</td>
<td>2 Days (8 hrs.)</td>
<td>Max. Marks: 100</td>
</tr>
</tbody>
</table>

Seminars, posters, models, educational tour report, practical record etc. will carry internal marking which will be added in the practicals.

**Paper-I: Animal Diversity –I (Non-chordates)**

**Scheme of Examination:**

Max. Marks: 50

1. There will be 5 Questions in each paper. All questions will be compulsory and carry equal marks.

2. Question number 1 will comprise 10 very short answer (maximum 25 words) type questions, each of 1 mark. Questions should be evenly distributed covering entire syllabus.

3. Each paper is divided into four units/sections. There will be one question from each unit/section. The question number 2 to 5 will have internal choice.

**Section - A**

1. Principles of classification: Salient features and classification up to orders in non-chordates (Protozoa to Aschelminthes).

2. Protozoa: Type study- *Entamoeba, Paramecium, Plasmodium, Trypanosoma* and *Leishmania*.


**Section - B**

4. Porifera:
   (i) Type study - *Sycon*; Types and evolution of canal system.
   (ii) Development of Sycon

5. Coelenterata:
   (i) Type study - *Obelia* and *Aurelia*; Polymorphism in Hydrozoa.
   (ii) Metagenesis.

**Section - C**

6. Ctenophora: Type study - *Beroe*; Affinities of Ctenophora

7. Platyhelminthes: Type study - *Fasciola hepatica* and *Taenia solium*; Parasitic adaptations

8. Aschelminthes: Type study - *Ascaris*; Parasitic adaptations.
Section – D

10. Economic importance of Porifera, Corals. Coral reefs (types, formation and distribution with reference to India, and their conservation), Polymorphism in siphonophores.

Paper-II: Animal Diversity-II (Non-chordates)

Scheme of Examination:

Max. Marks: 50

1. There will be 5 Questions in each paper. All questions will be compulsory and carry equal marks.
2. Question number 1 will comprise 10 very short answer (maximum 25 words) type questions, each of 1 mark. Questions should be evenly distributed covering entire syllabus.
3. Each paper is divided into four units/sections. There will be one question from each unit/section. The question number 2 to 5 will have internal choice.

Section – A

1. Salient features and classification up to orders (Annelida to Hemichordates).
2. Annelida: Type study - Leech and Nereis: Metamerism in Annelida.
3. Onychophora: Type study - Peripatus: Affinities.

Section - B

4. Arthropoda: Type study - Prawn; Crustacean larval forms; Mouth parts and vision in Arthropods; Social insects (Termite and honey bee).
5. Mollusca: Type study - Pila and Unio; Torsion and distortion in Gastropods, Molluscan larvae

Section – C


Section - D

8. Applied aspects of -
   (i) Vermiculture.
   (ii) Sericulture and Ericulture.
   (iii) Lac culture.
   (iv) Apiculture.
10. Economic importance of Mollusca; Pearl culture.
Paper-III: Biochemistry

Scheme of Examination: Max. Marks: 50

1. There will be 5 Questions in each paper. All questions will be compulsory and carry equal marks.
2. Question number 1 will comprise 10 very short answer (maximum 25 words) type questions, each of 1 mark. Questions should be evenly distributed covering entire syllabus.
3. Each paper is divided into four units/sections. There will be one question from each unit/section. The question number 2 to 5 will have internal choice.

Section - A

1. Basic chemical concepts, bonds and functional groups.
2. Carbohydrates: Classification, structure and clinical significance.
3. Lipids: Classification, structure and clinical significance.
4. Vitamins: Types (water and fat soluble), structure, function and clinical significance.

Section - B

5. Proteins: Classification and structural properties.

Section - C

7. Regulation of metabolism:
   (i) Carbohydrates: Oxidation of glucose through glycolysis, Kreb’s cycle and oxidative phosphorylation, glycogenogenesis, glycogenolysis and gluconeogenesis.
   (ii) Proteins: Essential and non-essential amino acids, transformation of amino acids, deamination, transamination, decarboxylation, fate of ammonia, synthesis of urea (Ornithine cycle), fate of carbon skeleton.

Section - D

(iii) Lipids: β-oxidative pathway of fatty acids, brief account of biosynthesis of triglycerides, cholesterol and its metabolism.
(iv) Inborn errors of metabolism [Galactosemia, Glycogen storage disease (type I-VI), Hurler syndrome, Phenylketonuria, Alkaptonuria, Maple syrup urine disease, Lysosomal storage disease (Fabry disease, Gauchers disease, Nieman-Picks disease, Lesch-Nyhan syndrome)].

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Paper-IV  Cell Biology

Scheme of Examination:  Max. Marks: 50

1. There will be 5 Questions in each paper. All questions will be compulsory and carry equal marks.
2. Question number 1 will comprise 10 very short answer (maximum 25 words) type questions, each of 1 mark. Questions should be evenly distributed covering entire syllabus.
3. Each paper is divided into four units/sections. There will be one question from each unit/section. The question number 2 to 5 will have internal choice.

Section - A

1. Microscopy: General principle of compound microscope, fluorescent and electron microscope.
2. Principles and uses of instruments: pH meter, colorimeter, spectrophotometer and centrifuge.
3. Separation of cellular organelles through centrifugation and their characterization.

Section - B

4. Structure of prokaryotic and eukaryotic cells: Diversity of cell size and shape.

Section - C

8. Chromosome structure: Morphology, chromonema, chromomeremes, primary and secondary constrictions and telomeres.
10. Cell junctions: Tight junctions, desmosomes (belt and spot) and gap junctions.
11. Transport: Osmosis, diffusion (facilitated and mediated), active transport (Na⁺/K⁺ ATPase pump, Ca²⁺ ATPase pump) and ionic basis of membrane excitation.

Section - D

12. Cell-cell signaling: Endocrine, paracrine and autocrine signaling; second messenger cAMP and IP₃ DAG system.

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Paper-V: Molecular Biology

Scheme of Examination: Max. Marks: 50

1. There will be 5 Questions in each paper. All questions will be compulsory and carry equal marks.
2. Question number 1 will comprise 10 very short answer (maximum 25 words) type questions, each of 1 mark. Questions should be evenly distributed covering entire syllabus.
3. Each paper is divided into four units/sections. There will be one question from each unit/section. The question number 2 to 5 will have internal choice.

Section - A

1. Chromosome remodeling: Nucleosome concept, solenoid and scaffold formation; heterochromatin and euchromatin.
2. RNA: Structure and types (mRNA, tRNA and rRNA).
3. Replication mechanism in prokaryotes.
4. Transcription in prokaryotes.
5. Translation in E. coli.

Section - B

7. DNA replication: Semiconservative replication and replication mechanism in eukaryotes.
8. Genetic code.

Section – C

10. Translation and post-translational modifications in eukaryotes.
11. Gene expression: Operon concept; lac operon

Section - D

13. Transposons: LTR, reverse transcription of retroviral genomic-RNA to DNA.
14. Gene transfer (Conjugation, transformation and transduction) and gene therapy.
Paper-VI: Genetics and Biostatistics

Scheme of Examination: Max. Marks: 50

1. There will be 5 Questions in each paper. All questions will be compulsory and carry equal marks.
2. Question number 1 will comprise 10 very short answer (maximum 25 words) type questions, each of 1 mark. Questions should be evenly distributed covering entire syllabus.
3. Each paper is divided into four units/sections. There will be one question from each unit/section. The question number 2 to 5 will have internal choice.

Section - A

1. Mendelian inheritance; Deviation from Mendelian inheritance.
2. Chromosomal theory of inheritance.
3. Multiple alleles, gene interaction, epistasis, lethality and pleiotropic genes.
4. Linkage, crossing over and linkage maps.
5. Sex chromosome system and sex linkage.

Section - B

7. Sex determination and dosage compensation in Drosophila and mammals.
8. Mutation: Types and molecular basis; Variation in chromosomal number.

Section - C

11. Eugenics, euhenic and euphenics.

Section - D

12. Introduction, scope and application of biostatistics.
13. Understanding the concept of descriptive and inferential statistics.
14. Frequency distribution.
15. Diagrammatic and graphical presentation of data (bar diagrams, histograms, frequency polygons & Pie charts).
17. Standard deviation and standard error and their merits & demerits.

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Syllabus: B.Sc. Zoology (Hons.) Part-I

Min. Marks 40 8 hrs./week Max. Marks: 100

Practicals

I. Microscopic techniques

1. Organization and working of optical microscopes: (Dissecting and compound microscopes).
2. General methods of microscopic permanent preparations: Narcotization; fixing and preservation, washing, staining and destaining, dehydration, clearing and decolourization & mounting. General idea of composition, preparation and use of:
   (a) Fixatives: Formalin and Bouin's fluid.
   (b) Stains: Borax carmine, Aceto-carmine, Aceto-orcein, Haematoxylin & Eosin, Giemsa.

II. Collection and culture methods

1. Collection and culture of Euglena, Daphnia, Cyclops etc.
2. Culture of Paramecium in the laboratory and study of its structure, life processes and behavior.

III. Museum specimen

1. Porifera: Sycon, Leucosolenia, Euplectella and Spongilla.
7. Onychophora: Peripatus.
IV. Microscopic slides

1. Protozoa: *Englena, Trypanosoma, Entamoeba, Leishmania, Giardia, Elphidium, Foraminiferous shell, Monocystis, Plasmodium, Paramecium, Paramecium (Binary fission & conjugation), Opatina, Suctotherus, Balantidium and Vorticella.*


3. Coelenterata: *Obelia, Hydra and Obelia medusa.*


5. Annelida: T. S. of body of *Nereis,* Heteronereis-parapodium.


V. Anatomy: Study of the following with charts / models / CD-ROM’s, high resolution picture, video’s of lives anatomy, web-site dedicated to alternative of animal anatomy providing free wares etc.

1. *Phoronid:* External features, general viscera, alimentary canal, nervous system and reproductive system.

2. *Periplaneta:* External features, appendages, mouth parts, alimentary canal, nervous system and reproductive system.


4. *Pila:* External features, pallial organs and nervous system.

VI. Permanent Preparation

*Amoeba, Paramecium, Euglena, Foraminiferous shells, Sponge spicules, Sponge fibres, Gemmules, Hydra, Obelia colony, Parapodium of Nereis and Heteronereis, salivary gland, mouth parts and trachea of Periplaneta, whole mount of mosquito larva.*

VII. Exercises in Biochemistry

1. Detection of carbohydrates, proteins and lipids in the given sample.

2. Identification of mono-, di- and polysaccharide in the given sample.

3. Quantitative estimation: Standard curve of total cholesterol, total protein and glycogen.


VIII. Exercises in Cell Biology

1. Squash preparation for the study of mitosis in onion root tip.

2. Squash preparation for the study of meiosis in Grasshopper Periplaneta testes.


4. Study of mitochondria using vital stain (Janus Green B).
5. Permanent slides of mitosis and meiosis (all stages).

IX. Exercises in Genetics

2. Identification of male & female *Drosophila*.
3. Identification of wild and mutant (Yellow body, Ebony body, Vestigial wings, White eyes etc.) *Drosophila*.
4. Permanent preparation of W.M. of *Drosophila*.
5. Permanent preparation of sex comb of *Drosophila*.
6. Study of Barr body from buccal smear.

X. Exercises in Biostatistics

1. Construction of frequency tables, bar diagrams, histograms, frequency polygons and Pie charts.
2. Exercises on Mean, median and mode (Direct, short-cut and step deviation methods).
3. Exercises on standard deviation and standard error.

B.Sc. Zoology (Hons.) Part-I

Scheme of practical examination and distribution of marks

8 Hrs. (2 days, 4hrs./day)

Min marks: 20
Max marks: 50

1st day  

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<td>1.</td>
<td>Anatomy</td>
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<td>2.</td>
<td>Permanent preparation</td>
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<td>3.</td>
<td>Exercise in Biochemistry</td>
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<td>4.</td>
<td>Identification and Comments on spots (1 to 8)</td>
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<td>5.</td>
<td>Viva voce</td>
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<td>6.</td>
<td>Class Record</td>
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<td>7.</td>
<td>Seminar / Project Report</td>
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JAIPUR
1. Exercise in Cell Biology 7
2. Exercise in Genetics 7
3. Exercise in Biostatistics 6
4. Identification and Comments on spots (1 to 5) 15
5. Viva voce 5
6. Class Record 5
7. Seminar/Project Report/Collection 5

Note:
1. With reference to anatomy, and museum specimens, candidates must be well versed in the study of various systems with the help of charts/models/C D roms/multimedia computer based simulations including computer assisted learning (CAL) and other softwares.
2. With reference to whole mounts and museum specimens in case of the animal types may be substituted with diagrams/photographs/models etc.
3. Students will keep record of all the work done in the practical records.
4. It should be ensured that animals used in the practical exercises are not covered under the wild life act 1972 and amendments made subsequently.
5. The details methodology may be asked to be written where ever is necessary.

Recommended Books:

7. De Robertis EDP and De Robertis Jr EMF: Cell and Molecular Biology. 8th edition Lippincot Williams & Wilkins, 2006.
4. **BOTANY**

**B.Sc. Part I (Hons)**

Maximum Marks: 400

- Paper-I Cytology, Genetics and Plant Breeding 75marks
- Paper-II Algae, Fungi and Bryophyta 75marks
- Paper-III Plant Physiology and Biochemistry 75marks
- Paper-IV Ecology and environmental science 75marks
  Practical (6 hrs.) 100marks

**B.Sc. Part II (Hons)**

Maximum Marks: 400

- Paper-I Molecular biology 75marks
- Paper-II Pteridophyta, Gymnosperm and Paleobotany 75marks
- Paper-III Morphology and Anatomy of angiosperms 75marks
- Paper-IV Microbiology and plant pathology 75marks
  Practical (6 hrs.) 100marks

**B.Sc. Part III (Hons)**

Maximum Marks: 400

- Paper-I Plant Biotechnology 75marks
- Paper-II Systematics of angiosperms 75marks
- Paper-III Plant utilization and Ethanobotany 75marks
- Paper-IV Embryology of angiosperms and Seed science 75marks
  Practical (6 hrs.) 100marks

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Scheme of Examination (Common for all theory papers)

Each theory paper shall have two parts A & B. Part A will be compulsory having 30 very short answer type questions (with a limit of 20 words) of one mark each with a total of 30 marks.

Part B of question paper shall be divided into three units. There will be one question from each unit. Question number 2-4 will have internal choice. Each question will carry 15 marks with a total of 45 marks.
Paper I- Cytology, Genetics and Plant Breeding

UNIT-I

The Cell: Introduction to modern tools and techniques of cell biology (Light and Electron microscopy); History; cell theory; cell size and cell structure of Prokaryotic and Eukaryotic cells.

Cell wall and cell membrane: Origin, ultra structure, chemical constituents and functions of cell wall; models of cell membrane organization; cellular transport and signaling.

Mitochondria and chloroplast: Origin of organelles; organelles structure and biogenesis; organelle membranes and organization of macromolecular complexes; variation in size, shape and number; types of plastids organelle-nuclear interactions; organelle genome organization.

Structure/function of other sub-cellular structures: Golgi complex; endoplasmic reticulum; ribosome; lysosomes ; microbodies-peroxisomes and glyoxysomes; cytoskeleton.

UNIT-II

Nuclear organization: ultra-structure; nuclear envelope and nuclear pore complex; nuclear matrix and nucleoplasm; DNA and histones; nucleosome and higher level of organization

Cell division and its regulation: Mitosis and meiosis-historical perspective and significance; various stages of cell division progression; cytokinesis; role of centromere, kinetochore and spindle apparatus; animal and plant cell cycle; mechanisms of cell cycle regulation; apoptosis.

Chromosomal Alterations: Origin, types and effects of duplications, deletions, inversions and translocations; meiosis in structural heterozygotes.Origin, types and
effects of auto and allopolyploidy; origin and meiosis in nullisomics, monosomics and trisomics.

Genetic alterations: Spontaneous and induced mutations; mutagens—types and mode of action; transitions, transversions and frame-shift mutations.

UNIT-III

Mendelism: Mendel’s experiment and principles of inheritance, back cross and test cross, gene interaction and modified dihybrid ratios – complementary, supplementary, duplicate and epistatic factors.

Multiple allelism: multiple alleles in Drosophila (eye colour) man (blood group).

Linkage and sex determination: coupling and repulsion phases; two and three point test crosses, linkage map; mechanism of sex determination; sex linked, sex limited and sex influenced characters.

Maternal influence on inheritance: shell coiling in snails and Kappa particles in Paramecium; cytoplasmic inheritance in yeast (mitochondria) and Mirabilis jalapa (plasmid)

Plant breeding: Introduction, objectives of plant breeding. Types of plant reproduction: vegetative, sexual and apomixes, their effect on generating and fixing genotypic variation; Green revolution.

Methods of plant improvement: Pureline and mass selection; hybridisation in self and cross pollinated crops; introduction and acclimitisation; hybrid vigour and inbreeding depression.

Suggested laboratory exercises:

Cytology
- Study of prokaryotic cells of various organisms.
- Bacteria, (Bacillus, Coccus, Streptococcus, Spirillum).
- Study of eukaryotic cells of various organisms.
- Comparative study of cell structure in onion cells, Hydrilla and Spirogyra.
• Study of cyclosis in *Tradescantia* staminal hairs.
• Bacterial staining (Gram's staining).
• Study of plastids (Cassia, Lycopersicum, Capsicum).
• Mitosis - all stages- onion root tip.
• Meiosis –permanent slides.

**Genetics and Plant Breeding**

• Study of sex chromosomes.
• Preparation of chromosome maps-Gene mapping with a Three-Point Cross.
• Exercise based on Mendal's Laws.
• Exercise on gene Interaction and modified hybrid ratios.
• Emasculation and hybridisation.

**Suggested Readings:**

Paper II Algae, Fungi and Bryophyta

UNIT-I

Algae: History, occurrence and distribution, general characters, thallus organization and evolutionary tendencies, ultrastructure of algal cell, classification and economic importance; important features and life history of Chlorophyceae-Volvox and Chara, Xanthophyceae-Vaucheria and Oedogonium, Phaeophyceae-Ectocarpus and Rhodophyceae Polysiphonia.

UNIT-II

Fungi: History, occurrence and distribution, general characters, ultrastructure of fungal cell, classification and economic importance, nutrition, reproduction, important features and life history of Mastigomycotina-Psathyum, Phytophthora, Zygomyctina-Mucor, Ascomycotina-Saccharomyces, Eurotium, Chaetomium, Peziza; Basidiomycotina-Puccinia, Agaricus; Deuteromycotina-Cercospora, Colletotrichum. General account of Lichens.

UNIT-III


Suggested laboratory exercises:

Algae

External Morphology and Permanent slides of-

- Volvox: Volvox colony, daughter colony, Antheridia, Zygote.
- Chara: Sexual organs, Globule and Nucule
- Oedogonium: Thallus structure, Sexual Stage, Antheridia and Oogonia.
- Vaucheria- Thallus structure, Sexual Stage, Antheridia and Oogonia
- Ectocarpus- Thallus structure, Unilocular and Pleurilocular sporangia
- Polysiphonia- Thallus structure, Cystocarp, Tetrasporophyte.

Fungi

External Morphology and Permanent slides of-
- Chaetomium-Sexual reproduction-Ascospores
- Peziza- Sexual Reproduction-Apothecia V.S.
- Puccinia  Wheat leaf: Uredospore and Teleutospore
- Agaricus- Pileus (V.S.)
- Colletotrichum-Thallus

Bryophyta

Study of Specimens and external morphology of the following-
- Riccia-Thallus structure
- Marchantia-Thallus structure, Gemma cup, male and female gametophyte
- Anthoceros-Thallus structure, sporophyte
- Funaria-Thallus structure, sporophyte

SUGGESTED BOOKS


Paper-III Plant Physiology and Biochemistry

UNIT-I

Plant-water relations: Water transport processes; diffusion and osmosis ; water potential and chemical potential, absorption of water transport through tracheids and
xylem; transpiration and its significance factors affecting transpiration; exchange of gases, role of stomata, mechanism of stomatal movement; antitranspirants, guttation.

**Mineral nutrition:** criteria of essentiality of element; macro and micronutrient; role of essential elements; mineral deficiency symptoms and plants disorders; nutrients uptake and transport mechanism; role of cell membranes, ions pumps and carriers; ion antagonism and toxicity.

**Transportation of organic substances:** transport of photosynthetic; source sink relationship the mechanism of translocation in the phloem assimilate partitioning.

**UNIT-II**

**Photosynthesis:** Structure of photosynthetic apparatus; photosynthetic pigments; electron transport pathways in chloroplast membranes; photophosphorylation; Calvin cycle; C4 carbon cycle; Crassulacean acid metabolism; photorespiration.

**Respiration:** Glycolysis; TCA cycle and its regulation; electron transport in mitochondria; oxidative phosphorylation, pentose phosphate pathway.

**Nitrogen metabolism:** Biological nitrogen fixation; reduction of N2 to ammonia, nif genes; regulation of nitrate reductase and nitrogenase; nitrate and ammonium assimilation.

**UNIT-III**

**Growth and development:** Phases of growth; Seed dormancy and seed germination; concept of photoperiodism; physiology of flowering; the florigen concept and role of hormones; vernalistaion; Senescence and fruit ripening; importance of respiratory climacteric; discovery, physiological role and mechanism of action of the phytohormones- auxins, cytokinin, gibberellins, abscisic acid, Signal transduction basic concept; plant movement-tropic and nastic ;Biological clock.

**Secondary metabolites:** Introduction of secondary metabolites (alkaloids, flavonoids and steroids) and their importance.

**Suggested laboratory exercises:**

**Physiology and Biochemistry**

- Root Pressure-To demonstrate root pressure.
- Transpiration-To demonstrate rate of transpiration by use of potometers.
- Photosynthesis -Photosynthesis by inverted funnel method, Moll's experiment.
- Respiration-To demonstrate anaerobic and aerobic respiration.
- Respiration-R.Q. by Ganong's respirometer.
- Plasmolysis- To determine the osmotic potential of vacuolar sap by plasmolytic method.
- Osmosis-Demonstration of phenomenon of osmosis by use of potato osmometer.
- Permeability-To study the effect of temperature of permeability of plasma membrane.
- Chloroplast Pigments- To separate chloroplast pigments by solvent method.
- Chloroplast Pigments -To separate chloroplast pigments using paper chromatography.
- Separation of Amino acids-To separate amino acids in a mixture by paper chromatography.
- Enzymes-To demonstrate the enzyme activity - Catalase, Peroxidase and Amylase and effect of pH and temperature on enzyme activity.
- Histochemical Test- Cellulose; Lignin; Starch; Fat; Protein and; Tannin

SUGGESTED BOOKS


Paper IV Ecology and Environmental Science

UNIT-I

Plants and Environment: Atmosphere (stratosphere, troposphere, mesosphere and thermosphere) : Adaptations (Morphological, anatomical and physiological) Hydrophytes, Xerophytes and Halophytes. Light (global radiation, photosynthetically active radiation... Zonation in water body: littoral, limnetic and profundal zones; (
heliophytes and sciophytes) Temperature (Raunkier's classification of plants: megatherm, mesotherm, microtherm, heikistotherm; themoperiodicity). Soil (soil profile, development-weathering and maturation). Soil texture, soil types, role of pH, organic matter, soil water, soil nutrients. Interactions among organisms (neutralism, amensalism, allelopathy), competition, predation, parasitism, proto-cooperation, mutualism.

Ecosystems: Concept, Structure and Function of Ecosystem; Energy flow models and principles; trophic levels; Food chains and Food webs; Productivity; Ecological Pyramids; Ecological efficiency; Biogeochemical Cycles - C, N and P; Ecosystem Diversity – Aquatic (freshwater) and Terrestrial (Forests).

UNIT-II

Population ecology: Characteristic (Density, Dispersion, Natality, Mortality, Survivorship curves, Age Structure); Diversity and pattern; Population growth, Carrying capacity; Population regulation: - r and k selection.

Communities: Concept of ecological niche, Ecological amplitude, Ecotone and Edge effect; Succession types, Climax concept, Species diversity (α, β).

Phytogeography: Phytogeography of India, Vegetation of Rajasthan.

UNIT III

Natural resource management: Renewable and non-renewable resource, management and conservation; Endangered conventional and non-conventional energy sources; Conservation of Biodiversity. Hot Spots, IUCN categories of threatened species.

Impact of human activities: - Pollution of Air, Water, and soil and their prevention and control; Environmental Protection Act (EPA) and Global Warming. Environment Impact Assessment (EIA)
Suggested laboratory exercises

- Determination of pH of various soil and water samples by pH meter and pH paper.
- Analysis of chlorides and dissolved oxygen in water samples (titration method).
- Determination of bulk density and soil porosity and water holding capacity in soil samples.
- Determination of organic matter in soil samples by Walkley and Black method.
- Determination of species area curve by minimal quadrate size to study the herbaceous vegetation.
- Quantitative analysis of herbaceous vegetation for frequency, density and abundance.
- Estimation of biomass of aerial and belowground part of herbaceous plants (fresh and dry weight).
- Study the adaptation of following Hydrophytes: -
  - Xerophytes – *Calotropis, Capparis*, and *Cassurina* stem and *Nerium* leaf.

SUGGESTED BOOKS

Teaching: 3 Hours per Week per Theory paper.
2 Hours per Week for Practical Paper

Examination:

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<tr>
<th>Scheme</th>
<th>Min. Pass Marks</th>
<th>Max. Marks</th>
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<td>Science - 160</td>
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<td>400</td>
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<tr>
<th>Paper – I</th>
<th>Discrete Mathematics</th>
<th>Duration</th>
<th>Max. Marks</th>
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<td>3 hrs.</td>
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| Paper – II      | Calculus             | 3 hrs.   | 85         |

| Paper – III     | Conic Section and    | 3 hrs.   | 85         |
|                 | Three Dimensional Geometry |        |            |

| Paper – IV:     | Number Theory        | 3 hrs.   | 85         |
| Practical:      | Optimization Techniques | 2 hrs.   | 60         |

Note:
1. Common paper will be set for both the Faculties of Social Science and Science. However, the marks obtained by the candidate in the case of Faculty of Social Science will be converted according to the ratio of the maximum marks of the papers in the two Faculties.

2. Each candidate is required to appear in the Practical examination to be conducted by internal and external examiners. External examiner will be appointed by the University and internal examiner will be appointed by the Principal in consultation with Local Head/Head, Department of Mathematics in the college.

3. An Internal/external examiner can conduct Practical Examination not more than 100 (Hundred) candidates.

4. Each candidate has to pass in Theory and Practical examinations separately.

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Paper I: Discrete Mathematics
Teaching: 3 Hours per Week
Duration of Examination: 3 Hours
Max. Marks: 85

Note: This paper is divided into FIVE Units. TWO questions will be set from each Unit. Candidates are required to attempt FIVE questions in all taking ONE question from each Unit. All questions carry equal marks.

Unit 1: Sets, Cardinality, Principal of inclusion and exclusion, Mathematical induction.
Relations and Functions- Binary relations, Equivalence relations and Partitions, Partial ordered relations and Lattices, Chains and Antichains, Pigeon Hole principle.

Unit 2:

Unit 3: Logic and Propositional Calculus, Propositions, Simple and compound Propositions, Basic Logical operations, Truth tables, Tautologies and contradictions, Propositional Functions, quantifiers.


Unit 5: Trees – Properties, Spanning tree, Binary and Rooted tree.
Digraphs – Simple digraph, Asymmetric digraphs, Symmetric digraphs and complete digraphs. Digraph and Binary relations. Matrix representation of graphs and digraphs.

Reference Books:

2. N. Deo, Graph Theory with Applications to Computer Science, Prentice-Hall of India.
Paper- II: Calculus
Teaching : 3 Hours per Week
Duration of Examination : 3 Hours

Max. Marks: 85

Note: This paper is divided into FIVE Units. TWO questions will be set from each Unit. Candidates are required to attempt FIVE questions in all taking ONE question from each Unit. All questions carry equal marks.

Unit 1: Series – Infinite series and Convergent series. Tests for convergence of a series – Comparison test, D’Alembert’s ratio test, Cauchy’s n-th root test, Raabe’s test, De-Morgan-Bertrand’s test, Cauchy’s condensation test, Gauss’s test. (Derivation of tests is not required). Alternating series. Absolute convergence. Taylor’s theorem. Maclaurin’s theorem. Power series expansion of a function. Power series expansion of \( \sin x, \cos x, e^x, \log(1+x), (1+x)^n \).


Unit 5: Areas, Rectification, Volumes and Surfaces of solids of revolution.

Reference Books:


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Paper-III: Conic Section and Three dimensional Geometry
Teaching: 3 Hours per Week
Duration of Examination: 3 Hours

Max. Marks: 85

Note: This paper is divided into FIVE Units. TWO questions will be set from each Unit. Candidates are required to attempt FIVE questions in all taking ONE question from each Unit. All questions carry equal marks.

Unit 1: Polar equation of conics, Polar equation of tangent, normal and asymptotes, chord of contact, auxiliary circle, director circle of conics

Unit 2: Sphere, Cone.

Unit 3: Cylinder, Central Conicoids – Ellipsoid, Hyperboloid of one and two sheets, tangent lines and tangent planes, Direct sphere, Normals.

Unit 4: Generating lines of hyperboloid of one sheet system of generating lines and its properties. Reduction of a general equation of second degree in three-dimensions to standard forms.


Reference Books:

Practical: Optimization Techniques
Teaching: 2 Hours per Week per Batch

Examination:
Scheme
Max.Marks
Min.Pass.Marks

Distribution of Marks:
Two Practicals one from each group
20 Marks each = 40 Marks
Practical Record = 10 Marks
Viva-voce = 10 Marks
Total Marks = 60 Marks

Duration: 2 Hours
60
20

58
Group A: Modelling of industrial and engineering problems into LPP and its dual and their solution by Simplex Method.

Group B: Modelling of industrial and engineering problems into Assignment Problems and Transportation Problems and their solutions.

Note:
1. Problems will be solved by using Scientific Calculators (non-Programmable)
2. Candidates must know about all functions and operations of Scientific Calculator.
3. Each Candidate (Regular/non-Collegiate) has to prepare his/her practical record.
4. Each Candidate has to pass in Practical and Theory examinations separately.

Paper IV: Number Theory
Teaching : 3 Hours per Week
Duration of Examination : 3 Hours  Max. Marks: 85

Note: This paper is divided into FIVE Units. TWO questions will be set from each Unit. Candidates are required to attempt FIVE questions in all taking ONE question from each Unit. All questions carry equal marks.

Unit 1: Divisibility – Division Algorithm, g.c.d. the Euclidean algorithm. l.c.m., Prime, Infinitude of primes, Fundamental theorem of Arithmetic. Fibonacci sequence.

Unit 2: Congruence – Linear congruence, Fermat, Little and Wilson’s theorems. Fermat’s last theorem, Euler’s factorization, Mersenne’s factorization.

Unit 3: Number theoretic functions, \( \tau \) and \( \sigma \)-functions, the Mobiuss function, Greatest integer function, Euler phi function and the properties of Phi function. Application to Cryptography.

Unit 4: Diophantine equations – \( ax + by = c \), \( ax + by + cz = d \), \( x^2 + y^2 = z^2 \), \( x^4 + y^4 = z^4 \). General Integers solution of the equation \( x^2 + y^2 + z^2 = w^2 \) \((x,y,z,w = 1)\).


Reference Books:

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University of Rajasthan
JAIPUR
### 6. PSYCHOLOGY

**B.A./B.Sc. Honours Part-I**

**SCHEME OF EXAMINATION:**

<table>
<thead>
<tr>
<th>Papers</th>
<th>Nomenclature</th>
<th>Duration</th>
<th>Max. Marks</th>
<th>Min. Pass Marks</th>
</tr>
</thead>
<tbody>
<tr>
<td>Paper-I</td>
<td>Advanced General Psychology</td>
<td>3 Hrs.</td>
<td>75</td>
<td></td>
</tr>
<tr>
<td>Paper-II</td>
<td>Social Psychology</td>
<td>3 Hrs.</td>
<td>75</td>
<td></td>
</tr>
<tr>
<td>Paper-III</td>
<td>Developmental Psychology</td>
<td>3 Hrs.</td>
<td>75</td>
<td></td>
</tr>
<tr>
<td>Paper-IV</td>
<td>Statistical Foundations in Psychology</td>
<td>3 Hrs.</td>
<td>75</td>
<td></td>
</tr>
<tr>
<td>Practicals</td>
<td></td>
<td>3 Hrs.</td>
<td>100</td>
<td>40</td>
</tr>
</tbody>
</table>

**NOTE:**

1. There will be four theory Papers in Psychology in B.A. Honour Part-I. It would be common for Arts and Science. Each paper will be of 3 hours. It would comprise 3 Sections A, B and C and would cover the entire course content of the paper.

- **Section-A** will contain 10 questions of 20 words consisting of 1.5 marks each. Thus, Part-A will be 15 marks.
- **Section-B** will contain 7 questions of 50 words each, out of which students are required to attempt 5 questions. Each question will be of 3 marks. Thus, Part-B will be of 15 marks.
- **Section-C** will contain 3 long questions each with internal choice. Each question will be of 15 marks. Thus, Part-C will be of 45 marks.

For clarification the distribution of marks is tabulated as below:

<table>
<thead>
<tr>
<th></th>
<th>B.A. Honours(Psychology) Part-I</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Section</td>
</tr>
<tr>
<td>A</td>
<td></td>
</tr>
<tr>
<td>B</td>
<td></td>
</tr>
<tr>
<td>C</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Total Marks</td>
</tr>
</tbody>
</table>

2. Use of simple calculator will be allowed for statistical portions of all papers.
PAPER-I:

ADVANCED GENERAL PSYCHOLOGY

Section-A

1. Introduction to Psychology: Definition, Goals, History, Recent Trends and Methods.

2. Perception: Definition and Determinants; Gestalt view of Perception. Types of Illusion and Depth Perception.


Section-B


5. Memory: Meaning and Models - Level of Processing, Information Processing and Parallel Distributed Processing; STM and LTM, Forgetting Curve and Causes of Forgetting.


Section-C

7. Thinking and Problem Solving : Basic Elements of Thought: Mental Imagery, Concepts, Reasoning and Decision Making; Problem Solving: Trial and Error, Algorithms, Heuristics, Insight; Barriers to Problem Solving; Methods of Problem Solving.


Books Recommended:

- Morgan, King & Robinson (1986). - Introduction to Psychology.

- Atkinson-Introduction to Psychology


- सिंह. अरुणकुमार (2002). आधुनिक सामान्य मनोविज्ञान. नई दिल्ली, मोतीलल बनारसीदास

Paper-II:

Social Psychology

Section-A


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Section-B

4. Social Attitude: Development and Functions; Attitude Change and Measurement of Attitude.

5. Groups and Organizations: Basic Characteristics of Group Structure; Norms and Ideology, Performance in Group and Individual Situation; Cooperation and Conflict, Decision Making in Groups.

6. Leadership: Origin and Attributes of leadership; Functions, Type and Theories of leadership.

Section-C


Books Recommended:


Paper-III:

Developmental Psychology

Section-A


2. Theories of Human Development: Psychoanalytic, Learning and Cognitive Developmental Theories.

3. Prenatal Period and Infancy: Characteristics and Periods of Prenatal Development; Hazards during Prenatal Period; Characteristics of Infancy; Adjustment to Postnatal Life.

Section-B

4. Early and Late Childhood: Characteristics and Developmental Tasks; Personality Development in Early and Late Childhood.

5. Adolescence: Characteristics of Adolescence, Social Changes during Adolescence; Adolescent Interests; Sex Interests and Sex Behaviour; Personality Changes during Adolescence.

6. Adulthood: Characteristics and Developmental Tasks; Vocational and Marital Adjustment; Adjustment to Parenthood.

Section-C

7. Old Age: Mental Abilities and Interests in Old Age; Changes in Motor Abilities; Adjustment to Physical Changes; Adjustment to Retirement and Changes in Family Life.


Dy. Registrar (Acad.)

Books Recommended:


Paper-IV:

Statistical Foundations in Psychology

Section-A

1. Introduction: Nature and Scope of Statistics and Psychological Data; Application of Statistics in Psychology; Nature and Levels of measurement- Categorical and Continuous Variables.


3. Measurement of Central Tendency: Purpose and Types; Characteristics and Computation of Mean, Median and Mode.
Section-B

4. Measures of Variability: Concept and Uses; Characteristics and Computation of Range, Quartile Deviation, Average Deviation and Standard Deviation.

5. Correlation: Concept and Types- Pearson’s Product Moment Correlation (for Ungrouped Data by Assumed Mean and Actual Mean); Spearman’s Rank Order Correlation.

6. Hypothesis Testing and Inferences Making: Population and Sample, Types of Sampling, Standard error of Mean, ‘t’ test (Independent group), Interpretation of ‘t’ values, levels of Significance.

Section-C


8. ANOVA: Purpose and Assumptions of ANOVA. One way and Two way ANOVA


Books Recommended:


Practicals:

1. Human Maze Learning
2. Serial Position Effect (Non-sense syllables)
3. Bilateral Transfer of Training
4. Retroactive Inhibition
5. Figure Ground Reversal
6. Concept Formation
7. Measurement of Attitude
8. Assessment of Emotional Maturity
9. Assessment of Social Maturity
10. Youth Problem Inventory
11. Normal Probability Curve
12. Measurement of Intelligence (Bhatia Battery)
7. Geography

Scheme of Examination

Min. Pass Marks 160 (40%)  Max. Marks 400
Paper -I 3 hour duration  Physical Geography  Max. Marks 80
Paper -II 3 hour duration  Human Geography  Max. Marks 80
Paper -III 3 hour duration  Economic Geography  Max. Marks 80
Paper -IV 3 hour duration  Geography of Rajasthan  Max. Marks 80
Practical

Notes

1. Students are permitted to use the stencils, simple calculator and log tables wherever needed in both theory and practical examinations. Each theory paper will have a teaching of hours per week.

2. There will be a common paper for Arts and Science.

3. Q.1 will be compulsory and will cover the entire course of the paper.

Q.No. 1 of 20% marks of the maximum marks be set in two parts.

(a) Part (a) will have ten items for locating on a map (to be supplied by examination centre) carrying 10% marks of the maximum marks and candidates shall attempt any five items.

(b) Part (b) will have 10 short answer questions carrying 10% marks of the maximum marks and candidates shall attempt any five items.

4. Remaining 9 questions carrying equal marks will be set with three questions from each section of the syllabus.

5. Candidate will attempt 5 questions in all including question No. 1 selecting at least one question from each section.

6. Practical examination will be conducted by the board of examiners.

7. The candidate will have to pass in theory and practical separately.

SYLLABUS

Paper I: Physical Geography

Section A

Definition, scope and development of physical geography, geological history of the Earth; zoning of Earth's interior, rocks, origin of continents and oceans; continental drift theory and plate tectonics; concept of isostasy: views of Airy, Pratt, Joly and Holmes. Earth movements: epeirogenic and orogenic; mountain building theories: Kober, Jeffreys, Daly, Joly and Holmes and plate tectonics; denudation, cycle of erosion: views of W.M. Davis and W. Penck, erosional and depositional topographies: river, under groundwater, glacier, wind and oceanic waves.

Section B
Composition and structure of the atmosphere, insolation, air temperature, air pressure, pressure belts and planetary winds, monsoon and local winds, humidity, classification of clouds and precipitation, air masses, fronts and cyclones: tropical and temperate, classification of the world climates: Koppen and Thorthwaite, general climatic classification.

Section C

Surface configuration of oceans bottom: Pacific, Atlantic and Indian oceans, ocean deposits, horizontal and vertical temperature of oceans, oceanic salinity, tides, oceanic waves and currents, coral reefs and their origin: views of Darwin and Dana, W.M. Davis, Murray, classification of marine resources, biosphere and its components, ecosystems, plant community and animal kingdom, biomes: equatorial rainforest, monsoon, savanna and temperate grasslands.

Recommended Readings:

चौहान, वी.एस. व गौतम, ए. 2005. भौतिक भूगोल (जीवमण्डल सहित)। रस्तोगी प्रकाशन, मेरठ।
दयाल, पी. 2012. भौतिक भूगोल। राजेन्द्र प्रकाशन, नई दिल्ली।
गौतम, अल्का, 2012 : भौतिक भूगोल। रस्तोगी प्रकाशन, मेरठ।
सिंह, सिंहवर्मा, 2005 : मू-आकृति विज्ञान। तारा प्रकाशन, वाराणसी।
सिंह, सिंहवर्मा, 2011: भौतिक भूगोल का स्वरूप। प्रवास पुस्तक भवन, इलाहाबाद।
शर्मा, एच.एस. शर्मा, एम. एल. एच.मिगल, एम.एन. 2008: भौतिक भूगोल। पंचशील प्रकाशन जयपुर।

Paper II: Human Geography

Section A

Introduction of human geography: meaning, definition, nature, scope and importance, branches of human geography and its relation with other social sciences, principles of human geography, essential elements of human geography: Brunnhes and Huntington, approaches to human geography: environmental determinism, possibilism, stop and go determinism,
contribution of various scholars: Fredrick Ratzel, Miss Ellen Sample, Vidal de la Blache, Huntington.

**Section B**


**Section C**

Building materials and house types, types and patterns of rural & urban settlement, internal structure of cities, transport foci and centers of specialized services, principal human occupations and principal agglomerations, their ecological and distributional aspects, trends of urbanization movement of mankind: definition, types, causes and effects in past and present times.

**Recommended Readings:**


गुर्जर, आर.के. एवं जाट, श्री. सी. 2014: मानव भूगोल। पंचशील प्रकाशन, जयपुर।


हाकन, एम. 2008: संसाधन भूगोल। वसुधा प्रकाशन, गोरखपुर।


कौशिक, एस.डी. 2012: मानव भूगोल। रसोगी पुस्तकक्षेत्र, पैरों।

राव, श्री. पी. एवं श्रीवस्तव, श्री.के. 2008: मानव भूगोल। वसुधा प्रकाशन, जयपुर।

प्रसाद, रामा एवं गीता, जे. 2013: जनसंख्या भूगोल। श्रीलु पुस्तकक्षेत्र, जयपुर।

Paper III: Economic Geography

Section A

Meaning and scope of economic geography, study of the geographical factors affecting production, consumption and distribution of principal raw materials and food stuffs.

Section B

Man's utilization of natural resources and conservation, agricultural types and agricultural region of the world, irrigation systems, important minerals and their distribution iron, copper, aluminium and uranium, coal and petroleum.

Section C

Industrial region of the world, major manufacturing industries and their localisation Iron and steel, textile and chemical, study of economic regions – Damodar Valley, Hoogly and Ruhr region, world trade and transport, trade and trade routes – Sea, Air and Pipe lines. (Questions will be on the basis of world regions and not on countries.)

Recommended Readings:

गौतम, अल्का. 2010: आर्थिक भूगोल। रस्तोंगी प्रकाशन, नेरठ।
हरून, एम. 2006: संसाधन भूगोल। बसुविधा प्रकाशन, गोरखपुर।
जाट, धीरजी. 2014: आर्थिक भूगोल। पंचशील प्रकाशन, जयपुर।
Paper IV: Geography of Rajasthan

Section A

Physical aspects of Rajasthan: geological structure, relief, climate, drought, drainage, natural vegetation. Environmental pollution - causes and types; desertification, soils, soil erosion and conservation; availability, problems and conservation of water resources.

Section B

Mineral resources: distribution and production; Power and energy resources: distribution and production (hydro-electricity, coal, petroleum, solar energy and bio-energy) irrigation sources, irrigation intensity, crop wise irrigation, quality of irrigation water problems, irrigation projects: detailed study of Indira Gandhi canal project, Chambal valley project, Mahi Bajaj Sagar projects on physical and socio-economic aspects, agriculture: development under five year plans, problems of agriculture development, general land use, live-stock and dairy development, minerals.
Industries: textile, sugar, cement, marble and granite, fertilizer, zine and copper smelting.
Transport & trade, development of tourism, desert development programme, tribal areas development programme, Aravali hill development programme.

Section C

Cultural and development aspects: population-number, growth, distribution and density, rural and urban, male and female population, literacy status, occupational structure, schedule castes and schedule tribes, population problems, study of bhil, meena and garasia.
Settlement pattern: types of settlements, building materials and house types in Rajasthan with examples, factors affecting settlement.

Recommended Readings:

Lodha, R. & Maheshwari, D. 2001: Geography of Rajasthan. Shahitya Bhawan Publication, Hospital Road, Agra
नाथुरामकर, एल.एन. 2012.13: राजस्थान की अर्थव्यवस्था। कॉलेज बुक हाउस, जयपुर।
साइनाल, स्नेह 2012: राजस्थान का हूगोल। कॉलेज बुक हाउस, जयपुर।
Sing, R.L. 1971 (ed.): India A Regional Geography NGSI.Varanasi.
स्केन्ना, एच.एम. 2012: राजस्थान का हूगोल। राजस्थान हिन्दी ग्रंथ अकादमी, जयपुर।

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University of Rajasthan
Practicals

Scheme of examination

Min. Pass Marks: 32

<table>
<thead>
<tr>
<th>Written test</th>
<th>Bifurcation of Marks</th>
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</thead>
<tbody>
<tr>
<td>Time</td>
<td>40</td>
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<tr>
<td>3 hrs.</td>
<td>15+5</td>
</tr>
<tr>
<td>Total Marks</td>
<td>80</td>
</tr>
<tr>
<td>2½ hrs.</td>
<td>15+5</td>
</tr>
</tbody>
</table>

N.B. 1. There shall be 6 questions in written test selecting at least two questions from each section. Candidates are required to attempt 3 questions selecting 1 question from each section. All question carry equal marks. Each practical both of 30 students will be allotted a teaching of 4 hrs per week for practicals.

SYLLABUS

Section A


Section B

Enlargement and reduction of maps, use of pantograph, representation of temperature, pressure and rainfall data, use of line and bar graphs, isotherms, isobars and isohytes, construction and significance of climograph, hythergraph and climatograph.

Section C

Study and interpretation of weather maps of India (particularly July and January)

Prismatic Compass survey: equipments, methods of measurement of bearings, correction of bearings, record of survey closing error and its corrections.

Recommended Readings:

Recommended Readings:

गांधी, जे.पी. 2012: प्रायोगिक भूगोल। रस्तीय प्रकृतिविज्ञान, नेरठ।