INSTITUTE OF ADVANCED STUDIES IN EDUCATION

(DEEMED TO BE UNIVERSITY)

GANDHI VIDYA MANDIR, SARDARSHAHR

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SYLLABUS

SCHEME OF EXAMINATION AND COURSE OF STUDY

FACULTY OF HUMANITIES SCIENCES

B.Sc. (THREE YEAR COURSE)

Bachelor of Sciences Examination

Session – 2021-2024

Programmeme Educational Objectives

B.Sc Programme Outcomes

Bachelor of Science (B.Sc) intends to offer theoretical as well as practical knowledge about different subject areas such as Physics, Chemistry, Mathematics, Zoology and Botany and other fields depending on the specialisation a student opts. This Programme course is beneficial for students who have a strong interest and background in Science and Mathematics wishing to pursue multi and inter-disciplinary science careers in future.

The Programme outcomes are as follows:

1. This course forms the basis of science comprising of the subjects like Physics, Chemistry, Botany, Zoology and Mathematics.
2. It helps to cultivate scientific temper and thus can turn out to be more beneficial for the society as the scientific developments can make a nation or society to grow at a fast pace.
3. After higher studies students have the option to join as scientist and can even look for professional job oriented courses.
4. This course also enables students to serve in Indian Army, Indian Navy, Indian Air Force as officers.
5. After the completion of the B.Sc degree there are various opportunities available for the science students. Often, in some prestigious universities or colleges in India and abroad the students are hired directly by big MNC's after their completion of the course.
6. On the completion of this course students can go for higher studies i.e. M. Sc and then do some research for the welfare of mankind.
7. Students after this course have the option to join Indian Civil Services as IAS, IFS etc.
8. Science graduates can go to serve in industries or establish their own industrial unit.
9. Besides the research jobs, students can also work or get jobs in Marketing, Business & Other technical fields. Science graduates also recruited in the bank sector to work as customer service executives. Students can also find employment in government sectors.

Programme Specific outcomes: B.Sc. Medical/Non-Medical

a) B.Sc. Medical

1. B.Sc. Medical student can acquire knowledge regarding Botany, Zoology and Chemistry.

2. Medical Students can define and explain major concepts in the biological sciences.
3. They will be able to correctly use biological instrumentation and proper laboratory techniques.
4. Students can communicate biological knowledge in oral and written form
5. Students can recognize the relationship between structure and function at all levels: molecular, cellular, and organismal.
6. They will be able to go for Indian Forest Service and other competitive examinations.
7. They can opt for higher studies in Botany, Zoology and Chemistry.

b) B.Sc. Non-Medical

1. B.Sc. Non-Medical student can concentrate on Chemistry, Physics and Mathematics.
2. A non-medical student may demonstrate a scientific knowledge of the core physics principles in Mechanics, Electromagnetism, Modern Physics, and Optics.
3. He can demonstrate basic manipulative skills in algebra, geometry, trigonometry, and beginning calculus.
4. The student shall determine the appropriate level of technology for use in: a) experimental design and implementation, b) analysis of experimental data, and c) numerical and mathematical methods in problem solutions.
5. He can apply the underlying unifying structures of mathematics (i.e. sets, relations and functions, logical structure) and the relationships among them.
6. He is able to investigate and apply mathematical problems and solutions in a variety of contexts related to science, technology, business and industry, and illustrate these solutions using symbolic, numeric, or graphical methods.
7. The student shall acquire knowledge of Chemical Thermodynamics, Kinetics, Electrochemistry, Atomic Structure, Organic Chemistry, Spectroscopy and Skill in Industrial Chemistry.
8. A non-medical student will be able to join Indian Air Force, Indian Navy and can also go for other competitive exams. He can go for higher studies in Mathematics, Chemistry, Physics.
9. He will be able to join as a scientist in research institutes of immense knowledge having a great scope for growth and development. He will be able to prove to be an asset for the society by producing something more innovative.
10. Banking sector is another promising area for non-medical students.

SCHEME OF EXAMINATION

(Compulsory – General English, General Hindi & Envornmental Studies)

Important points to be noted:

- The theory question paper will consist of Five Sections.
- Theory (External) – 80
  Internal Sessional Marks (Internal) – 20

Division of Marks:

Sl No.	Division of Sessionals	Full Marks	Division of Marks
1	Assignments	10	Each subject has five units. Each unit covers 2 marks. (5X2=10)
2	Terminal Test	05	Two terminal tests having 2.5 marks. (2X 2.5=05)
3	Attendance	03	93% and above = 03 marks 85% - 93% = 02 marks 76% - 85% = 01 marks
4	Co-Curricular Activity	02	Cultural and literary = 01 mark Games and Sharamdan = 01 mark
-	Total	20	-

- Total Marks – 100 (Three Papers)
- Pass Marks – 36 percent.
- Mandatory to pass the Internal and External (Written Exam) separately, Obtaining 36 Percent Marks.
- Duration of Examination: 3 Hours.
- The candidate has to clear the compulsory papers in the three chances. Non-appearance or absence in the examination of compulsory papers will be counted as a chance

SCHEME OF EXAMINATION

(Compulsory – Elementary Computer Applications)

Important points to be noted:

- The theory question paper will consist of Five Sections.
- Theory (External) – 50
- Practical (External) – 40
- Internal Sessional Marks (Internal) – 10

Division of Marks:

Sl. No.	Division of Sessionals	Full Marks	Division of Marks
1	Assignments	05	Each subject has five units. Each unit covers 2 marks. (5X1=05)
2	Terminal Test	02	One terminal test having 02marks.
3	Attendance	02	88% and above = 01 marks 76% - 88% = 01 mark
4	Co-Curricular Activity	01	Cultural , literary , Games and Sharamdan = 01 mark
-	Total	10	-

- Total Marks – 100 (One Paper)
- Pass Marks – 36 percent.
- Mandatory to pass the Internal and External (Written Exam) separately, Obtaining 36 Percent Marks.
- Duration of Examination: 2 Hours.
- Duration of Practical Examination: 2 Hours.
- Please note that the Practical subject requires 40 % of marks to pass the examination separately
- The candidate has to clear the compulsory papers in the three chances. Non-appearance or absence in the examination of compulsory papers will be counted as a chance

SCHEME OF EXAMINATION

(Optional Subjects)

Content B.Sc. Part - I, II & III

There will be Six Papers Optional & Four Papers in 3 years and each paper will be of 3 hours duration and will carry 80 marks.

Note: The student will attempt five question in all with one compulsory question form each unit. Hovever there is an option in each question. Attempt either essay type or short answer types question have two parts. Limits of short answer type question are 150 words.

Important points to be noted:

- The theory question paper will consist of Five Sections.
- Theory (External) – 50
- Practical (External) – 40
- Internal Sessional Marks (Internal) – 10

Division of Marks:

Sl. No.	Division of Sessionals	Full Marks	Division of Marks
1	Assignments	05	Each subject has five units. Each unit covers 2 marks. (5X1=05)
2	Terminal Test	02	One terminal test having 02marks.
3	Attendance	02	88% and above = 01 marks 76% - 88% = 01 mark
4	Co-Curricular Activity	01	Cultural , literary , Games and Sharamdan = 01 mark
-	Total	10	-

Total Marks – 600 (Six Optionals Papers: 100 Marks Each)

- Pass Marks – 36 percent.
- Mandatory to pass the Internal and External (Written Exam) separately, Obtaining 36 Percent Marks.
- In the Paper I and II the minimum marks for Passing the examination are 58 for External Exam and 14 marks for Internal Examination .This is applicable on the optional subjects of B.Sc. Part I,II and III.
- Please note that the Practical subject requires 40 % of marks to pass the examination separately
- Duration of Examination: 3 Hours for Each Paper.

BACHELOR OF SCIENCE

1. The course of study for the examination shall extend over a period of Three years as an Bachelor of Science course. There shall be an examination at the end of each year, namely, B.Sc.Part. I examination at the end of B.Sc.Part.I, B.Sc.Part. II examination at the end of Second Year and B.Sc.Part. III examination at the end of Third Year.

2. The examination shall be conducted by means of written papers and practical tests wherever required.

3. The subjects for examination shall be as follows :

3.1 Compulsory Subject with Paper Code:

(i) General Hindi BSC-C 101

(ii) General English BSC-C 102

(iii) Elementry Computer Application BSC-C 103

(iv) Environmental Studies BSC-C 104

Note: Foreign nationals and students belonging to non-Hindi speaking areas, if any, may be allowed to offer Elementary Hindi in lieu of General Hindi and in such cases the rules prescribed for General Hindi shall be applicable to Elementary Hindi.

3.2 Optional Subject with Paper Code:

(i) Physics BSCPH- 101,102,103.

(ii) Chemistry BSCCH-101,102,103.

(iii) Mathematics BSCMA-101,102.,103

(iv) Botany BSCBO-101,102,103.

(v) Zoology BSCZO-101,102,103

4. A candidate, who after passing the Senior Higher Secondary Examination scheme with Science subjects of the Board of Secondary Education, Rajasthan, or an examination recognised by the University as equivalent thereto, has attended a regular course of study for B.Sc.Part. I in the University for One Academic Year shall be eligible to appear at the B.Sc.Part. I Examination.

5. Promotion:

5.1 Candidates will be declared to have passed the examination if they obtain minimum pass marks in each subject viz. 36% in each compulsory and in each optional subject of paper.

Provided that if a candidate fails to secure the minimum pass marks in all or any of the compulsory subjects he/she shall be allowed to clear the paper(s) in subsequent supplementary and/or main examination. Such a candidate shall not be admitted in B.Sc.Part. III course if he/she fails to clear such back paper(s) latest by Part II supplementary examination.

5.2 A candidate who, after passing B.Sc.Part. I Examination of the University has attended a regular course of study for B.Sc. Part. II in the University for one academic year shall be eligible to appear at the B.Sc.Part. II Examination.

5.3 A candidate shall not be required to re-appear in a compulsory subject in which he has once passed even if he fails at the examination.

5.4 A candidate who, after passing the B.Sc.Part. II Examination of the University has attended a regular course of study for B.Sc. Pt. III in the University for one academic year shall be eligible to appear at the B.Sc.Part. III Examination.

6. Additional Optional Subject:

6.1 Any candidate who has passed B.Sc. Examination of the University under senior secondary + three year degree course pattern shall be allowed to present himself for examination in any subsequent year in any one of the optional subjects prescribed for the B.Sc. Examination (senior secondary + three year degree course pattern) and not already taken by him at the degree examination provided he is not registered for any other examination in the University in the same year, and if successful, will be given a certificate to that effect. Such a candidate shall be required to appear in all the papers of the subject in one and the same year.

6.2 A candidate who desires to appear for the examination under this provision must submit his application on prescribed form. The application shall be accompanied with an examination fee prescribed for B.Sc.Part. III examination and shall be forwarded by the Dean of the faculty concerned.

6.3 No candidate shall be allowed to offer Science subjects for the examination unless he/she produces satisfactory evidence that he/she has completed the course of instruction in practical science in a recognised college during the year preceding the examination.

6.4 In the case of a candidate whose application is rejected or who does not submit an application in one subject but only pays fees, the amount paid by the candidate on account of fees shall be refunded after deducting Rs. 500/.

7. The number of papers and maximum marks for each paper together with the minimum marks required for a pass shall be shown in the scheme of examination separately. It will be necessary for a candidate to pass in the theory part as well as practical part of his subject/paper, wherever prescribed, separately. Classification of successful candidates shall be as follows: —

First division 60% and above of the aggregate marks prescribed for optional subjects only at the B.Sc.Part. I, II and III examinations.

Second division 48% and above (but less than 60%) of the aggregate marks prescribed for optional subjects only at the B.Sc. Part. I, II and III examinations

All the rest will be declared to have passed the examination if they obtain the minimum pass marks in each subject viz, 36%. No division shall be awarded at the B.Sc. Part. I and B.Sc.Part. II Examination. (For details of papers, maximum and minimum marks and syllabus etc. separate syllabi shall be published from time to time.)

Evaluation & Examination

Note-

The minimum pass marks in each year examination shall be 36% for each theory paper and 36% for practical separately.

Candidates can apply for Re-evaluation in any of the theory courses as per rules stipulated by the University for B.Sc. degree. Changes in Statutes/Ordinances/ Rules/ Regulations/ Syllabi and books may from time to time be made by amendment or remaking and a candidate shall, except in so far as the University determines otherwise, comply with any change that applies to years she/he has not completed at the time of change.

Notes

There shall be a University examination at the end of each year as per details of the scheme of examination.

A candidate will be permitted to appear in the annual examination only if he/she has pursued a regular course of study and attended at least 75% of the classes for all the practicals class 90%.

A candidate shall be admitted to the next higher class only if she/he passes his/her Part I/ Part II / Part III Examination as per rules mentioned here in after.

In order to qualify for B.Sc. degree a candidate should obtain a minimum of 36% marks in theory and practical separately.

In Part I, there will be two core subjects; compulsory course is General Hindi, General English, ICT in Education and Environmental Education. In order to pass, a candidate must secure atleast 40% marks in each Compulsay course. However, the marks obtained in these papers will not be taken into account for awarding the division. In case a candidate fails in the compulsory course, she/he has to clear the same in consequent year.

The minimum pass marks in the supplementary examination shall be the same as prescribed for the main examination.

Rules &Regulation: -

- Final examination is divided into two parts external and internal in all the courses, except the courses having practical exams. Internal assignment will be included two tests (5 marks each).
- The candidate who has passed any year of B.Sc. Programmeme after taking supplementary examination will be awarded minimum pass marks in the concerned subject irrespective of marks actually obtained in the supplementary examination.
- A candidate who fails in one compulsory subject and one optional subject will be eligible to take admission next year. A candidate having this

qualification will be eligible to take admission in second year and appear in the supplementary examination in the course(s) in which she/he fails along with subsequent examination and get two more chances for clearing this course. In second year, if a candidate fails, she/he has only one more chance to qualify the exam. Non-appearance or absence from the examination of this paper will be counted as a chance.

- A candidate who fails in one or two subjects (one compulsory subject and one optional subject) in any year of the Programme will be eligible to take the supplementary examination in the course(s) in which she/he fails and get two more chances for clearing this course either along with the supplementary examination in next subsequent year. Non-appearance or absence from the examination of this paper will be counted as a chance.
- In case the candidate is not able to pass supplementary examination in two subsequent years, she/he can appear only as an ex-student in all courses again at the main examination of the next subsequent year. She/he will not be required to appear in practical(s) if she/he has already cleared the same and has to pay extra one third fee as ex-student. A candidate shall be deemed to be an ex-student if she/he has completed a regular course of study at the Institute and fulfilled the required attendance and appeared in University examination but failed or did not take the examination.
- A candidate who fails in the practical/theory/field work of a course at the main examination shall be required to appear only in the corresponding practical/ theory of the supplementary examination.
- A candidate who appears for the supplementary examination may take provisional admission to the next higher class at his/her own risk. Such a candidate will, however, be allowed to appear in the University examination of the next higher-class course to his/her passing the supplementary examination, fulfilling the attendance requirement as a regular candidate and completion of courses of study as per scheme of examination. If a candidate getting supplementary does not take provisional admission to the next higher class by the notified last date of admission and passes the supplementary examination at a later stage, she/he will not be admitted to the next higher class. However, such a candidate may take admission to the next higher class in the next academic session.
- A candidate who fails in more than two courses (except General Hindi/General English/ Environmental studies and Elementary Computer Application) in any year of the course shall be declared failed and will

not be promoted to the next class. Such a candidate will be permitted to appear at the main examination of the subsequent year in all the courses only as an **ex-student.**

- Candidate who fails in more than two courses but passes in practical he/she will be required to appear again in all the courses (theory) except practical only as an ex-student.
- A candidate will be given a maximum of three chances at the main examination and the corresponding supplementary examination in any year of the course. If he/she does not pass the examination even thereafter, she/he will not be eligible for readmission to any year of the Programmeme.

COURSES OF STUDY AND SCHEME OF EVALUATION

Examination of B.Sc. Part -I

Candidates are required to choose any groups from the following:

(I -Physics, Mathematics, Chemistry) (II –Chemistry, Zoology and Botany)

Subject Compulsary/ Optional	Course Name	Paper Code	Int. Sessional	Theory (Written Exam)	Pract.	Max. Marks
Compulasry Subjects	PAPER I- General Hindi	BSC-C 101	20	80	_	100
	PAPER I- Genral English	BSC -C 102	20	80	_	100
	PAPER I - Elementary Computer Application	BSC-C 103	10	50	40	100
	PAPER I- Environmental Studies	BSC-C 104	20	80	_	100
Physics	PAPER I - Relativity, Mechanics, Oscillations	BSCPH-101	10	40	50	200
	PAPER II - Mathematical Background, Properties of Matter and Electromagnetic Waves	BSCPH-102	10	40		
	PAPER III - Waves, Acoustics and Kinetic Theory of Gases	BSCPH-103	10	40		
Mathematics	PAPER I - Algebra	BSCMA - 101	10	56	-	200
	PAPER II - Calculus	BSCMA - 102	10	56		

	PAPER III - Vector Calculus and Geometry	BSCMA - 103	10	58		
Chemistry	PAPER I- Inorganic Chemistry	BSCCH-101	10	40	50	200
	PAPER II - Organic Chemistry	BSCCH-102	10	40		
	PAPER III- Physical Chemistry	BSCCH-103	10	40		
Zoology	PAPER I- Non-Chordata	BSCZO-101	10	40	50	200
	PAPER II - Animal Cell Biology And Genetics	BSCZO-102	10	40		
	PAPER III- Molecular Genetics	BSCZO-103	10	40		
Botany	PAPER I- Diversity of Microbes and Lower Plants	BSCBO-101	10	40	50	200
	PAPER II - Diversity of Cryptogams (Bryophytes & Pteridophytes)	BSCBO-102	10	40		
	PAPER III- Molecular Biology & Genetic Engineering	BSCBO-103	10	40		

Examination of B.Sc. Part -II

Subject Compulsary/ Optional	Course Name	Paper Code	Int. Sessional	Theory (Written Exam)	Pract.	Max. Marks
Physics	PAPER I - Electricity and Magnetism	BSCPH-201	10	40	50	200
	PAPER II - Statistical and Thermody-namics	BSCPH-202	10	40		
	PAPER III - Optics and Lasers	BSCPH-203	10	40		
Mathematics	PAPER I - Advanced Algebra	BSCMA - 201	10	56	-	200
	PAPER II - Real Analysis	BSCMA - 202	10	56		
	PAPER III - Differential Equations	BSCMA - 203	10	58		
Chemistry	PAPER I- Inorganic Chemistry	BSCCH-201	10	40	50	200
	PAPER II - Organic Chemistry	BSCCH-202	10	40		
	PAPER III- Physical Chemistry	BSCCH-203	10	40		
Zoology	PAPER I- Chordata	BSCZO-201	10	40	50	200
	PAPER II - Animal Physiology And Endocrinolo gy	BSCZO-202	10	40		
	PAPER III- Evolution And	BSCZO-203	10	40		

	Palentology					
Botany	PAPER I- Diversity of Seed Plants	BSCBO-201	10	40	50	200
	PAPER II - Systematic of Angiosperms	BSCBO-202	10	40		
	PAPER III- Plant Cell Biology and Genetics	BSCBO-203	10	40		

Examination of B.Sc. Part -III

Subject Compulsary/ Optional	**Course Name**	**Paper Code**	**Int. Sessional**	**Theory (Written Exam)**	**Pract.**	**Max. Marks**
Physics	PAPER I - Nuclear and Solid State Physics	BSCPH- 301	10	40	50	200
	PAPER II - Quantum Mechanics, atomic and Molecular Physics	BSCPH- 302	10	40		
	PAPER III– Electronics and Solid State Devices.	BSCPH- 303	10	40		
Mathematics	PAPER I - Complex Analysis	BSCMA- 301	10	56	-	200
	PAPER II - Mechanics	BSCMA- 302	10	56		
	PAPER III - Numerical Analysis and Optimization	BSCMA- 303	10	58		

	Techniques					
Chemistry	PAPER I- Inorganic Chemistry	BSCCH- 301	10	40	50	200
	PAPER II - Organic Chemistry	BSCCH- 302	10	40		
	PAPER III- Physical Chemistry	BSCCH- 303	10	40		
Zoology	PAPER I- Developmental Biology	BSCZO- 301	10	40	50	200
	PAPER II - Environmental Studies	BSCZO- 302	10	40		
	PAPER III- Ethology, Economic Zoology And Wild Life	BSCZO- 303	10	40		
Botany	PAPER I- Structure, Development and Reproduction in Flowering plants	BSCBO- 301	10	40	50	200
	PAPER II - Plant Physiology	BSCBO- 302	10	40		
	PAPER III- Ecology & Economic Botany	BSCBO- 303	10	40		

अनिवार्य प्रश्न पत्र

बी.एस.सी प्रथम वर्ष (सामान्य हिन्दी)

प्रथम प्रश्न पत्र **BSC-C-101**

पूर्णांक–100 **न्यूनतम उत्तीर्णांक– 36**

आन्तरिक मूल्यांकन–20 **न्यूनतम उत्तीर्णांक– 7**

सैद्धान्तिक प्रश्न पत्र

समयः 03 घण्टा न्यूनतम उत्तीर्णांक–36 अधिकतम अंक–80

सामान्य हिन्दी

उद्देश्य

1. राष्ट्रीय भावना, नारी भावना को प्रगाढ़ करने की प्रेरणा देना।
2. दार्शनिक विचारधारा को विकसित करना।
3. मिथकीय चेतना और आधुनिकता बोध, आत्म संघर्ष तथा काव्य सौष्ठव से अवगत कराना।
4. मानवीय संवेदनाओं को कहानी और उपन्यास के माध्यम से विकसित करना।
5. सामाजिक समस्याओं के संदर्भ में गद्य साहित्य को चिंतन हेतु तैयार कराना।

अधिगम सम्प्राप्तियाँ :–

1. विद्यार्थी आधुनिक कविता के अध्ययन से भारतीय काव्यधारा की संपूर्ण विवेचना में सक्षम हो सकेंगे। छायावादी काव्य में स्थापित नवीन भावबोध एवं नई काव्यशैलियों से परिचित हो सकेंगे।
2. हिन्दी काव्यधारा में युगीन परिस्थितियों यथा राजनीतिक, सामाजिक, आर्थिक, सांस्कृतिक कारणों के विश्लेषण क्षमता की वृद्धि हो सकेगी।
3. समाज के सामाजिक सन्दर्भों को रोचकपूर्ण तरीके से और सरल रूप से प्रेषित कराना।
4. छात्रों को गद्य साहित्य की लेखन शैली व पठन शैली से अवगत करवाना। उपन्यास कला तथा कहानी कला के मूलभूत अंतर को समझने में समर्थ हो सकेंगे।

इकाई– 1

साहित्य खण्ड –

(क) गद्य भाग :– निर्धारित रचनाएँ :–

भारतवर्ष की उन्नति कैसे हो सकती है	– भारतेन्दु
मेरा जीवन	– प्रेमचन्द
मजदूरी और प्रेम	– पूर्ण सिंह
भारतीय संस्कृति की देन	– हजारी प्रसाद द्विवेदी
सोना	– महादेवी वर्मा (रेखाचित्र)
राष्ट्रपिता महात्मा गांधी	– मुक्तिबोध
सवालों की नोक पर	– मोहन राकेश

गर्दिश के दिन – गुलशेर अहमद खान 'शानी'
निन्दा रस – हरिशंकर परसाईं (व्यंग्य)
नेता नहीं नागरिक चाहिए – रामधारी सिंह दिनकर
आज भी खरे हैं तालाब – अनुपम मिश्र

इकाई– 2

(ख) पद्य भाग :– निर्धारित रचनाएँ :–

अयोध्यासिंह उपाध्याय 'हरिऔध' – कर्मवीर
मैथिलीशरण गुप्त – भूलोक का गौरव (भारत–भारती)
(भूलोक का गौरव....आज भी कुछ खड़े हैं।)
संदेश यहाँ मैं नहीं स्वर्ग का लाया – (साकेत–आठवाँ सर्ग)
(निज रक्षा का अधिकार उच्च फल जैसा।)
सूर्यकान्त त्रिपाठी 'निराला' – तोड़ती पत्थर
जयशंकर प्रसाद – अरूण यह मधुमय देश हमारा (चन्द्रगुप्त से)
हमारा प्यारा भारतवर्ष (स्कन्दगुप्त से)
सुभद्रा कुमारी चौहान –झाँसी की रानी
हरिवंशराय बच्चन – पथ की पहचान
शिव मंगल सिंह सुमन – परिचय (हिल्लोल से)
केदार नाथ अग्रवाल – जब–जब मैंने उसको देखा,
धरती उस किसान की
नागार्जुन – प्रेत का बयान
भवानी प्रसाद मिश्र – गीतफरोश
ताराप्रकाश जोशी – आ रे आ बादल
सरल विशारद – यही एक दर्द, अनुभूति सुख, एक अनुभूति,
परिवार के चार चित्र (खामोशी के रंग से)

इकाई– 3

1. संक्षेपण
2. लोकोक्ति, मुहावरे
3. शुद्धिकरण

(क) शब्द शुद्धिकरण
(ख) वाक्य शुद्धिकरण

इकाई– 4

1. पारिभाषिक शब्द
2. शब्द युग्म
3. पल्लवन
4. पत्र (प्रारूप)

इकाई– 5

निबन्ध लेखन – समसामयिक विषय पर निबंध लिखना।

परीक्षकों के लिए निर्देश :–

1. प्रश्न पत्र इकाइयों में विभक्त होगा।
2. प्रत्येक इकाई से निर्देशानुसार व्याख्यात्मक एवं आलोचनात्मक प्रश्न पूछे जाएंगे।
3. प्रत्येक इकाई से व्याख्यात्मक एवं आलोचनात्मक प्रश्नों को निरन्तर क्रम से पूछा जाएगा।
4. पाठ्यक्रम में कुछ न कुछ बदलाव होता रहता है। अतः परीक्षक पूर्ववर्ती प्रश्न पत्र को प्रमाण न माने।

विस्तृत अंक योजना :–

इकाई–1

(अ) चार व्याख्याएँ पूछी जाएगी जिनमें से दो व्याख्याएँ करनी होंगी।
(ब) चार आलोचनात्मक प्रश्न पूछे जाएँगे उनमें से दो प्रश्न करने होंगे।

इकाई– 2

(अ) चार व्याख्याएँ पूछी जाएगी जिनमें से दो व्याख्याएँ करनी होंगी।
(ब) चार आलोचनात्मक प्रश्न पूछे जाएँगे उनमें से दो प्रश्न करने होंगे।

इकाई–3

(अ) संक्षेपण
(ब) लोकोक्ति एवं मुहावरे
(स) शुद्धिकरण
(क) शब्द शुद्धिकरण
(ख) वाक्य शुद्धिकरण

इकाई– 4

(अ) पारिभाषिक शब्द
(ब) शब्द युग्म
(स) पल्लवन
(द) पत्र (प्रारूप)

इकाई– 5

निबन्ध लेखन। समसामयिक विषय पर पाँच विषयों में से किसी एक विषय पर निबंध लिखा जाएगा।

सहायक पुस्तकें :–

1. नगेन्द्र, (1999) साकेत : एक अध्ययन, नई दिल्ली, नेशनल पब्लिशिंग हाउस
2. नगेन्द्र, (1987) कामायनी के अध्ययन की समस्याएँ, नई दिल्ली, नेशनल पब्लिशिंग हाउस
3. शर्मा, रामविलास (1969) निराला की साहित्य साधना, नई दिल्ली, राजकमल प्रकाशन

4. शर्मा, रामविलास (1977) महावीर प्रसाद द्विवेदी और हिन्दी नवजागरण, नई दिल्ली, राजकमल प्रकाशन
5. शर्मा, रामविलास (1991) निराला, नई दिल्ली, राधाकृष्ण प्रकाशन
6. श्रोत्रिय, प्रभाकर, अतीत के हंस, मैथिलीशरण गुप्त, नई दिल्ली, राजकमल प्रकाशन
7. बाजपेयी, नन्द दुलारे, एवं प्रसाद, जयशंकर (1997) रांची, भारतीय भण्डार
8. म.प्र. हिन्दी ग्रंथ अकादमी (2009) हिन्दी कथा साहित्य (संस्करण द्वितीय) भोपाल, रवीन्द्रनाथ ठाकुर मार्ग वानगंगा
9. भारद्वाज, हेतु (सम्पा.) (2016) कहानी विविधा (प्र. सं.)
10. मुंशी, प्रेमचंद (2014) गोदान (प्र. सं.) जोधपुर, अरिहंत प्रकाशन
11. श्रीवास्तव, शिवनारायण (1951) हिन्दी उपन्यास, सरस्वती मन्दिर प्रकाशन
12. सिंह, कुँवरपाल सिंह (1976) हिन्दी उपन्यास सामाजिक चेतना. नई दिल्ली, पाण्डुलिपि प्रकाशन
13. सिंह, कुँवरपाल सिंह (1980) प्रेमचन्द और जनवादी साहित्य की परम्परा, दिल्ली, भाषा प्रकाशन

Examination of B.SC. Part I
Content of B.SC.
General English (Compulsory Subject)

Paper Code- BSC-C 102

Max. Marks – 100 **Min. Pass Marks – 36**
Internal Max. Marks –20 **Min. Pass Marks – 07**
Theory Paper – 80 **Min. Pass Marks – 29**
Duration : 3 hrs.

GENERAL ENGLISH

Objectives:

1. Students develop proficiency in English which equips them to:
2. Understand the demands of audience, course, situation and purpose and the Use of language for effective communication.
3. Analyse language in context to gain an understanding of grammar, vocabulary, spelling, punctuation and speech. Examine authentic literary and non literary texts and develop insight and appreciation.
4. Gain an understanding of study and reference skills.
5. To making students read English prose with a view to enhancing their comprehension of the language and encouraging them to develop reading habits.
6. Developing basic skills in grammar, enriching their vocabulary and enabling them to write simple and correct English.

Section - A

Grammar [**10**Marks]

- Determiners
- Tenses and Concord
- Auxiliaries
- Prepositions
- Basic Sentence Patterns

Section - B

Transformations [**10** Marks]

- Active to Passive Voice
- Simple to Compound / Complex
- Declarative into Negative/ Interrogative
- Direct to Indirect Speech

Section - C

(Comprehension) [**40**Marks]

- Comprehension of an Unseen Passage[8 Marks]
- Comprehension (from the following Texts): Comprehension based Questions of 8 Marks will be asked from Prose, Short Stories, One Act Play and Poetry each [32 Marks]

Prose

- A.P.J. Abdul Kalam: The Power of Prayer
- Martin Luther King: I have a Dream
- Albert Einstein: The World as I see it

Short Stories

- Leo Tolstoy: The Three Questions
- Ruskin Bond: A Face in the Dark

One Act Play

- Cedric Mount: Never Never Nest

Poetry

- R.N. Tagore : Heaven of Freedom
- John Donne : Death be not Proud
- Swami Vivekanand : Kali the Mother

Section - D

Written Composition [**20** Marks]

- Precis Writing [5 Marks]
- Paragraph Writing [5 Marks]
- Letter Writing Formal and Informal [5 Marks]
- Report Writing [5 Marks]

Suggested Readings:

1. Murphy, Raymond :Intermediate English Grammar (CUP) Huddleston
2. Rodney :English Grammar: An Outline (CUP)
3. Greenbaum, Sidney: The Oxford English Grammar (OUP)
4. Kamlesh S. Bhatt (Trinity): Impressions: An Approach to English.

Examination of B.SC. Part I
(Compulsory Subject)
Paper Code- BSC-C 103
ELEMENTARY COMPUTER APPLICATIONS

Max. Marks – 100	**Min. Pass Marks – 36**
Theory Paper – 50	**Min. Pass Marks – 18**
Practical - 40	**Min. Pass Marks – 14**
Internal Max. Marks –10	**Min. Pass Marks – 04**

Duration : 3 hrs.

Note:

1. Part – I Contain 60 multiple choice type question. Each question carries ½ marks.
2. Part – II Contain 05 very short types question. (one mark each)
3. Part – III Contain 03 short question (five marks each)

Learning outcomes:

On the completion of the Course, the student teacher will be able to

1. To acquaint the students with the knowledge of latest computer technology and its use in education.
2. To acquaint the students with the various computer software packages available now a days.
3. To develop the capabilities to analyse the data using computers and already developed software
4. To acquaint the students with Author ware package.
5. To develop the skills of writing programs to analyse and process the statistical data.
6. Recognise, understand and appreciate ICT as an effective learning tool for learners and as an enormous functional support.

Course Outline:

Unit - I

Computer Fundamentals:- Introduction to Information Technology, Generation of Computers, Types of computers: Micro, Mini, Mainframe, Super, Architecture of Computer System: CPU, ALU Primary Memory: RAM, ROM, Cache memory, Secondary Memories, Input/Output device, Pointing device. Number System (binary, octal, decimal and hexadecimal) and their conversions, Logic gates, Languages: machine, assembly and high level languages including 3GL, 4GL.

Unit - II

Word Processing packages: Standard features like toolbar, word wrap, text formatting, paragraph formatting, effect to text, mail merge.

Spreadsheet Packages: Type of entries, Simple arithmetic calculations, formula and statistical functions, Different types of charts, Sorting, searching, formatting, printing.

Power point :- Slide creation, slide show, adding graphics, formatting, customizing and printing.

Unit – III

Multimedia technology Introducing framework for multimedia devices, image compression standard, JPEG, MPEG ,MIDI formats.

Database Management System : Data, fields and records, information database, creation of a database file, inserting, deletion and updating of records, modifying structure, editing and browsing of records, searching, sorting and indexing of records.

Unit – IV

Concept of Operating System, need and types of operating systems: batch, single user, multiprocessing, and time sharing, introduction to Unix/Linux, Windows and its simple commands.

Type of networks, LAN, MAN and WAN, concept of topology , bridges, routers, gateways, modems, ISDN leased lines, teleconferencing and videoconferencing.

Unit – V

Internet: Concept, email services, www , web browsers, search engines, simple programs in HTML, type of HTML document, documents structures: element, type and character formatting, tables, frames and forms, E-mail.

E-Commerce: Concept of e-commerce, benefits and growth of e-commerce, e-commerce categories, e-Governance, EDI, electronic funds transfer on EDI networks Electronic payment system.

Practical:-

The laboratory exercise 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 concept only . In addition, DOS, MS Windows, MS Word, MS Excel, MS Power Point packages has to be practiced in the lab.

The practical examination scheme should be as follows:

a) Record/ Sessionals 7 marks
b) Viva-Voce 8 marks
c) Practical Exercise (DOS) 5 marks
d) Practical Exercise (MS Windows) 5 marks
e) Practical Exercise (MS Word) 5 marks
f) Practical Exercise (MS Excel) 5 marks
g) Practical Exercise (MS Power Point) 5 marks

References:

1. Computer Fundament al By P.K. Sinha (BPB Publications)
2. Computer Made Easy For Beginners (in Hindi) By Niranjan Bansal, Jayshri Saraogi
3. IT Tools and Applications By Satish Jain, Shashank Jain, Dr. Madhulika Jain (BPB Publication).
4. Rapidex computer Course, Vikas Gupta, Pustak Mahal.

Examination of B.Sc. Part I

Content B.Sc.

Environmental Studies (Compulsory Subject)

Max. Marks – 100	**Min. Pass Marks – 36**
Theory Paper – 80	**Min. Pass Marks– 29**
Internal Max. Marks –20	**Min. Pass Marks – 07**

Duration : 3 hrs.

Note: The question paper will contain 10 questions in all, i.e., two questions from each unit.Each question is divided into two Parts -Part A Part B having 12 and 4Marks respectively.Candidate has to answer Part A in about 5 pages and part B in about one page selecting one question from each section.

Learning outcome:-

After completion of the course, student will be able to:-

1. To understand background of EVS as a composite area of study that draws upon the science, social science and environ mental education.
2. To develop understanding about various ecosystems and biodiversity.
3. Helping student to develop the ability to plan comprehensive units for environmental management and conservation.
4. Understanding about the issues of conservation and environmental regeneration have
   been infused at appropriate places in all the textbooks.
4. To analyze and understand environment concerns through the process of inquiry.
5. To develop a sense of awareness about the environment hazards and its causes and remedies.

UNIT I

Introduction and Environmental Studies-

- Environmental studies: Historical background, concept, Nature and scope of EVS.
- Natural and social environment: concept, its components, and relationship,
  man& Environment, man on environment,
- Disciplinary and Multidisciplinary approach of EVS
- Renewal and Non- Renewable Resources

UNIT II

Eco-systems-

- Concept of an ecosystem.
- Structure and function of an ecosystem.
- Producers, Consumers and decomposers.
- Energy flow in ecosystem.

- Ecological Succession.
- Food Chain, Food webs and ecological pyramids.
- Introduction, types, characteristic features, structure and function of the following ecosystem-
- Forest ecosystem.
- Grassland ecosystem.

UNIT III

Biodiversity, Its Conservation

- Introduction – Definition: genetic, species and ecosystem diversity.
- Value of Biodiversity & Biodiversity at global, National & local levels.
- Hot-Spots of Bio-diversity.
- Threats to Bio-diversity: Habitat loss, poaching of wild life, man wild life conflicts.
- Conservation of Bio-diversity: In-situ and Ex-situ conservation of Bio-diversity.

Unit- IV

UNIT – II Environmental Issues:-

- Meaning, concept, process, effects and preventive action of Acid rain, Global warming and cooling.
- Natural & Manmade disasters.
- Meaning, concept, Effects and preventive action of
- Water pollution.
- Air Pollution.
- Noise Pollution.
- Land or Soil pollution.

UNIT – V

Unit – IV Environmental conservation & management:

- Meaning, concept and importance of environmental conservation & management.
- Role of women in conservation: Chipko movement, Khejri Movement.
- Consumerism and waste generation and its management.
- Agricultural / urban waste: their impact and management.

Reference:

- Kaushik,A. and Kaushik, C.P.(2004). Perspectives in Environmental studies. New Age International(P) Ltd. Publishers, New Delhi
- Goel, M.K. (2006). Paryavaran Addhyayan. Vinod Pustak Mandir, Agra.
- Rathore, H.C.S., Bhattacharya, G. C., Singh, S.K., Singh, M. and Gardia,A.(2008). Society and Environmental Ethics. Seema Press, Varanasi.

- Sharma,P.D.(2001).Ecology And Environment. Rajson Printers,New Delhi.
- Shukla, C.S.(2007). Paryavaran Shiksha. Alok Prakashan, Lucknow.
- Singh,S.K.(2006).Environmental Education.Sapna Ashok Prakashan.Varanasi.
- Singh, S.K.(2008) Environmental Education and Ethics. Amrit Prakashan.Varanasi.
- Singh, S.K.(2010). Fundamentals of Environmental Education.Sharda Pustak Bhawan. Allahabad.
- Srivastava, P. (2005) Paryavaran Shiksha, Madhya Pradesh Hindi Granth Academy, Bhopal, Pp. 195.
- NCERT (2004) Environmental Education in Schools, NCERT, New Delhi, Pp.112.
- NCERT (2011). Teachers' Handbook on Environmental Education for the Higher Secondary Stage, DESM, NCERT,New Delhi.
- Ram,P.S. and Singh,R.(2013). Paryawaran Shiksha Ke Ubharate Aayam. Sharda Pustak Bhawan, Allahabad

B. Sc. Part-I

PHYSICS

Paper-I: Relativity, Mechanics and Oscillations

BSCPH-101

Maximum Marks: 50 **External Marks: 40**

Internal: 10 Marks

Learning outcomes: -After completion of the course, student-teachers will be able:

1. Understand Newtonian mechanics, special theory of relativity.
2. Apply Newton's laws to explain natural physical phenomena.
3. Discuss on the simple harmonic motion and its equation.
4. Differentiate between damped oscillator and driven oscillator.
5. Identify the coupled oscillator and some electrically coupled oscillators.

UNIT - I

Inertial frames, Galilean Transformation, Non-inertial frames, laws of motion andmotion in uniform field, fictious forces, Displacement, velocity and acceleration in rotatingco-ordinate systems, centrifugal acceleration, coriolis force and its applications.

UNIT-II

Michelson-Morley experiment, search for ether, Postulates of the special theory ofrelativity, Lorentz transformations, length contraction, time dilation, velocity transformations,variation of mass with velocity, mass energy equivalence. Four vector formulation (qualitative only).

UNIT - III

Motion under central force, Conservation laws, Kepler's law, Gravitational law andfield.Potential due to a spherical body, Gauss and Poisson equations for gravitational self energy.

System of particles, centre of mass, equation of motion of single stage and multi stage rocket, concepts of elastic and inelastic collisions.

UNIT-IV

Rigid body motion, Rotational motion, Moment of inertia and their coefficients,Principle axes,Euler's equations.

Potential well and periodic oscillations, cases of harmonic oscillations, differential equations and its solution, Kinetic and potential energy. Simple harmonic oscillations in spring and mass system, Simple and

compoundpendulum, Torsional pendulum, Bifilar oscillations, Helmholtz resonator, LC circuits,Vibration of bar magnet, Oscillation of two masses connected by a spring.

UNIT-V

Superposition of two simple harmonic motions of same frequency along the same line, Interference, Superposition of two mutually perpendicular simple harmonic vibrations ofsame frequency, Lissajous figures, Cases of different (multiple) frequency.

Damped harmonic oscillators, Power dissipation, Quality factor, Driven harmonic os- cillator, Transient and steady state, Power absorption, Two coupled oscillations, normal modes, Effect of coupling in mechanical systems. Electrically coupled circuits, frequency response.

Text and Reference Books:

1. Resnick, R. (1971). Introduction to special relativity.(Wiley India Pvt. Ltd.,2005) Charles Kittel, Berkeley Physics Course vol.-1, Mechanics (Mc Graw-Hill,1965)
2. Stephani, H. (2004). Relativity: An introduction to special and general relativity. Cambridge university press.
3. Feynman, R. P., Leighton, R. B., & Sands, M. (1965). The Feynman lectures on physics; vol. i. American Journal of Physics, 33(9), 750-752.
4. Feynman, R. (2018). Feynman lectures on gravitation. CRC Press.
5. Bajaj, N. K. (1988). The physics of waves and oscillations. Tata McGraw-Hill Education.
6. Gambir, R.S. (2006) Mechanics (CBS Publishers and Distrubutions, New Delhi.

B.Sc. Part-I

PHYSICS

Paper-II: Mathematical Background, Properties of Matter and Electromagnetic Waves

BSCPH-102

Maximum Marks: 50 **External Marks: 40**

Internal: 10 Marks

Learning outcomes: -After completion of the course, student-teachers will be able:

1. To Understand the Scalars and Vectorsproducts & its types of product.
2. To Know about Elasticity, Small deformations, Young's modulus.
3. To Define the Kinematics of moving fluids &Equation of continuity.
4. To Understand the Faraday's law & Lenz's law.
5. Learn the electromagnetic wave and Electromagnetic field and Energy density.

UNIT – I

Scalars and Vectors: Dot & Vector products, triple vector product, gradient of scalarfield and its geometrical interpretation, divergence and curl of a vector field, line, surface andvolume integral, Flux of vector field, Gauss's divergence theorem, Green's theorem and Stokes theorem. Curvilinear Coordinates.

UNIT - II

Elasticity, Small deformations, Young's modulus, Bulk modulus and Modulus ofrigidity for an isotropic solid, Poisson ratio, relation between elastic constants, Theory of bending of beam, Cantilever, Torsion of a cylinder, Bending moment and Shearing forces.

UNIT – III

Kinematics of moving fluids, Equation of continuity, Euler's equation, Bernoulli’stheorem, Viscous fluids, Streamline and Turbulent flow, Reynold’s number, Poiseulle’s law, Capillary tube flow, Stoke’s law, Surface tension and surface energy, molecular inter pretation of surface tension, Pressure on a curved liquid surface, wetting.

UNIT-IV

Electromagnetic induction, Faraday's law (integral and differentialform), Lenz's law, Mutual and Self inductance, Transformers, Energy in astatic magnetic

field, Measurement of self inductance by Rayleigh's method, Maxwell's displacement current, Maxwell's equations, Electromagnetic fieldand Energy density.

UNIT-V

Plane electromagnetic wave in vacuum, Wave equation for E and B of linearly,circularly and elliptically polarized electromagnetic waves, Poynting vector, Boundarycondition for B, E, H & D, Frasnel’s relations(E in the plane), Reflection and refraction at a plane boundary of dielectrics, Polarization by reflection and total internal reflection,

Text and Reference Books:

1. Zil'berman, G. E. (1970). Electricity and magnetism. Elma.
2. Bleaney, B. I., Bleaney, B. I., & Bleaney, B. (2013). Electricity and Magnetism, Volume 2(Vol. 2). Oxford University Press.
3. Neittaanmäki, P., Rudnicki, M., Rudnicki, M., & Savini, A. (1996). Inverse problems and optimal design in electricity and magnetism (No. 35). Oxford University Press.
4. Resnick, R., Walker, J., & Halliday, D. (1988). Fundamentals of physics (Vol. 1). Hoboken: John Wiley.
5. Blatt, F. J., & Blatt, F. J. (1989). Principles of physics. Boston, London: Allyn and Bacon.
6. Griffiths, D. J. (2005). Introduction to electrodynamics. Prentice Hall of India A.M parties, Electomagnetic field.
7. Griffiths, D. J. (1999). Introduction to Electrodynamics Prentice-Hall. Upper Saddle River, NJ.
8. Sarwate, V. V. (1993). Electromagnetic fields and waves. Bohem press.
9. Ghosh,S. N. (2002). Electromagnetic theory and wave propagation. CRC Press.
10. Kakani and Hemrajani (2008). Electromagnetism theory and Problems, New Delhi: CBS Publishers and Distributors.

B.Sc. Part-I

PHYSICS

Paper-III: Waves, Acoustics and Kinetic Theory of Gases

BSCPH-103

Maximum Marks: 50 **External: 40**

Internal: 10 Marks

Learning outcomes: -After completion of the course, student-teachers will be able:

1. To Understand the Matter of Kinetic Theory.
2. To Know about Estimates of molecular diameter and mean free path.
3. To Define the Maxwellian distribution of law of velocity & speed in an ideal gas.
4. Discuss the group velocity and phase velocity.
5. Learn about the waves and acoustics.

UNIT-I

KINETIC THEORY OF MATTER

Ideal Gas: Kinetic model, deduction of Boyle's law, interpretation of temperature, estimationof rms speeds of molecules. Brownian motion, estimate of the Avogadro number.Equipartition of energy, specific heat of monatomic gas, extension to di-and triatomic gases,Behaviour at low temperatures.Adiabatic expansion of an ideal gas, application toatmospheric physics.

Real Gas: Van der Waals gas equation of state, nature of Van der Waals forces, comparisonwith experimental P-V curves. The critical constants of gas, Joule expansion ofideal gas, and of a Van der Waals gas, Joule coefficient, estimate of J-T cooling.

UNIT-II

Transport phenomena in gases: Molecular collisions, mean free path and collision crosssections. Estimates of molecular diameter and mean free path.Transport of mass, momentumand energy and interrelationship, dependence on temperature and pressure.

Liquifaction of gases: Boyle temperature and inversion temperature. Principle ofregenerative cooling and of cascade cooling, liquification of hydrogen and helium.Refrigeration cycles, meaning of efficiency.

UNIT-III

Maxwellian distribution of law of velocity and speed in an ideal gas: Distribution of speedsand of velocities, experimental verification, distinction between mean, rms and most probablespeed and velocity values. Doppler broadning of spectral lines.

UNIT-IV

WAVES

Waves in media: Speed of transverse waves on a uniform string, speed of longitudinal wavesin a fluid, energy density and energy transmission in waves, typical measurements. Wavesover liquid surface: ripples. Group velocity and phase velocity, their measurements.

Superposition of waves: Linear homogeneous equations and the superposition principle,nonlinear superposition and consequences.

Standing waves: Standing waves as normal modes of bounded systems, examples,Harmonics and the quality of sound; examples. Chladni's figures and vibrations of a drum.Production and detection of ultrasonic waves and applications.

UNIT-V

ACOUSTICS

Noise and Music: The human ear and its responses; limits of human audibility, intensity andloudness, bel and decibel the musical scale, temperament and musical instruments violin,sitar, flute, harmonium & tabla.

Reflection, refraction and diffraction of sound: Acoustic impedance of a medium,percentage reflection and refraction at a boundary, Measurements of frequency and velocity,impedance matching for transducers, diffraction of sound, principle of a sonar system, soundranging.

Textbooks and References:

1. S. C. Garg, K. Ghosh, S. Gupta, (2009). Oscillations and Waves (PHI Learning Pvt. Ltd.)
2. Glasstone, S. (2007). Thermodynamics for chemists. Narahari Press.
3. Bajaj, N. K. (1988). The physics of waves and oscillations. Tata McGraw-Hill Education.
4. Gambir, R.S.(2006) Mechanics (CBS Publishers and Distrubutions, New Delhi).
5. Garg, S. C. K. Ghosh, S.Gupta, (2009). Oscillations and Waves (PHI Learning Pvt. Ltd.
6. Ghosh, R.K (1975). The Mathematics of Waves and Vibrations, (Mc Milan, 1975)
7. Hołyst, R., & Poniewierski, A. (2012). Thermodynamics for chemists, physicists and engineers. Springer Science & Business Media.
8. K.S. Pitzer, L. Brewer (1961). Thermodynamcs (Mc Graw Hill Book Company).
9. Reif, F. (2009). Fundamentals of statistical and thermal physics. Waveland Press.
10. Samuel Glasston (2006). Thermodynamics for Chemists (Affiliated East West Press Pvt. Ltd., New Delhi)
11. Umezawa, H. (1995). Advanced field theory: Micro, macro, and thermal physics. AIP.
12. Yu. B. Rumer, M. Sh. Ryvkin (1980). Thermodynamics. Statistical Physics and Kinetics (Mir Publishers, Moscow).
13. Zemansky, M. W., & Dittman, R. H. (1981). Heat and Thermodynamics (International Edition). Mcgraw-Hill Book Company).

B. Sc. Part-I

PHYSICS PRACTICALS

Duration: 4 hrs Min.Pass Marks 27 Max. Marks 50

Total number of experiments to be performed by the students during the session should be 16, selecting any eight from each section. In examination two experiments are to be performed taking at least one from each section.

The distribution of marks in the practical examination will be as follows:

(i) Two experiments	30 Marks

For each experiment, distribution of marks will be as follows:

Figure:	2
Formula/Theory:	2
Observation:	7
Calculation and Result:	3
Precautions:	1
(ii) Viva voce	10
(iii) Records	10
Total	**50 Marks**

LIST OF EXPERIMENTS

Section A

- Study of conservation of momentum in two dimensional oscillations.
- Study of a compound pendulum.
- Study of damping of a bar pendulum under various mechanics.
- Study of oscillations of a mass under different combinations of springs.
- Study of bending of a cantilever or a beam
- Study of torsion of a wire (static and dynamic methods.)
- Study of flow of liquids through capillaries.
- Determination of surface tension of a liquid by different methods.
- Study of viscosity of a fluid by different methods.
- To find M.I. of an irregular body by inertia table.

- To study the random decay and determine the decay constant by statistical method.
- Determine Y by Searle's apparatus.

Section B

- Study of magnetic field due to a current
- Conversion of galvanometer into an ammeter
- Conversion of galvanometer into voltmeter.
- To determine the internal resistance of primary cell using potentiometer.
- Measurement of low resistance by Carey-Foster Bridge.
- Measurement of inductance using impedance at different frequencies.
- Measurement of capacitance using impedance at different frequencies.
- I-V characteristics of a P-N junction diode
- Determine unknown resistor by post office box.
- To determine Poisson's ratio of rubber tube.
- To determine the frequency of A.C main.

B. Sc. Part-I
MATHEMATICS
Paper I: Algebra
BSCMA-101

Maximum Marks: 66 **External: 56**

Internal: 10 Marks

Learning Outcomes:- After completion of the course, student-teachers will be able:

1. To finding the roots, derive the relation between roots and coefficients of a general polynomial in one variable.
2. To finding Rank of matrices, eigenvalue and eigenvectors of square matrices, inverse of matrices, solution of system of linear equations using matrix.
3. To know about groups, subgroups and its properties, cosets and cyclic groups with theorems on it.
4. To know about normal subgroups, fundamental theorems on homomorphism and isomorphism of groups and their properties.
5. To know about permutations and alternating groups, simple groups and order of elements in group.

UNIT-I

Relation between roots and coefficients of general polynomial equation in one variable,transformation of equations, Descarte's rule of signs, Solution of Cubic equations (CardonMethod) Biquadratic Equations(Ferrari Method).

UNIT-II

Symmetric, Skew symmetric. Hermitianand skew Hermitian matrices. Linear Independenceof row and column matrices.Row rank, Column rank, Rank of a matrix by Echelon form, thecharacteristic equation of a matrix and eigenvectors.Cayley Hamilton theorem and its use infinding inverse of a matrix.Applications of matrices to a system of linear (both homogenousand non-homogenous) equations.Theorems of consistency of a system of linear equations.

UNIT-III

Definitions and examples of groups, general properties of groups, subgroups, cyclicgroups,cosetsdecomposition, Lagrange's theorem and its consequences, Fermat's and Euler'stheorems.

UNIT-IV

Homomorphism and isomorphism of groups, normal subgroups, quotient groups.Thefundamental theorem of homomorphism.Kernel of homomorphous and its properties.

UNIT-V

Permutations groups, even, odd and cyclic permutations, transformations, the alternating group-An, Conjugacy, and simple groups. Cayles theorem. Order of an element of a groupand its properties.

REFERENCE BOOKS:

1. Chandrika Prasad : The Text Book of Algebra and Theory of Equations, Pothishala Pvt Ltd.Allahabad.
2. Vashitha, A. R: Modern Algebra, KrishnaPrakashnaMandir, Meerut.
3. Gokhrooet. Al.: Matrices (Hindi Ed.) Navkar Prakashan, Ajmer.
4. Gokhrooet. Al.: Abstract Algebra (English/Hindi Ed.)NavkarPrakashan, Ajmer.
5. P. B. Bhattacharya Basic Abstract Algebra and Others : (2nd Edition) Camb. University PressIndian Edition,1997.
6. I. N. Herstein: Topics in Algebra Wiley Eastern Ltd.New Delhi (1975).
7. Bansal, Bhargava & Abstract Algebra,Agarwal : Jaipur Publishing House, Jaipur.

B. Sc. Part-I

MATHEMATICS

Paper-II :Calculus

BSCMA-102

Maximum Marks: 66 **External: 56**

Internal: 10 Marks

Learning Outcomes:-After completion of the course, student-teachers will be able:

1. To know about pedal equation, envelope-evolutes, asymptotes and curvatures of a curve.
2. To know about partial differentiation, Euler's therem, Taylor's series of two variables and Jacobian.
3. To know about maxima-minima of functions of two or more variables and tracing of curves in Cartesian and polar curves.
4. To know about Beta-Gamma functions, change of order of integrations and transformation of coordinates in integrations.
5. To know about to finding the length, area, and volume using integrations.

UNIT-I

Pedal equation of a curve, Envelope and Evolutes, Asymptotes, Curvature: VariousFormulae, centre of curvature, chord of curvature and related problems.

UNIT-II

Partial differentiation, chain of variables, Euler's theorem on homogeneous functions,firsttwo differential coefficients of an implicit functions. Taylor's theorem for functions of two variables, Jacobians with properties.

UNIT-III

Maximum – Minimum and saddle points of functions of two and three variablesconnected by a relation. Lagrange's method of undermined multipliers. Test of concavityand convexity,points of inflexion, multiple points, curve tracing in Cartesian and polarcoordinates (standardcurves).

UNIT-IV

Differentiation and Integration under the sign of integration, Beta and Gamma functions,double integrals, change of order of integration, transformation in polar coordinates.

UNIT-V

Quadrature, rectification, volume and surface of solid of revolution. Triple integrals.Dirichlet's integrals and Liouville's extension.

REFERENCE BOOKS:

1. Gorakh Prasad : Text Book of Differential calculus,Pothishala Pvt. Ltd. Allahabad.
2. Gorakh Prasad : Text Book of Integral calculus,Pothishala Pvt. Ltd. Allahabad.
3. N. Piskunov : Differential and Integral calculus,Peace Publications, Moscow.
4. Gokhrooet. al. : Differential Calculus (English/Hindi Ed.)Navkar Prakashan, Ajmer.
5. Gokhrooet. al. : Integral Calculus (English/Hindi Ed.)Navkar Prakashan, Ajmer.
6. Erwin Kreyszig : Advance Engineering MathematicsJohm Willey and sons 1999.

B. Sc. Part-I

MATHEMATICS

BSCMA-103

Paper-III: Vector Calculus and Geometry

Maximum Marks: 68 **External: 58**

Internal: 10 Marks

Learning Outcomes:-After completion of the course, student-teachers will be able:

1. To know about vector differentiation of scalar and vector point functions.
2. To know about vector integration and theorems of Green, Gauss, Stokes and their verifications.
3. To know about tracing of conics in polar and Cartesian coordinates.
4. To know about equations of sphere, cone and cylinder.
5. To know about tangent and normal planes on ellipsoid and paraboloid.

UNIT-I

Scalar and Vector point functions, vector differentiation, directional derivatives, gradient,divergence and curl. Identities involving these operators and related problems.

UNIT-II

Vector integration, theorems of Stokes, Green, Gausses and problem based on them(Statement and verifications)

UNIT-III

General equations of second degree in two dimensions, Tracing of conics, Polar equations ofconics: tangents, normal equations, asymptotes, chord of contact, pole and polar.

UNIT-IV

Sphere, cone and cylinder.

UNIT-V

Central conicoid: Ellipsoid, tangent planes, polar planes, polar lines, enveloping cone, enveloping cylinder, sections with given centre. Normals, conjugate diameters and diameteral planes and their properties. Paraboliod tangent plane, diameters, diameteral planes.Normals. Plane section of conicoids.

REFERENCE BOOKS:

1. Murray R. spiegal : Vector Analysis SchaumPublishing Co. , New York.
2. N. Saran and S. N. Nigam : Introduction to Vector AnalysisPothishala Pvt. Ltd.Allahabad.
3. Shanti Narian : A text book of Vector CalculusS. Chand & Co. New Delhi.
4. Gokhrooet. al. : Vector Calculus (English/Hindi Ed.) Navkar Prakashan, Ajmer.
5. N.Saran and R. S. Gupta : Analytic Geometry of three dimension Pothishala Pvt. Ltd. Allahabad.
6. Shanti Narian : Analytic Solid Geometry. S. Chand & Co. New Delhi.
7. Golaset. al. : Analytic Solid Geometry.
8. Gokhrooet. al. : Coordinate Geometry (English/Hindi Ed.) Navkar Prakashan, Ajmer.

B. Sc. Part-I

CHEMISTRY

Paper-I: Inorganic Chemistry
BSCCH-101

Maximum Marks: 50 **External Marks: 40**

Internal: 10 Marks

Note: The paper is divided in five independent units. Two questions will be set from each unit. The candidates are required to attempt one question from each unit.

Learning outcomes: -After completion of the course, student-teachers will be able:

1. To understandprinciples of Atomic structure and Chemical Bonding.Get familiar with chemistry of main group elements.
2. To apply the principles of Acids and Bases in real life situation.
3. To determinethe crystal structure of NaCl, KCl and CsCl (Laue's method and powder method).
4. To define the characteristics of different type of bond.
5. To define the Basic properties of main group elements&Transition Elements.

Unit I

Atomic Structure and Bonding

A. **Atomic Structure**: Idea of de-Broglie matter waves, Heisenberg uncertainty principle, atomic orbitals, Schrödinger wave equation, significance of Ψ and Ψ^2, quantum numbers, radial and angular wave functions and probability distribution curves, shapes of s, p, d, orbitals.

B. **Structure and Bonding**: Covalent Bond -Valence bond theory and its limitations, directional characteristics of covalent bond, various types of hybridization and shapes of simple inorganic molecules and ions, valence shall electron pair repulsion (VSEPR) theory to NH_3, H_3O^+, SF_4, CIF_3, I^-, Cl^- and H_2O, MO theory, homonuclear and heteronuclear (CO and NO) diatomic molecules, multicenter bonding in electron deficient molecules, bond strength and bond energy, percentage ionic character from dipole moment and electro- negativity difference.

Unit II

Chemistry of main group elements

A. **S-Block Elements**: Comparative study, diagonal relationship, salient features of hydrides, solvation and complexation tendencies including their function in biosystems, an introduction to alkyls and aryls.

B. **P-Block Elements:** Comparative study (including diagonal relationship) of groups 13-17 elements, compounds like hydrides, oxides, oxy acids and halides of group 13-16, hydrides of boron-diborane and higher boranes, borazine, borohydrides, fullerenes, carbides, fluorocarbons, silicates (structural principle), tetrasulphur, tetra nitride, basic properties of halogens, interhalogens and polyhalides.

C. **Chemistry of Noble Gases**: Chemical properties of the noble gases, chemistry of xenon, structure and bonding in xenon compounds.

Unit III

Ionic compounds: Bonding and Structure

A. **Ionic solids** – Ionic structures, radius ratio effect and coordination number, limitation of radius ratio rule, lattice defects, semiconductors, lattice energy 18 and Born-Haber cycle, solvation energy and solubility of ionic solids, polarizing power and polarisability of ions, Fajan's rule, Metallic bond-free electron, valence bond and band theories.

B. **Structure of Ionic solids:** Definition of space lattice, unit cell; Laws of crystallography – (i) Law of constancy of interfacial angles,
(ii) Law of rationality of indices
(iii) Law of symmetry, Symmetry elements in crystals. X-ray diffraction by crystals, Derivation ofBragg equation, Determination of crystal structure of NaCl, KCl and CsCl (Laue's method and powder method).

C. **Weak Interactions**- Hydrogen bonding, van der Waals forces.

Unit IV

Acids and Bases Theories of Acids and Bases:

A. Arrhenius, Bronsted-Lowry, the Lux-Flood, solvent system and Lewis concept of acids and bases. Solvent system of acid and bases with special reference to liquid Ammonia, liquid BrF3

B. **Concept of Hard and Soft Acids and Bases (HSAB):** Classification of acids and bases as hard and soft, Pearson's HSAB concept, acid-base strength and hardness and softness, Symbiosis, theoretical basis of hardness and softness, electro negativity and hardness and softness.

C. **Solvent Systems**: Physical properties of a solvent, types of solvents and their general characteristics reactions in non-aqueous solvents with reference to liquid NH3 and liquid SO2.

Unit-V

Chemistry of Transition Elements

A. Chemistry of Elements of First Transition Series: Characteristic properties of d block elements, properties of the elements of the first transition series, their binary compounds (hydrides, carbides and oxides) and complexes with respect to relative stability of their oxidation states, coordination number and geometry.
B. Chemistry of Elements of Second and Third Transition Series: General characteristics, comparative treatment of Zr/Hf, Nb/Ta, Mo/W in respect of ionic radii, oxidation states, magnetic behaviour, spectral properties and stereochemistry.

Textbooks and References

1. Lee, J.D. Concise Inorganic Chemistry, ELBS.
2. Douglas, B.E. and Mc Daniel, D.H., Concepts & Models of Inorganic Chemistry
3. Day, M.C. and Selbin, J. Theoretical Inorganic Chemistry, ACS Publications.
4. Shriver and Atkins Inorganic Chemistry, W. H. Freeman and Company
5. James Huheey, Inorganic chemistry: Principles of Structure and Reactivity, Pearson Education India
6. B.N. Figgis, J.E Huheey, P.W. Atkins Inorganic Chemistry, Pearson Education
7. Duward Shriver, Inorganic Chemistry, W. H. Freeman
8. Gary Wulfsberg, Inorganic Chemistry, University Science Books
9. A. R. West, Solid State Chemistry and its Applications, Wiley

B. Sc. Part-I

CHEMISTRY
Paper-II: Organic Chemistry
BSCCH - 102

Maximum Marks: 50 **External Marks: 40**

Internal: 10 Marks

Learning outcomes: -After completion of the course, student-teachers will be able:

1. To understand the spectroscopy of Organic Compounds
2. To Know about the Heterocyclic compounds.
3. To Know about the basics of Aminoacids, peptides, proteins and nucleic acids.
4. To Know about the Synthetic Polymer & Synthetic Dyes.
5. To Know about the Fats oil and detergent.

Unit-I

Spectroscopy: Nuclear magnetic resonance (NMR) spectroscopy, paramagnetic resonance (1H NMR) spectroscopy, linear shielding and deshielding chemical shift and molecular structure, spin-spin splitting and coupling constants, areas of signal, interpretation of PMR, simple organic molecules such as ethyle bromide, ethanol, acetal dehyde 1,1,2 tribromomethane, ethyleacetate, toluene and acetophenone.Problems pertaining to the structure elucidation of the simple organic compound using UV, IR and NMR spectroscopic technique

Unit-II

Heterocyclic Chemistry: Nomenclature, Preparation and properties of compound having one heteroatom with five and six number ring (Pyrrole, Thiophene, Furan and Pyridine).

Fats, oil and detergent: Natural fats, edible oils of vegetable origin, common fatty acids, glycerides, hydrogenation of unsaturated oils, saponification value, iodine value, acid value, soaps, synthetic detergent, alkyl and aryl sulphonates.

Unit-III

Amino acids, peptides, proteins and nucleic acids: Classification, structure and stereochemistry of amino acids, Acid base behaviour, Electrophoresis, Preparation and Reaction of an amino acid, structure and nomenclature of peptides and proteins, classification of proteins, peptide structure, determination, end group analysis, selective hydrolysis of protein, level of protein structure, protein denaturation/ renaturation

Nucleicacid: Introduction, constitution of nucleic acid, ribonucleosides and ribonucleotides, the double helical structure of DNA

Unit-IV

Nitrogen containing compounds and enolates

Nitroalkane and nitroarenes: Preparation ofnitroalkane and nitroarenes. Chemical reaction of nitroalkanes, mechanism of nucleophilic substitution in nitroarene and their reduction in acidic, neutral and alkaline medium. Picirc acid, Halonitroarenes reactivity.

Amines: Structure and nomenclature amines, physical properties, stereochemistry of amines, separation of a mixture of primary, secondary and tertiary amines, structural features affecting basicity of amines, amine salts as phase transfer catalyst, preparation of alkyl and aryl amines (reduction of nitro compounds, nitriles), reductive amination of aldehydic and ketonic compounds, Gabriel-Phthalimide reaction, Hoffmann Bromamide reaction. Reaction amine-electrophilic aromatic substitution in aryl amine, Reaction of amines with nitrous acid, synthetic transformation of aryl diazonium salt, ezo coupling.

Unit-V

Synthetic Polymer: Chain growth polymerization- Free radical vinyl polymerization, ionic vinyl polymerization, Ziegler–Natta polymerization and vinyl polymers, condensation or step growth polymerization, polyester, polyamides, phenol formalaldehydes, raisins, urea, formalaldehyde raisin, an epoxy raisin and polyurethanes

Synthetic dyes: Colour and constitution (electronic concept), classification of dye. Chemistry and synthesis of methyl orange Congo red, malachite green, crystal violet, phenolphthalein, alizarin and indigo

Textbooks and References

1. Sharma Y. R. elementary organic spectroscopy: principles and chemical applications paperback.
2. Mehta and Mehta, Organic chemistry, PHI
3. Donald L. Pavia Gary M. Lampman George S. Kriz James A. Vyvyan, Introduction to Spectroscopy, 5th Edition.
4. Bahl B S & Bahl Arun 5000 Solved Problems in Organic Chemistry, S. Chand Publishing.
5. Madan R L, Chemistry for Degree Students B.Sc. 3Rd Year S. Chand Publishing.
6. Nafis Haider S, Fundamental of Organic Chemistry, S. Chand Publishing.

B. Sc. Part-I

CHEMISTRY
Paper III: Physical Chemistry
BSCCH-103

Maximum Marks: 50 **External Marks: 40**

Internal: 10 Marks

Learning outcomes: -After completion of the course, student-teachers will be able:

1. To understand Nuclear chemistry, behaviour of gases and liquid and colloidal States.
2. To get familiar with Solutions, Dilute Solutions and Colligative Properties.
3. To apply the principles of concept of Equilibrium in real life situation.
4. To determine the liquid crystal, solid and liquid, Classification, structure of nematic and cholestric phases.

Unit-I

Mathematical Concepts and Nuclear Chemistry

Mathematical Concepts: Logarithmic relations, curve sketching, linear graphs and calculation of slopes, differentiation of functions like Kx,, sin x, lxima and minima, partial differentiation andreciprocity relations, Integration of some useful/relevant functions; permutations and combinations, Factorials, Probability.

Nuclear Chemistry: Radioactive decay: decay law, disintegration constant, half-life and average life, alpha and beta disintegration reactions, group displacement law, nuclear reactions fission, fusion, artificial radioactivity, applications of radioactivity, nuclear power, carbon dating, biological effects of various types of radiations, nuclear chemistry for peace, Nuclear chemistry in Medicine and diagnostic techniques.

Unit –II

Behaviour of gases

Gaseous States: Postulates of kinetic theory of gases, deviation from ideal behaviour, Vander Waals equation of state;

Critical Phenomena: PV isotherms of real gases, continuity of states, the isotherms of van der Waals equation, relationship between critical constants and

van der Waals constants, the law of corresponding states, reduced equation of state.

Molecular velocities: Root mean square, average and most probable velocities, Qualitative discussion of the Maxwell's distribution of molecular velocities, collision number, mean free path and collision diameter, Liquification of gases (based on Joule – Thomson effect).

Unit III

Liquid and Colloidal States

Liquid State: Intermolecular forces, structure of liquids (a qualitative description).Structural differences between solids, liquids and gases, Liquid crystals: Difference between liquid crystal, solid and liquid, Classification, structure of nematic and cholestric phases, Thermography and seven segment cells.

Colloidal States: Definition of colloids, classification of colloids, Solids in liquids (sols): properties – kinetic, optical and electrical; stability of colloids, protective action, Hardy-Schulze law, gold number. Liquids in liquids (emulsions): types of emulsions, preparation, Emulsifier, Liquids in solids (gels): classification, preparation and properties, inhibition, general application of colloids, colloidal electrolytes.

Unit IV

Solutions, Dilute Solutions and Colligative Properties

Ideal and no-ideal solutions, methods of expressing concentrations of solutions, activity and coefficient.Dilute solutions, colligative properties, Raoult‘s law relative lowering of vapour pressure, molecular weight determination. Osmosis, law of osmotic pressure and its measurement, determination of molecular weight from osmotic pressure.Elevation of boiling point and depression of freezing point.Thermodynamic derivation of relation between molecular weight and elevation in boiling point and depression in freezing point.Experimental methods for determining various colligative properties.

Unit V

Concept of Equilibrium

Chemical Equilibrium: Equilibrium constant and free energy. Thermodynamic derivation of law of mass action. Le Chatelier‘s

principle.Reaction isotherm and reaction isochore Clapeyron equation and Clausius – Clapeyron equation, applications.

Phase Equilibrium: statement and meaning of the terms – phase, component and 20 degree of freedom, derivation of Gibbs phase rule, phase equilibria of one component system-water, CO_2 and S systems. Phase equilibria of two component system – solid – liquid equillibrium, simple eutectic-Bi-Cd, Pb-Ag systems, and desilverisation of lead. Solid solutions compound formation with congruent melting point (Mg-Zn) and incongruent melting point, (NaCl- H_2O), ($FeCl_3$-H_2O) system. Freezing mixtures, acetone-dry ice. Liquid-liquid mixturesIdeal liquid mixtures, Raoult‘s and Henry‘s law. Non-ideal systemazeotropes- HCl-H_2O and ethanol–water systems. Partially miscible liquids–Phenol-water, trimethylamine-water, nicotine-water systems.Lower and upper consolute temperature. Effect of impurity on consolute temperature.Immiscible liquids, steam distillation.Nernst distribution law- thermodynamic derivation, applications.

Textbooks and References :

1. Engel, Physical Chemistry, Pearson Publications.
2. Mary Anne White, Physical Properties of Materials, Taylor & Francis second edition.
3. D N Bajpai, Advanced Physical Chemistry, S. Chand Publishing
4. S Lewis and D Gladstone, Elements of Physical Chemistry, Macmillan.
5. Peter Atkins Julio de Paula, Atkins' Physical Chemistry Oxford University Press.

B. Sc. Part-I

CHEMISTRY PRACTICAL

Duration: 5 Hours Min. Pass Marks: 18 Max. Marks: 50

Distribution of Marks

Exercises		Marks
1.	Semi-micro analysis of Inorganic mixture containing three cations and three anions in given mixture.	10
2.	Laboratory techniques	7
	(ii) Purification of the given organic compounds by crystallization (charcoal) sublimation and determination of its m.p. Or Determination of mixed melting points using urea-cinnamic acid mixtures of given compositions.	7
3.	One Physical Chemistry Experiment	10
4	Vice-voce	8
5.	Records	8
	Total	50 marks

A. Inorganic Chemistry Semi micro analysis: Detection of the presence of three cations and three anions (including interfering) in a given mixture qualitatively.

B. Organic Chemistry: Laboratory techniques

1. Calibration of Thermometer Naphthalene (80-82°C), Acetanilide (113.5-114°C), Urea (132.5-133°C), Distilled Water (100°C)
2. Distillation a. Simple distillation of ethanol-water mixture using water condenser b. Distillation of nitrobenzene and aniline using air condenser
3. **Crystallization**
   a. Concept of induction of crystallization
   b. Phthalic acid from hot water (using fluted filter paper and stem less funnel)
   c. Acetanilide from boiling water
   d. Naphthalene from ethanol
   e. Benzoic acid from water

4. **Decolourisation and crystallization using charcoal**
    a. Decolourisation of brown sugar (sucrose) with animal charcoal using gravity filtration.
    b. Crystallization and decolorisation of impure naphthalene (100g of naphthalene mixed with 0.3g of Congo Red using 1g decolorizing carbon) using ethanol.
5. **Sublimation** (simple and Vacuum) Camphor, Naphthalene, phthalic acid and Succinic acid.
6. **Determination of melting point/ boiling points**
    a. Determination of melting point: Naphthalene, Benzoic acid, Urea, Succinic acid, Cinnamic acid, Salicylic acid, Acetanilide, m-Dinitrobenzene p- Dichlorobenzene, Aspirin.
    b. Determination of boiling points: Ethanol, Cyclohexane, Toluene, Aniline and Nitrobenzene.

C. Physical Chemistry

I. Chemical Kinetics

a. To determine the specific reaction rate of the hydrolysis of methyl acetate/ethyl acetate catalyzed by hydrogen ions at room temperature.
b. To study the effect of acid strength on the hydrolysis of an ester.
c. To compare the strength of HCI and H_2SO_4 by studying the kinetics of hydrolysis of ethyl acetate.
d. To study kinetically the reaction rate of decomposition of iodide by H_2O_2

II. Colloids. a. To prepare arsenious sulphide sol and compare the precipitating power of mono -, bi- and trivalent anions.

III. Viscosity

a. To determine the percentage composition of a given mixture (non interacting systems) by viscosity method.
b. To determine the percentage composition of a given binary mixture by viscosity method (acetone & ethyl methyl ketone)

IV. Surface Tension

a. To determine the surface tension of amyl alcohol in water at different concentrations and calculate the excess of these solutions.
b. To determine the percentage composition of a given surface tension binary mixture by surface tension method (acetone & ethyl methyl ketone).

B. Sc. Part-I
ZOOLOGY
Paper I: Non-Chordata
BSCZO-101

Maximum Marks: 50 **External: 40 Marks**

Internal: 10 Marks
Learning outcomes: -After completion of the course, student-teachers will be able:

- To understand invertebrates, the organizational hierarchies and complexities, the evolutionary trends in external morphology and internal structure; identification and classification with examples, to enable them to understand various modes of adaptations in animals.
- To get familiar with various kind of nonchordata Amoeba to Asterias.
- To apply the General principles of taxonomy and classification in real life situation and further studies.

Unit – I

- General principles of taxonomy and classification. Outline classification of Protozoa up to order.
- General Structural organization of Amoeba, Euglena and Plasmodium.
- Habit and habitat, structure, nutrition, osmoregulation and reproduction of Paramecium
- Locomotion in Protozoans- pseudopodial, ciliary and flagellar.
- Nutrition in Protozoa
- Reproduction in Protozoa.

Unit –II

- Outline classification of Porifera and Coelenterata up to order.
- Habit and habitat, morphology, internal structure, reproducation of Sycon
- Canal system and skeleton in Sponges
- Habit, habitat, morphology, internal structure, nutrition and reproducation of Obelia
- Polymorphism in coelenterates, coral reefs.

Unit –III

- Outline classification of Platyhelminthes and Nematheminthes up to order.
- Habit and habitat, morphology, internal structure, reproduction and life – cycle of Fasciola, and Ascaris
- Parasitic adaptations in Helminthes

Unit – IV

- Outline classification of Annelida and Arthropoda up to order.
- Habit and habitat, structure, nutrition, respiration, circulation, excretion, nervous system and reproduction ofHirudinaria *Palaemon*
- Peripatus: structure and affinities
- Mouth parts and feeding habits of Insects.
  Peripatus: structure and affinities
  Mouth parts and feeding habits of Insects.

Unit – V

- Outline classification of Mollusca and Echinodermata up to order
- Habit and habitat, structure, nutrition, respiration, blood vascular system, excretion, nervous system and reproduction of Pila
- Torsion in Gastropoda
- Habit and habitat, structure, nutrition, respiration, blood vascular system, excretion, nervous system and reproduction of Asterias
- Larval forms of Echinoderms.
  .

Textbooks References

1. Barnes, R. D. (1987). *Invertebrate zoology* (No. Ed. 5). WB Saunders company.
2. Brooks, W. K. (1882). *Handbook of invertebrate zoology: for laboratories and seaside work*. SE Cassino.
3. Brooks, W. K. (1882). *Handbook of invertebrate zoology: for laboratories and seaside work*. SE Cassino.
4. Curtis, W. C., Guthrie, M. J., & Jeffers, K. R. (1938). *Textbook of general zoology*. Wiley.
5. Hegner, R. W., &Engemann, J. G. (1968). *Invertebratezoology*(No. QL362 H4 1968). Macmillan.
6. Hyman, L. H. (1940). *The invertebrates: mollusca I*(Vol. 6). McGraw-Hill.
7. Jordan, E. L., &Verma, P. S. (1996). Invertebrate Zoology sixth revised and Enlarged edition. *S. Chand and Company, Ltd. 857pp*.
8. Jordan, E. L., &Verma, P. S. (2009). *Invertebrate zoology*. S. Chand & Company.
9. Light, S. F. (1941). *Laboratory and field text in invertebrate zoology*. Associated Students Store, University of California.
10. McEdward, L. (2020). *Ecology of marine invertebrate larvae*. CRC press.
11. Parker, T. J., & Haswell, W. A. (1967). *Textbook of zoology*. Macmillan International Higher Education.
12. Scott-Ram, N. R., & Scott-Ram, N. R. (1990). *Transformed cladistics, taxonomy and evolution*. Cambridge University Press.
13. Sedgwick, A. (1905). *A Student's Text-book of Zoology*(Vol. 2). Allen & Unwin.
14. Verma, P. S. (2001). *Invertibrate Zoology*. S. Chand Publishing.
15. Willmer, P. (1990). *Invertebrate relationships: patterns in animal evolution*. Cambridge University Press.
16. Zoology, I. by EL Jordan And PS Verma, Publisher: S. *Chand And Company*.

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B. Sc. Part-I

ZOOLOGY

PAPER II: Animal Cell Biology And Genetics

BSCZO-102

Maximum Marks: 50 **External Marks: 40**

Internal: 10 Marks

Learning outcomes -

After completion of the course, student-teachers will be able:

1. To comprehend the modern concepts and applied aspects of Cell Biology and modern concepts of Genetics and to create awareness regarding inheritance.
2. To appreciate the role and significance of cell in human welfare and environment;

Unit – I

- **Introduction of cell:** Discovery, characteristics of prokaryotic (bacterial) and eukaryotic cells (plant and animal cells), cell theory, viruses and viroids.
- **Cell membrane:** Ultra structure, chemical composition, models, unit membrane concept, fluidity, glycocalyx and functions of cell membrane. Modifications (specializations) of plasma membrane. Transport across cell membrane: Passive transport (osmosis, diffusion), facilitated (mediated) diffusion; active transport (primary and secondary) and Endocytosis and Exocytosis.
- **Mitochondria:** Morphology, ultra structure, chemical composition, functions, origin, electron transport chain and generation of ATP molecules.

Unit –II

- **Ultrastructure, types, chemical composition, origin and functions of:**
  ER and Golgi-complex
  Lysosome, Ribosome
  Centriole,
  Cilia and flagella

Unit- III

- **Nucleus:** occurrence, number, shape, size and structure (nuclear envelopes, nuclear matrix and nucleolus)
- **Chromosomes:** Introduction, discovery morphology, structure (chromatids, primary and secondary constrictions, nucleolar organizer and

telomeres) types. Chemical composition and functions. Chromosomal organizations: Euchromatin, heterochromatin, nucleosome concept.

- **Cell reproduction:** Cell cycle, phases, process and significances of mitosis and meiosis.
- **Chromosomal mutations-**
  Variation in chromosome number (aneuploidy and euploidy)
  Structural changes in chromosomes (delection, duplication, inversion and translocation).

Unit – IV

- **Mendelian principles of inheritance-** monohybrid and dihybrid cross, back cross and test cross.
- **Deviation of Mendelism–** incomplete dominance, codominance and lethal genes, modification of 3: 1 and 9: 3: 3: 1 with examples and problems.
- **Gene interactions:** Epistasis, complementary, supplementary, duplicate genes with cumulative effects and collaborator genes.
- **Multiple alleles:**Characters, examples, pseudoalleles, inheritance of A, B, AB, O and Rh blood groups (antibody reactions)

Unit –V

- **Sex-determination**: Genetic (sex chromosome, genic balance and haplo-diploidy mechanisms), hormonal and environmental control of sex determinations with examples.
- **Sex-linked inheritance:** white eye color in Drosophila, colour blindness and hemophilia in man.
- **Linkage**: Definition difference between linkage and independent assortment, chromosomal theory of linkage, kinds, linkage groups and significances.
- **Crossing over:** Definition, mechanism, theories, kinds, frequency, factors affecting crossing over and significances.

Textbooks and References

1. Alberts, B., Johnson, A., Lewis, J., Raff, M., Roberts, K., & Walter, P. (2015). *Molecular biology of the cell*. Garland Science. *New York*, 1227-1242.
2. Blomquist, G. J., & Bagnères, A. G. (Eds.). (2010). *Insect hydrocarbons: biology, biochemistry, and chemical ecology*. Cambridge University Press.
3. Conklin, K. F., Doerfler, W., Grafstron, R. H., Groudine, M., Hamilton, D. L., Jaenisch, R., ...&Langner, K. D. (2012). *DNA methylation: biochemistry and biological significance*. Springer Science & Business Media.
4. Gupta, P. K. (2005). *Cell and molecular biology*. Rastogi Publications.
5. Karp, G. (2007). *Cell and Molecular Biology*. John Wiley & Sons Incorporated.
6. Karp, G. (2009). *Cell and molecular biology: concepts and experiments*. John Wiley & Sons.
7. Kotpal, R. L. (1967). *Annelida*. Rastogi Publications.
8. Lodish, H., Berk, A., Kaiser, C. A., Krieger, M., Scott, M. P., Bretscher, A., & Matsudaira, P. (2008). *Molecular cell biology*. Macmillan.
9. Rosen, F. S., Steiner, L., &Unanue, E. (1989). *Macmillan dictionary of immunology*.
10. Tripathi, G. (2010). *Cellular and Biochemical Science*. IK International Pvt Ltd.
11. WILSON, E. B. K., & Walker, J. (2005). Biochemistry and Molecular biology. *Kuudespainos*.

B. Sc. Part-I

ZOOLOGY

PAPER III: Molecular Genetics

BSCZO-103

Maximum Marks: 50 **External: 40**

Internal: 10 Marks

Learning outcomes: -After completion of the course, student-teachers will be able:

1. To Comprehend the modern concepts and applied aspects of molecular genetics biotechnology and instrumentation.
2. To get familiar with Concept of gene expression, spectrophotomenty and gene amplification.
3. To apply the principles of electrophoresis in separation technique of proteins and apply the primciples spectrophotometer in real life situation.

Unit – I

Introduction, concept and development of Molecular Genetics & Genetic engineering.

Unit – II

Nucletic acids: DNA (prokaryotic and eukaryotic)-Structure, forms, chemical composition functions and units of DNA, Genetic Code, Replication of DNA

Unit –III

RNA: Genetic RNA, non – genetic RNAs (mRNA, tRNA, and rRNA) – Structure and functions.

Unit –IV

Gene mutation: nature of mutation, types of mutation and causes of mutation. DNA repair: mismatch repair, direct repair, base-excision, nucleotide-excision repair and other types of DNA repair. Genetic diseases and faulty DNA repair.

Unit –V

Gene expression: Transcription and translation of prokaryotes and eukaryotes. Regulation of gene expression in prokaryotes (Lac and tryptophan operon)

Textbooks and References

1. Alberts, B., Johnson, A., Lewis, J., Raff, M., Roberts, K., & Walter, P. (2015). *Molecular biology of the cell*. Garland Science. *New York*, 1227-1242.
2. Blomquist, G. J., &Bagnères, A. G. (Eds.). (2010). Insect hydrocarbons: biology, biochemistry, and chemical ecology. Cambridge University Press.
3. Conklin, K. F., Doerfler, W., Grafstron, R. H., Groudine, M., Hamilton, D. L., Jaenisch, R, & Langner, K. D. (2012). DNA methylation: biochemistry and biological significance. Springer Science & Business Media.
4. Gupta, P. K. (2005). Cell and molecular biology. Rastogi Publications.
5. Karp, G. (2007). Cell and Molecular Biology. John Wiley & Sons Incorporated.
6. Karp, G. (2009). Cell and molecular biology: concepts and experiments. John Wiley & Sons.
7. Kotpal, R. L. (1967). Annelida. Rastogi Publications.
8. Lodish, H., Berk, A., Kaiser, C. A., Krieger, M., Scott, M. P., Bretscher, A., & Matsudaira, P. (2008). Molecular cell biology. Macmillan.
9. Rosen, F. S., Steiner, L., &Unanue, E. (1989). Macmillan dictionary of immunology.
10. Tripathi, G. (2010). Cellular and Biochemical Science. IK International Pvt Ltd.
11. WILSON, E. B. K., & Walker, J. (2005). Biochemistry and Molecular biology. Kuudespainos.

B. Sc. Part-I
ZOOLOGY PRACTICAL

Duration: 4 Hours **Max. Marks: 50**

Course Content

- **Study of museum specimens:** with respect to levels and patterns of organization biosytematics. Biodiversity, adaptations, development stages, population dynamics, ecological implications etc.

  Porifera: Sycon, Spongilla, Euplectella, Leucosolnia, Hylonema, Hypospongia, Euspongia:

  Coeleterata: Hydra, Tubularia, Millepora, Physalia, Porpita, Vellela, Aurelia, Tubipora, Alcyonium, Metridium, Pennatula, Grantia, Fungia, Gorgonia.

  Helminthes: Fasciola, Taenia solium, Planaria, Ascaris, Ancyclostoma

  Annelida: Nereis Heteroneresis, Aphrodite, Chaetoptreus. Arenicola, Pheretima, Hirudinaria

  Arthropoda: Palaemon, Eupagurus, Scolopendra, Apis, Peripatus.

  Mollusca: Chiton, Pila, Aplysia, Helix, Dentalium, Mytilus, Pinctada, Unio, Sepia,

  Loligo Octopus.

  Echinodermata: Antedon, Holothuria, Cucumaria, Astropecten, Asterias, Echinus
- **Microscope:** Simple and compound microscope, working mechanism and maintenance.
- **Study of Permanent slides:**

  Paramecium, ParameciumConjugation, paramecium binary fission, Euglena, Vorticella, Sycon- L.S., Sycon T.S., Hydra L.S., Hydra T.S, Cercaria larva, Metacercaria, Miracidium larva, Sporocyst larva, Redia larva, Ascaris male and female T.S., T.S. thorough, pharynx region, Gizzard and intestinal region of Earthworm, T.S. through buccal cavity of Hirudinaria, Crustacean larva- Zoea, Metazoea, Nauplius, Mysis, T.S. of gill of Unio, T.S. of the shell & mantle of Unio. Glochidium larva of Unio.
- **Dissections** and/or its demonstration through Charts/Models/Video/CD/digital alternative etc and/or preparation of working models of the different systems of the following animals.

  Earthworm: Alimentary canal Nervous system, Reproductive system

  Leech: Alimentary canal

  Cockoach: Mouthparts, Digestive system, nervous system

  Prawn: Nervous system

Pila: Nervous system

- **Microsopic preparation or their observation of the following:-**
  Paramecium, Eunglena, Sponge-spicules, gemmules, Obelia, Hydra, parapodium of Nereis, statocyst of Prawn, mouth parts of Cockroach, radula of Pila, gill of Unio.
- Study of bacterial and eukaroytic cell
- Slides of sub cellular components(Cell organelles)
- Erythrocyte plasma membrane permeability.
- Study of Karyotype and Idiogram of man.
- Study of Barr Bodies in human buccal epithelial cells.
- Drosophila culture and life cycle.
- Sexual Dimorphism in Drosophila, Identification of wild or mutant varieties.
- Study of salivary gland chromosomes of Drosophila
- Problems on pedigree analysis.
- Meiotic studies of testes of cockroach.
- Isolation of milk protein form the milk sample.
- Separation of serum by using centrifuge
- Estimation of protein by Biuret Method.
- Separation of plasma by centrifugation.
- Preparation and use of culture media for microbes.
- Media preparation media sterilization and inoculation.
- Qualitative tests for carbohydrates.
- Qualitative test for proteins.
- Qualitative test for lipids.

Note:

- Use of animals for dissection is subject to the conditions that these are not banned under the Wildlife Protection Act or any other legislation.
- Students are required to submit the following during examination.
- One assignment on the instrument/ technique about its principle, working, precautions and applications, and /or reagents / solutions preparation.
- Report on study of animals from their natural habitat from their local surroundings. Vermicompost etc.

Guidelines/ Instructions for Practical Examination

Max. Marks: 50 **Time allowed: 4 Hrs.**

S. No.	Exercise	Marks
1.	Dissection* (Exposition, labeled diagram)	**6**
2.	Temporary mounting –one (Staining, identification, sketch	**3**
3.	Museum specimens – five(identification and classification	**10**
4.	Permanent slides – two or four(Identification with reasons)	**4**
5.	Preparation of chromosome slide (root tip/grasshopper testis)	**5**
6.	Drosophila spotting / pedigree	**5**
7.	Practical record and slides	**5**
8.	Viva	**4**
9.	Project report and assignment	**8**
* as per UGC guidelines		

B. Sc. Part-I
BOTANY
PAPER –I: Diversity of Microbes and Lower Plants
BSCBO-101

Maximum Marks: 50 **External Marks: 40**
Internal: 10 Marks
Learning outcomes:-After completion of the course, student-teachers will be able:

1. To acquaint students with the diversity that exists in microorganisms;
2. To understand the morphology, organization, structure, and reproduction in microbes;
3. To know about the role and significance of microbes in human welfare & environment;
4. To know the symptoms of selected diseases caused by microbes.

Unit – I

- **Viruses and Bacteria:** Structure, Multiplication, transmission and disease symptoms of viruses, Structure and economic importance of mycoplasma, Bacteria structure, nutrition, reproduction and economic importance, Gram‘s staining, Disease sysmptom of bacteria in plants e.g.:- Citrus Canker, Viruses e.g.:- Mosaic Viruses disesse in tobacco.
- General account and economic importance of Cyanobacteria.

Unit II

- **Fungi:** General characters, occurrence, classification (Alexopolus and Mims, 1979; G. C. Ainswort,1986), Types of mycelia, structure of fungal cell, fungal flagella, Nutrition and economic importance of fungi. Host-parasite interaction, Control of plant diseases. Disease Symptoms of Fungi in Plants.

Unit III

Structure reproduction and life history of:

- Mastigomycotina –Synchytrium&Phytophthora
- Ascomycotina – Saccharomyces,Eurotium,Peziza
- Basidiomycotina – Puccinia, Agaricus, Ustilago
- Deuteromycotina – Alternaria, Cercospora, Colletotrichum, General account and economic importance of Lichens

Unit- IV

- **Algae:** General characters, occurrence, classification (Fritsch, 1935), Pigmentconstitution, fine structure of algal plastids, life-cycles, Origin and evolution of sex and thallus in algae.
- Cyanophyceae: Life Cycle of Nostoc, Anabaena and Oscillatoria

Unit V

Structure, reproduction and evolutionary significance of following genera:

- Chlorophyceae: Chlamydomonas, Volvox, Oedogonium, and Coleochaete
- Xanthophyceae: Vaucheria,
- Phaeophyceae: Ectocarpus, Sargassum
- Rhodophyceae: Polysiphonia

Suggested Readings:

1. Dube, H. C. (1990). Fungi, general characteristics. *An introduction to fungi, 2nd revised edn. Vikas, New Delhi*, 11-146.
2. Hays, J. (1986). *Genetics of bacteria*: Edited by J. Scaife, D. Leach, and A. Galizzi. New York: Academic Press. (1985).
3. Mudd, J. B. (Ed.). (2012). *Responses of plants to air pollution*. Elsevier.
4. Odom, J. M., & Singleton, R. (1993). *The sulfate-reducing bacteria: contemporary perspectives* (pp. 189-210). New York: Springer-Verlag.
5. Sharma, O. P. (1986). *Textbook of algae*. Tata McGraw-Hill Education.
6. Sharma, O. P. (1992). *Textbook of Thallophyta*. McGraw Hill Pub. Co.
7. Sharma, P. D. (1991). *The Fungi*. Rastogi Publications.
8. Sharma. P.D. 1991. The Fungi. Rastogi & Co. Meerut.
9. Smith Jr, J. P. (2018). The Herbarium.
10. Smith, GM. (1971). Cryptogamic Botany. Algae & Fungi. Vol. 1 New Delhi: Tata McGraw Hill Publishing Co.

B. Sc. Part-I

BOTANY

Paper- II: Diversity of Cryptogams (Bryophytes & Pteridophytes)

BSCBO-102

Maximum Marks: 50 **External Marks: 40**

Internal: 10 Marks

Learning outcomes:-After completion of the course, student-teachers will be able:

1. To acquaint students with the diversity that exists in cryptogams.
2. To understand the morphology, organization, structure, and reproduction in cryptogams.
3. To appreciate the role and significance of cryptogams in human welfare and environment.
4. To study the Geological time scale, fossils and fossilization processes, significance of fossils.

Unit- I

- General characters, distribution, origin of the land habit in plants, classification, Evolutionary trends in thallus and sporophyte development, Alternation of generations, classification, and Economic importance of Bryophytes.

Unit- II

- Structure, reproduction, and evolutionary significance of following genera: Hepaticopsida – Riccia, Marchantia
- Anthocerotopsida – Anthoceros, Bryopsida - Funaria

Unit-III

- General characters, distribution, classification, stelar evolution, heterospory and origin of seed habit, and life cycles in pteridophytes.
- Structure, reproduction and evolutionary significance of the following genera:Psilotum,Lycopodium

Unit- IV

- Structure, reproduction and evolutionary significance of the following genera: Selaginella, Equisetum,Pteris and Marsilea.

Unit- V

- Geological time scale, fossils and fossilization processes, significance of fossils. Study of the following form genera of fossils
- Rhynia
- Calamites

Suggested Readings

1. Arnold, C. A. (2013). *An introduction to paleobotany*. Read Books Ltd.
2. Dube, H. C. (1990). Fungi, general characteristics. An introduction to fungi, 2nd revised edn. Vikas, New Delhi, 11-146.
3. Sharma, P. D. (1991). The Fungi. Rastogi Publications.
4. Sharma. P.D. 1991. The Fungi. Rastogi & Co. Meerut.
5. Smith, GM. (1971). Cryptogamic Botany. Algae & Fungi. Vol. 1 New Delhi: Tata McGraw Hill Publishing Co.
6. Stewart, W. N., Stewart, W. M., Stewart, W. N., & Rothwell, G. W. (1993). Paleobotany and the evolution of plants. Cambridge University Press.
7. Stewart, W. N., Stewart, W. M., Stewart, W. N., & Rothwell, G. W. (1993). Paleobotany and the evolution of plants. Cambridge University Press.

B. Sc. Part-I

BOTANY

Paper- III: Molecular Biology & Genetic Engineering

BSCBO-103

Maximum Marks: 50 **External Marks: 40**

Internal: 10 Marks

Learning outcomes:-After completion of the course, student-teachers will be able:

1. To understand & explain the concept of Molecular biology & Genetic Engineerig in plant
2. To get familiar with concept of cellular totipotencey
3. To explain the concept of Methods and applications in agriculture, horticulture, pharmaceuticals,
4. To implement the application of Genetic Engineerig in real life.

UNIT- I

Tools and Techniques in Plant Tissue Culture, Media Preparations, Solid media, Liquid media.

UNIT- II

Sterilization techniques, sterilization of glasswares and medium, Aseptic manipulation and Culture maintenance.

UNIT- III

Inoculation and Sub culture, Concept of Cellular totipotency, Methods of application of micro propagation, Haploid production, Zygotic embryo culture, Endosperm Culture, Somatic embryogenesis and Synthetic Seeds.

UNIT- IV

An Overview of Genetic Engineering, Tools & Techniques of genetic engineering, recombinant DNA technology.

UNIT- V

Methods and applications in agriculture, horticulture, pharmaceuticals, Genetic markers, PCR, Concept of genomics and proteomics, application of biotechnology.

Suggested Readings:

1. Vasil. I.K. and Thorpe, T.A. 1994, Plant Cell and Tissue Culture, Kluwer Academic Publishers, The Netherlands.
2. Kochar, S.L. 1998. Economic Botany in Tropics 2 nd edition. Macmillan India Ltd. New Delhi.
3. Simpson. B.B. and Conner-Ogorzaly, M. 1986.

B. Sc. Part-I
BOTANY
PRACTICALS

Duration– 4 Hours **Maximum Marks - 50**

Course Content:

- Study of the genera included in Theory syllabus of Algae and Fungi by making temporary micro preparations and observation of permanent slides.
- Observation of disease symptoms in host infected by Fungi, Bacteria, Viruses and Mycoplasma. Section cutting of diseased material and identification of the pathogens as per the theory syllabus.
- Study of morphology, anatomy and reproductive structures of genera included in Bryophytes and Pteridophytes by making temporary micro preparations and observation of permanent slides.
- Gram staining of bacteria.
- Study of crustose, foliose & fruticose Lichens.
- Maintenance & submission of a record of all the Laboratory activities.

1. Basic requirements of a tissue culture laboratory. (a) Common Glassware, (b) test tubes, culture tubes and screw-capped tubes, (c). Petridish (d). Pipette (e). Pasteur pipette (f) Erlenmeyer (b) flask (g).Volumetric flask (h) Cleaning glassware (i).Inoculation needle and inoculation loop (j). Bunsen burner (Spirit-lamp), (k) water baths (l). Autoclaves. (m) laminar air flow (n) Incubator (o) Hot air oven (p) Colony counter (q) pH meter (r) Electric balance (s) Spectro photometer (t) Centrifuse (u) binocular Microscope.
2. Method of using balance Preparation of temporary cotton plug Preparation of permanent cotton plugs. Preparation of culture media a) Preparation of liquid medium (broth) b) Preparation of Solid media (PDA medium and plates) c) Preparation of agar slants. d) Preparation of agar deep tubes.
3. Methods of Sterilization.
4. Demonstration of the techniques of micro-propagation by using different explants, e.g. axillary buds, shoot meristems etc. Objectives: To develop the molecular and biotechnological techniques and to develop skills of preparing media, separation of nucleic acids and culture of animal cells. Course Contents:
   a) Study of DNA by Fulgent reaction in the salivary gland chromosomes.
   b) Isolation of genomic DNA

c) Molecular separations by chromatography, electrophoresis, precipitation etc.
d) Isolation of milk protein form the milk sample.
e) Separation of serum by using centrifuge
f) Estimation of protein by Biuret Method.
g) Separation of plasma by centrifugation.
h) Separation of biomolecules by paper and gel chromatography.
i) Preparation and use of culture media for microbes.
j) Media preparation media sterilization and inoculation.
k) Cell culture techniuques- Design and functioning of tissue culture laboratory, cell proliferation measurements, culture media preparation and cell harvesting methods.

5. Isolation and staining of bacteria.
6. Determination of pH value of different water samples, blood urine and slaiva.
7. Qualitative tests for carbohydrates, Proteins & Lipids.
8. Effects of temperature on the activity of enzyme.)
9. Chart, model Power point/multimedia presentation preparation related to evidence of evolution Human /Horse evolution , Geographical time scale etc.

MARKING SCHEME

There shall be a practical examination of four hours duration and the distribution of marks shall be as follows:

1. A suitable stained section of plant part either of Bryophyte or Pteridophyte Marks: 10
2. Minor preparation of Bryophyte or Pteridophyte(not covered in Q.1) Marks: 08
3. Preparation and mounting of the part of :
   a) A Bryophyte. Marks: 05
   b) A Fungus
   c) An Alga
   d) Bacteria
4. Spots: six (a) One from each group (Algae, Lichen, Bryophytes, Fungi, Fossil, and Pteridophytes, plant-pathogens). (b) One microbiological experiment for comments. Marks: 12
5. Viva-Voce Marks: 05
6. Practical Record Marks: 10

B. Sc. Part-II

Physics

Paper-I: Electricity and Magnetism

BSCPH-201

Maximum Marks: 50 **External Marks: 40**

Internal: 10 Marks

Learning outcomes:-After completion of the course, student-teachers will be able:

1. To acquire a broad conceptual framework ofelectromagnetic phenomenon.
2. To evaluate and understand the difference between steady and alternating current.
3. To get familiar with concepts of force on a moving charge.
4. To apply their Knowledge of Magnetic Fields of Matter in higher study.

Unit – I

Electrostatics: Coulomb's law, calculations of E for simple distributions of charges at rest, dipole and quadrupole fields, Work done on a charge in an electrostatic field, conservative nature of the electrostatic field, Electric potential, relation between electric field and electric potential, torque on a dipole in a uniform electric field and its energy, flux of the electric field, Gauss's law and its application for finding E for symmetric charge distributions, Gaussian pillbox, Fields at the surface of conductor, Screening of E field by a conductor, capacitors, electrostatic field energy, force per unit area of the surface of conductor in an electric field, conducting sphere in a uniform electric field, point charge in front of a grounded infinite conductor.

Unit –II

Dielectrics: Parallel plate capacitor with a dielectric, dielectric constant, polarization and polarization vector, displacement vector D, molecular interpretation of Claussius-Mossotti equation, boundary conditions satisfied by E and D at the interface between two homogenous dielectrics: illustration through simple examples.

Unit –III

Electric Currents (steady and alternating): Steady current, current densityJ, non-steady currents and continuity equation, Kirchoff's law and analysis of multi-loop circuits, rise and decay of current in LR andCR circuits, decay constants, transients in LCR circuits, AC circuits, complex numbers and its application in solving AC circuit problems, complex impedance and reactance,

Measurement of capacitance using impedance at different frequencies, series and parallel resonance, Q factor, power consumed by an AC circuit, power factor, Y and networks and transmission of electric power.

Unit-IV

Magnetostatics: Force on a moving charge: Lorentz force, equation and definition of B, force on a straight conductor carrying current in a uniform magnetic field, Torque on a current loop, magnetic dipole moment, angular momentum and gyromagnetic ratio. Motion of charged particles in electric and magnetic fields. Linear accelerator, E asdeflecting field-CRO, sensitivity.Transverse B field, curvatures of tracks for energy determination of nuclear particles, principle of a cyclotron.Mutually perpendicular E and B fields, massspectrograph, velocity selector, its resolution.Response curve for LCR circuit and resonance frequency, quality factor.

Unit – V

Magnetic Fields in Matter: Biot-Savart law, calculation of H in simple geometrical situations, Ampere's Law, the divergence and curl of B, field due to a magnetic dipole, magnetization current, magnetization vector, magnetic permeability (linear cases), interpretation of a bar magnet as a surface distribution of solenoidal current, the field of a magnetized object.

Textbooks and references:

1. Griffith, D. J., & Ruppeiner, G. (1981). Introduction to electrodynamics.Prentice-Hall of India). Reitz and Milford; Electricity and Magnetism (Addison-Wesley).
2. Halliday and Resnik (2010). Physics, Vol-2 (Wiley Eastern)
3. Mahajan, A. S., & Rangwala, A. A. (2001). Electricity and magnetism. Tata McGraw-Hill Education.
4. Portis, A. M. (1978). Electromagnetic fields: sources and media. Wiley.
5. Pugh, E. M. (1960). Principles of electricity and magnetism.Addison-Welsley). Panofsky and Phillips; Classical Electricity and Magnetism (India Book House).
6. Purcell, E. M. (1985). Berkeley Physics Course: Electricity and Magnetism. McGraw-Hill.
7. Halliday and Resnik; Physics, Vol 2.(Wiley Eastern)
8. Portis, A. M. (1978). Electromagnetic fields: sources and media. Wiley.
9. Pugh, E. M. (1960). Principles of electricity and magnetism. Addison-Welsley).
10. Purcell, E. M. (1985). Berkeley Physics Course: Electricity and Magnetism. McGraw-Hill.
11. D. Halliday and R. Resnick, Physics, vol. 2, Wiley Eastern, New Delhi.
12. D.J.Grifth"Introductiontoelectrodynamics",(PrenticeHallofIndia.)
13. Electricity and Magnetism by K.K. Tewari (S. Chand & Company Limited).

B. Sc. Part-II

Physics

Paper-II: Statistical Physics and Thermodynamics

BSCPH-202

Maximum Marks: 50 **External Marks: 40**

Internal: 10 Marks

Learning outcomes:-After completion of the course, student-teachers will be able:

1. Get familiar with the statistical basis of thermodynamics and laws of universal.
2. Differentiate between M.B. statistics, B-E statistics & F-D statistics.
3. To get familiar with the laws of thermodynamics.
4. To apply the principles of laws of thermodynamics in real situations.
5. To learn about the Blackbody radiation.

Statistical Physics

Unit - I

Phase space, micro and macro states, the statistical basis of thermo-dynamics: The mu(μ) space representation, division of mu space into energy sheets and intophase cell of arbitrary size, Probability and thermodynamic probability, principle of equal apriori probabilities, probability distribution and its narrowing with increase in number ofparticles. The expressions for average properties. Constraints, accessible and in accessible states, distribution of particles with a given total energy into a discrete set of energy states. The mono atomic ideal gas. The barometric relations.

Unit - II

Some universal laws: Equilibrium before two systems in thermal contact, bridge with macroscopic physics.Probability and entropy, Boltzmann entropy relation.Statistical interpretation of second law of thermodynamics.Boltzmann canonical distribution law and its applications; rigorous form of equipartition of energy.

Transition to quantum statistics: 'h' as a natural constant and its implications, cases of particle in a one-dimensional box and one-dimensional harmonic oscillator. Indistinguish ability of particles and its consequences, M.B., Bose-Einstein, and Fermi-Dirac statistics and their comparision.

Unit -III

Thermodynamics

The laws of thermodynamics: The Zeroth law, various indicator diagrams, workdone by and on the system, first law of thermodynamics, internal energy as a state function, reversible and irreversible changes, Carnot cycle and its efficiency, Carnot theorem and the second law of thermodynamics, Different versions of the second law, practical cycles used in internal combustion engines, Entropy, principle of increase of entropy, The thermodynamic scale of temperature, its identity with the perfect gas scale, Impossibility of attaining the absolute zero temperature, third law of thermodynamics.

Unit - IV

Thermodynamic relationships: Thermodynamic variables-extensive and intensive, Maxwell's general relationships, application to Joule – Thomson expansion and adiabatic cooling in a general system, Van der Waals gas, Clausius-Clapeyron heatequation, Thermodynamic potentials and equilibrium of thermodynamical systems, relation with thermodynamical variables, Cooling due to adiabatic demagnetization, production and measurement of very low temperatures.

Unit - V

Blackbody radiation: Pure temperature dependence, Stefan-Boltzmann law, pressure of radiation, Spectral distribution of blackbody radiation, Wein 's displacement law, Rayleigh-jean's law, Planck's quantum postulates, Planck's law, complete fit with experiment, interpretation of behaviour of specific heats of gases at low temperature.

Textbooks and References:

1. Glasstone, S. (2007). Thermodynamics for chemists. Narahari Press.
2. Hirschfelder, J. O., Curtiss, C. F., Bird, R. B., & Mayer, M. G. (1964). Molecular theory of gases and liquids (Vol. 165). New York: Wiley.
3. Hołyst, R., & Poniewierski, A. (2012). Thermodynamics for chemists, physicists and engineers. Springer Science & Business Media.
4. K.S. Pitzer, L. Brewer (1961). Thermodynamcs (Mc Graw Hill Book Company).
5. Reif, F. (2009). Fundamentals of statistical and thermal physics. Waveland Press.
6. Umezawa, H. (1995). Advanced field theory: Micro, macro, and thermal physics. AIP.
7. Yu. B. Rumer, M. Sh. Ryvkin (1980). Thermodynamics. Statistical Physics and Kinetics (Mir Publishers, Moscow).
8. Zemansky, M. W., & Dittman, R. H. (1981). Heat and Thermodynamics (International Edition). Mcgraw-Hill Book Company).

B. Sc. Part-II

Physics

Paper-III: Optics and Lasers

BSCPH-203

Maximum Marks: 50 **External Marks: 40**

Internal: 10 Marks

Learning outcomes: -After completion of the course, student-teachers will be able:

1. To know thebackground, properties of matter and electromagnetic waves.
2. To get familiar with concepts of scalars and vectors.
3. To apply the principles of Construction, Working principle and Applications of laser induction in real situations.
4. To learn the Interference of a light, optics, Polarization and Optical Rotationand lasers.

Unit - I

Optics

Fermat's Principle: Principle of extremum path and application to laws of reflection refraction.

General theory of image formation: Cardinal points of an optical system, general relationships, thick lens and lens combinations.

Aberration in images: Chromatic aberrations, achromatic combination of lenses incontact and separated lenses, Monochromatic Aberration and corrections, aplanatic points of a spherically refracting surface and sphere, oil immersion objectives, meniscus lens.

Optical instruments: Entrance and exit pupils, Need for a multiple lens, eyepiece, common types of eyepieces.

Unit – II

Interference of a light: Division of wavefront and division of amplitude, Theprinciple of superposition, two-slit interference, Fresnel biprism, thin film interference, Newton‘s rings, its application of interference in determination of wavelength and precision measurements.Michelson interferometer, itsapplication for precision determination of wavelength, wavelength difference and the width of spectral lines, Fabry-Perot interferometer.

Unit - III

Fresnel diffraction: Fresnel half-period zones, Types of zone plates, Circularaperture, Circular disc, Diffraction at a straight edge, Construction and working principle of Zone plate and its application as a lens.

Fraunhofer diffraction: Phasor diagram, Diffraction at a single slit, double slits &N parallel slits and their intensity distribution, plane diffraction grating, reflection grating and blazed grating, Concave grating and different mountings, diffraction at a circular aperture.Rayleigh criterion of Resolution, resolving power of Telescope, Microscope, Grating and Prism.

Unit - IV

Polarization and Optical Rotation: Meaning and representation of Polarized light, Types of polarized light, Production of Polarized light, Brewster law, Malus law, double refraction, Phase retardation plates, Analysis of Polarized light as plane polarized, circularly polarized and Elliptically polarized light, Rotation of plane of polarization, Specific rotation and its experimental determination, Polarimeter (Laurent and Biquartz).

Unit – V

Lasers: Laser systems, Purity of a spectral line, coherence length and coherence in time, spatial coherence of a source, Einstein's A and B coefficients. Spontaneous and induced emissions, conditions for laser action, population inversion, Ruby laser, He-Ne laser and Semiconductor laser, Applications of laser.

Holography & Nonlinear optics: Hologram, construction and reproduction mathematical analysis, principle of self focusing, principle of fiber optics and types of optical fiber.

Textbooks and References:

1. Akhmanov, S. A., & Nikitin, S. Y. (1997). Physical optics. Clarendon Press.
2. Jenkinsand White;"Fundamental of Optics "(McGraw-Hill).
3. Smith and Thomson; "Optics" (JohnWileyand Sons).
4. Boyd, R. W. (2019). Nonlinear optics. Academic press.
5. Brewer, R. (Ed.). (2012). Laser spectroscopy. Springer Science & Business Media.
6. Hann, R. A., & Bloor, D. (Eds.). (1989). Organic materials for non-linear optics. London: Royal Society of Chemistry.
7. Jenkins, F. A., & White, H. E. (1937). Fundamentals of optics. Tata McGraw-Hill Education.
8. Longhurst, R. S. (1970). Geometrical and physical optics. Orient BlackSwan.
9. Martin, B. R., & Shaw, G. (2017). Particle physics. John Wiley & Sons.
10. Walls, D. F., & Milburn, G. J. (2007). Quantum optics. Springer Science & Business Media.
11. Wood, R. W. (1905). Physical optics. Macmillan.

B. Sc. Part-II

PHYSICS-PRACTICALS

Duration:4 hrs **Min.PassMarks:27** **Max. Marks: 50**

Total number of experiments to be performed by the students during the session should be 16, selecting any eight from each section. In examination two experiments are to be performed taking at least one from each section.

The distribution of marks in the practical examination will be as follows:

(i) Two experiments	30 Marks

For each experiment, distribution of marks will be as follows:

Figure:	2
Formula/Theory:	2
Observation:	7
Calculation and Result:	3
Precautions:	1
(ii) Viva voce	10
(iii) Records	10
Total	**50 Marks**

LIST OF EXPERIMENTS

Section: A

- Determination of wavelength using Biprism.
- Determination of wavelength of light using diffraction grating.
- Michelson's inter ferometer and determination of D1& D2.
- To find out he wave length of a monochromatic source of light using Newton's rings and find there fractive index of liquid.
- Determine the specific rotation of sugar solution by Polarimeter.
- Find out the melting point of a given substance using platinum resistance thermometer.
- Determine thermal conductivity of a bad conductor by Lee's method.

- Determine the thermo dynamic constant (γ) using Clements's and Desormas method.
- Study of variation of total thermal radiation with temperature.
- Determination of Resolving Power of Telescope.
- Determine wavelength of laser light using a diffraction grating.
- Determination of wavelength of Mercury source.

Section: B

- Study thermo emf versus temperature of a thermo couple. Find the neutral temperature and use it to find temperature of an unknown substance.
- Study the magnetic field along the axis of a current carrying circular coil for different currents. Plot the observations on a graph and find out the radius of a circular coil.
- Determination of band gap using a junction diode.
- Measurement of inductance of a coil by Anderson's bridge.
- Measurement of Capacitance and dielectric constant of a liquid by Desauty bridge.
- Study of decay of currents in LR and RC circuits.
- Response curve for LCR circuit and resonance frequency and quality factor.
- Determination of power factor (Cos θ) of a given coil using CRO.
- Determination of velocity of sound in air by standing wave method using speaker microphone and CRO.
- Determine the Ballistic constant of a ballistic galvanometer.
- Determination of a small thickness by interference method.

B. Sc. Part-II
Mathematics
Paper-I: Abstract Algebra
BSCMA-201

Maximum Marks: 66 **External: 56**

Internal: 10 Marks

Learning Outcomes:-After completion of the course, student-teachers will be able:

1. To know about ring, integral domain and fields, their properties, homomorphisms and quotient fields.
2. To know about ideals and their properties, quotient rings, Euclidean rings and unique factorization domain.
3. To know about vector spaces and sub-spaces, basis and dimension of a vector spaces and their properties.
4. To know about linear transformations and their matrix representations and rank-nullity theorem, change of basis and dual spaces.
5. To know about eigenvalue-eigenvectors of a linear transformations and diagonalization of matrices.

Unit - I

(Ring theory)

Introduction to Rings, Zero divisors, Integral Domain and Fields, their examples andproperties.Characteristic of a ring and integral domain. Sub rings, subfields, Prime field,Ringhomomorphism, Embedding of Rings, Field of quotients of an integral domain.

Unit - II

Ideals and their properties.Principal ideal and principal ideal ring, Prime ideal, Maximalideal. Ideals and Quotient rings, Euclidean rings, Unique Factorization Domain, Polynomialrings, Remainder theorem, factor theorem, Polynomials over the rational fields.

Unit - III

(Linear Algebra)

Vector Spaces: Definition and examples of a vector spaces, subspaces, sum and direct sumof subspaces, linear span, linear dependence, Independence and their basic properties, Basis,finite dimensional vector spaces, Existence theorem for basis, invariance of the number ofelements of a basis set, Dimension, existence

of complimentary subspace of a subspace of afinite dimensional vector space, dimension of sums of subspaces, quotient space and its dimension.

Unit - IV

Linear transformations : Linear Transformations and their representation as matrices, thealgebra of linear transformations, the Rank-Nullity theorem, change of basis, Dual space,Dual Basis, Bidual space, Adjoint of a linear transformation, Annihilator of a sub space.

Unit - V

Eigen values and Eigen vectors, similar matrices, equivalent matrices, Similarity of Linear transformations, Reduction to triangular form, Minimal Polynomial. Diagonalization of Matrices.

Books Recommended for Reference:

1. I.N. Herstein : Topics in Algebra.
2. Lang, S. : Linear Algebra.
3. Hoffman & Kunz : Linear Algebra.
4. A.R. Vashistha : Modern Algebra.
5. Gokhroo et. al. : Ring Theory (English / Hindi Edn.).
6. Gokhroo et. al. : Linear Algebra (English / Hindi Edn.).

B. Sc. Part-II
MATHEMATICS
Paper-II: Real Analysis
BSCMA-202

Maximum Marks: 66 **External: 56**

Internal: 10 Marks

Learning Outcomes:- After completion of the course, student-teachers will be able:

1. To know about limit, continuity and types of discontinuities of one and two variable functions.
2. To know about differentiability of two variable functions, mean value theorems and Taylor's theorems for two variable functions.
3. To know about Riemann integration and fundamental theorems on calculus.
4. To know about real sequences and series, their convergence and tests for convergence.
5. To know about Uniform convergence of series of functions, Improper Integrals and Fourier series.

Unit - I

Limit $\varepsilon - \delta$ definition of the limit of a function, Limit of functions of one and two variables, Continuity, classification of discontinuities, Sequential continuity, Properties of continuous functions, Uniform continuity, Continuity of functions of two variables.

Unit - II

Differentiability, Chain rule of differentiability, Differentiability of functions of twovariables, Darboux's intermediate value theorem for derivatives, Mean Value Theorems and their geometrical interpretations, Taylor's theorem with various forms of remainders,Taylor's theorem for functions of two variables.

Unit - III

Riemann integral, Partition, Darboux sums, Lower and Upper integrals, Integrability of continuous and monotonic functions. the fundamental theorem of Integral Calculus, Meanvalue theorems of Integral Calculus.

Unit - IV

Real sequence, definition, Theorems on limits of sequences, Bounded and mono tonic sequences, Cauchy's convergence criterion.Infinite Series of non negative terms, Comparison tests,Cauchy's nth root test, Ratio tests,Raabe's, logarithmic,

De Morgan and Bertrand’s testsAlternating series, Leibnit’z theorem,Absolute and conditional convergence.

Unit - V

Uniform convergence of series of functions, Weirestrass M-test, Abel’s and Dirichlet’s testfor uniform convergence. Improper integrals and their convergence, Comparison tests,Abel’s andDirichlet’s tests, Fourier Series, Fourier expansion of piecewise monotonicfunctions.

Books Recommended:

1. Real Analysis : Shanti Narayan.
2. Real Analysis : G. N. Purohit.
3. Real Analysis : Bhargava & Goyal.
4. Advanced Calculus : Gokhroo et. al. (English / Hindi Ed.).
5. Theory of Convergence : Gokhroo et. al. (English / Hindi Edn.)Navkar Prakashan, AJMER.

B. Sc. Part-II

MATHEMATICS

Paper-III: Differential Equations

BSCMA-203

Maximum Marks: 68 **External: 58**

Internal: 10 Marks

Learning Outcomes:- After completion of the course, student - teachers will be able:

1. To know about degree and order of a differential equation and finding solution of first order differential equations in various forms.
2. To know about finding the solutions of linear differential equations with constant coefficients, simultaneous and total differential equations.
3. To know about method variation of parameters and series solution of linear differential equations of second order, solutions of Legendre, Bessel and Hypergeometric equations.
4. To know about solutions of some special forms of partial differential equations and solutions of first order PDE by Charpit's method.
5. To know about classifications of linear PDE of second order and solutions of linear PDE with constant coefficients, Monge's method.

Unit - I

Degree and order of a differential equations, Equations of first order and first degree, Equations in which the variables are separable, Homogeneous equations, Linear equations and equations reducible to the linear form, Exact differential equations, Integrating Factors, First order and higher degree equations solvable for x, y, p, Clairaut's form and Singular solutions, Geometrical meaning of a differential equation, Orthogonal trajectories.

Unit - II

Linear differential equations with constant coefficients, Homogeneous Linear ordinary differential equations, Ordinary simultaneous differential equations, Total differential equations.

Unit - III

Linear differential equations of Second order, Transformation of the equation by changing dependent variable/the independent variable. Methods of variation of parameters.Series solution of differential equations, Power series method, Bessel, Legendre and Hypergeometric equations, Bessel, Legendre and Hyper geometric functions and their properties.

Unit - IV

Partial differential equations of the first order, Lagrange's solution, Some special type ofequations which can be solved easily by methods other than the general method, Charpit's general method of solution.

Unit - V

Partial Differential equations of second order and higher orders, Classification of linear Partial differential equations of second order, Homogeneous and non homogeneous equations with constant coefficients, Partial differential equations reducible to equations with constant coefficients, Monge's methods.

Books Recommended:

1. Differential Equations: Ray and Chaturvedi.
2. Differential Equations: Sharma and Gupta.
3. Differential Equations: Bansal and others.
4. Ordinary Differential Equations: Gokhroo et. al. (English / Hindi Ed.).
5. Partial Differential Equations: Gokhroo et. al. (English / Hindi Edn.) Navkar Prakashan, Ajmer.

B. Sc. Part-II

CHEMISTRY
Paper-I: Inorganic Chemistry
BSCCH-201

Maximum Marks: 50 **External Marks: 40**

Internal: 10 Marks

Learning outcomes -After completion of the course, student-teachers will be able:

1. To know the background, properties of organometallic compounds.
2. To get familiar with concepts of coordination compounds, chemistry of lanthanide and actinids.
3. To apply the principles of thermodynamics stability of metal complexes and factors affecting the stability.
4. To learn the Stability of Metal complexes and Oxidation Reduction.

Unit I

Coordination Compounds Werner's coordination theory and its experimental verification, effective atomic number concept, chelates, nomenclature of coordination compounds, isomerism in coordination compounds, valence bond theory of transition metal complexes. Limitations of valance bond theory, an elementary idea of crystal field theory, crystal field splitting in octahedral, tetrahedral and square planner complexes, factors affecting the crystal-field parameters.

Unit II

Chemistry of Lanthanide and Actinides

Chemistry of Lanthanide: Occurrence and separation, Electronic structure, oxidation states and ionic radii and lanthanide contraction, spectral and magnetic properties, complex formation and applications.

Chemistry of Actinides: Electronic configuration, oxidation states, actinide contraction, complex formation spectral and magnetic properties, applications. Chemistry of separation of Np, Pu and Am from Uranium, similarities between the later actinides and later lanthanides.

Unit III

Organometallic compounds: Definition, nomenclature and classification of organometallic compounds, Preparation, properties, bonding and applications of alkyls and aryls of Li, Al, Hg, Sn and Ti, a brief account of metal-ethylene complexes and homogenous hydrogenation.

Unit IV

Carbonyls and Nitrosyls

Metallic carbonyls: Metallic carbonyls General methods of Preparation, general properties, structure and nature of Metal carbonyls, bonding in carbonyls, Effective atomic number (EAN) rules as applied to metallic carbonyls. 18-electron rules applied to metallic carbonyls. Preparation, properties and structure of nickel tetracarbonyl, iron penta carbonyls, chromium hexa carbonyls, dimanganese deca carbonyl, dicobalt octa carbonyl.

Metallic nitrosyls: Some metallic notrosyls: Metal nitrosyl carbonyls, metal nitrosyl halides, sodium nitroprusside (Preparation properties, structures and uses) structure and nature of M-N bonding in nitorsysl. Effective atomic number (EAN) rules as applied to metallic nitrosyls.

Unit V

Stability of Metal complexes and Oxidation Reduction

Thermodynamic and Kinetic Aspects of Metal Complexes: A brief outline of thermodynamics stability of metal complexes and factors affecting the stability, stability constants of complexes and their determination, substitution reactions of square planar complexes.

Oxidation Reduction: Use of redox potential data-analysis of redox cycle, redox stability in water – Frost, Latimer and Pourbaix diagrams. Principles involved in the extraction of the elements.

Text books and Reference books:

1. R. C. Mehrotra and A. Singh Organometallic Chemistry:A Unified Approach, Wiley.
2. A. G. Sharp Inorganic Chemistry, Pearson.
3. Bell and Lott Modern approach to Inorganic chemistry, Van Nostrand.
4. G. L. Miessler and D. A. Tarr Inorganic Chemistry, Prentice Hall.
5. Cotton and Wilkinson Advanced Inorganic Chemistry, 6th Edition, Wiley.
6. Lee, J.D. Concise Inorganic Chemistry, ELBS.
7. Douglas, B.E. and Mc Daniel, D.H., Concepts & Models of Inorganic Chemistry.
8. Day, M.C. and Selbin, J. Theoretical Inorganic Chemistry, ACS Publications.
9. Shriver and Atkins Inorganic Chemistry, W. H. Freeman and Company.
10. James Huheey, Inorganic chemistry: Principles of Structure and Reactivity, Pearson Education India.
11. B.N. Figgis, J.E Huheey, P.W. Atkins Inorganic Chemistry, Pearson Education.

B. Sc. Part-II

CHEMISTRY
Paper II: Organic Chemistry
BSCCH-202

Maximum Marks: 50 **External Marks: 40**

Internal: 10 Marks

Learning outcomes: -After completion of the course, student-teachers will be able:

1. To know the background, properties of Fundamentals of Organic Chemistry.
2. To get familiar with concepts of isomerism and Types of isomerism.
3. To apply the principles of IUPAC nomenclature of branched and unbranched alkanes.
4. To learn the Cycloalkenes, Dienes, Alkynes.

Unit I

Fundamentals of Organic Chemistry

Structure and Bonding: Hybridization, bond lengths and bond angles, bond energy, localized and delocalized chemical bonding, van der Waals interactions, inclusion compounds, clatherates, charge transfer complexes, resonance, hyper conjugation, aromaticity, inductive and field effects, hydrogen bonding.

Mechanism of Organic Reactions: Curved arrow notation, drawing electron movements with arrows, half-headed and double-headed arrows, homolytic and heterolytic bond breaking, Types of reagents–electrophiles and nucleophiles, Types of organic reactions, Energy considerations.Reactive intermediates – Carbocations, carbanions, free radicals, carbenes, arynes and nitrenes (with examples). Assigning formal charges on intermediates and other ionic species. Methods of determination of reaction mechanism (product analysis, intermediates, isotope effects, kinetic and stereo chemical studies).

Unit II

Stereochemistry of Organic Compounds: Concept of isomerism, Types of isomerism; Optical isomerism – elements of symmetry, molecular chirality, enantiomers, stereogenic center, optical activity, properties of enantiomers, chiral and achiral molecules with two stereogenic centers, diastereomers, threo and erythro diastereomers, meso compounds, resolution of enantiomer, inversion, retention and racemisation. Relative and absolute configuration, sequence rules, D & L and R & S systems of nomenclature. Geometric isomerism – determination of configuration of geometric isomers, E & Z system

of nomenclature, geometric isomerism in oximes and alicyclic compounds. Conformational isomerism–conformational analysis of ethane and n-butane; conformations of cyclohexane, axial and equatorial bonds, conformation of mono substituted cyclohexane derivatives, Newman projection and Sawhorse formulae, Fischer and flying wedge formulae, Difference between configuration and conformation.

Unit III

Alkanes, Cycloalkanes and Alkenes

Alkanes: IUPAC nomenclature of branched and unbranched alkanes, the alkyl group, classification of carbon atom in alkanes, Isomerism in alkanes, sources, methods of formation (with special reference to Wurtz reaction, Kolbe reaction, Corey-House reaction and decarboxylation of carboxylic acids), physical properties and chemical reactions of alkanes, Mechanism of free radical halogenation of alkanes: orientation, reactivity and selectivity.

Cycloalkanes: Nomenclature, methods of formation, chemical reactions Baeyer's strain theory and its limitations. Ring strain in small rings (cyclopropane and cyclobutane), theory of strainless rings. The case of cyclopropane ring, banana bonds.

Alkenes: Nomenclature of alkenes, methods of formation, mechanisms of dehydration of alcohols and dehydrohalogenation of alkyl halides, regionselectivity in alcohol dehydration, The Saytzeff‘s rule, Hofmann elimination, physical properties and relative stabilities of alkenes. Chemical reactions of alkenes – mechanism involved in hydrogenation, electrophilic and free radical additions, Markownikoff's rule, hydroboration oxidation, oxymercuration-reduction. Epoxidation, ozonolysis, hydration, hydroxylation and oxidation with $KMnO_4$, Polymerization of alkenes, Substitution at the allylic and vinylic positions of alkenes, Industrial applications of ethylene and propene.

Unit IV

Cycloalkenes, Dienes, Alkynes

Cycloalkenes: Methods of formation, conformation and chemical reactions of cycloalkenes; Nomenclature and classification of dienes: isolated, conjugate and cumulated dienes, Structure of allenes and butadiene, methods of formation, polymerization, chemical reaction – 1, 2 and 1, 4 additions, Diels- Alder reaction.

Alkynes: Nomenclature, structure and bonding in alkynes, Methods of formation, Chemical reactions of alkynes, acidity of alkynes, Mechanism of electrophilic and nucleophilic addition reactions, hydroboration-oxidation, metal-ammonia reductions, oxidation and polymerization.

Arenes and Aromaticity: Nomenclature of benzene derivatives, the aryl group, Aromatic nucleus and side chain, Structure of benzene; molecular formula and kekule structure, stability and carbon-carbon bond lengths of benzene, resonance structure, MO picture. Aromaticity: The Huckle rule, aromatic ions.

Unit V

Concept of Electrophilic substitution reaction

Aromatic electrophilic substitution – general pattern of the mechanism, role of σand π- complexes, Mechanism of nitration, halogenation, sulphonation, mercuration and Friedel-Crafts reaction. Energy profile diagrams. Activating and deactivating substituents, orientation and ortho/para ratio, Side chain reactions of benzene derivatives, Birch reduction; Methods of formation and chemical reactions of alkylbenzenes alkynylbenzenes and biphenyl, naphthalene and Anthracene.

Alkyl and Aryl Halides: Nomenclature and classes of alkyl halides, methods of formation, chemical reactions, Mechanisms of nucleophilic substitution reactions of alkyl halides, SN2 and S 1 reactions with energy profile N diagrams; Polyhalogen compounds : Chloroform, carbon tetrachloride. Methods of formation of aryl halides, nuclear and side chain reactions; The addition-elimination and the elimination-addition mechanisms of nucleophilic aromatic substitution reactions; Relative reactivities of alkyl halides vs allyl, vinyl and aryl halides, synthesis and uses of DDT and BHC.

Textbooks and References

1. Morrison, R. N. & Boyd, R. N. Organic Chemistry, Dorling Kindersley (India) Pvt. Ltd. (Pearson Education).
2. Finar, I. L. Organic Chemistry (Volume 1), Dorling Kindersley (India) Pvt. Ltd. (Pearson Education).
3. Finar, I. L. Organic Chemistry (Volume 2: Stereochemistry and the Chemistry of Natural Products), Dorling Kindersley (India) Pvt. Ltd. (Pearson Education).
4. Eliel, E. L. & Wilen, S. H. Stereochemistry of Organic Compounds; Wiley: London, 1994.
5. March's Advanced Organic Chemistry: Reactions, Mechanisms, and Structure, Sixth Edition
6. Peter Sykes, A Guidebook to Mechanism in Organic Chemistry Paperback – 2003.
7. Harkishan Singh and V. K. Kapoor. Medicinal and Pharmaceutical Chemistry. Vallabh Prakashan Publishers, Delhi. 1996.
8. R L Madan Chemistry for Degree Students B.Sc. 2nd Year S. Chand Publishing.
9. Hashmat ali, Reaction Mechanism in Organic Chemistry S. Chand publishing.
10. John Leonard, Barry Lygo, Garry Procter Advanced Practical Organic Chemistry,

B. Sc. Part-II

CHEMISTRY
Paper III: Physical Chemistry
BSCCH-203

Maximum Marks: 50 **External Marks: 40**

Internal: 10 Marks

Learning outcomes: -After completion of the course, student-teachers will be able:

1. To know the background, properties of Fundamentals of thermodynamics.
2. To get familiar with concepts of Chemical Kinetics and Catalysis.
3. To apply the principles laws of thermodynamics and thermo chemistry.
4. To learn the Electrical transport-conduction in metals and in electrolyte solutions, conductance.

Unit I

Thermodynamics-I

Thermodynamics: Definition of thermodynamic terms: system, surroundings etc. Types of systems, intensive and extensive properties, State and path functions and their differentials.Thermodynamic process, Concept of heat and work. First Law of Thermodynamics: Statement, definition of internal energy and enthalpy.Heat capacity, heat capacities at constant volume and pressure and their relationship. Joule‘s law Joule-Thomson coefficient and inversion temperature. Calculation of w, q, dU, &dH for the expansion of ideal gases under isothermal and adiabatic conditions for reversible process.

Thermo chemistry: standard state, standard enthalpy of formation– Hess‘s Law of heat summation and its applications. Heat of reaction at constant volume.Enthalpy of neutralization. Bond dissociation energy and its calculation from thermochemical data, temperature dependence of enthalpy, Kirchhoff‘s equation.

Unit II

Thermodynamics – II

Thermodynamics: Second law of thermodynamics: need for the law, different statements of the law. Carnot cycle and its efficiency, Carnot theorem.Thermodynamic scale of temperature. Concept of entropy: entropy as a state function, entropy as a function of V & T, entropy as a function of P & T, entropy change in physical change, clausius inequality, entropy as a criteria of spontaneity and equilibrium. Entropy change in ideal gases and mixing of gases.

Third law of thermodynamics: Nernst heat theorem, statement and concept of residual entropy, evaluation of absolute entropy from heat capacity data. Gibbs and Helmholtz functions; Gibbs function (G) and Helmholtz function (A) as thermodynamic quantities, A & G as criteria for thermodynamic equilibrium and spontaneity, their advantage over entropy change. Variation of G with A with P, V and T.

Unit III

Electrochemistry-I

Electrical transportconduction in metals and in electrolyte solutions, specific conductance and equivalent conductance, measurement of equivalent conductance, variation of equivalent and specific conductance with dilution. Migration of ions and Kohlrausch law, Arrhenius theory of electrolyte dissociation and its limitations, weak and strong electrolytes, Ostwald‘s dilution law its uses and limitations. Debye-Huckel-Onsager‘s equation for strong electrolytes (elementary treatment only). Transport number, definition and determination by Hittorf method and moving boundary method. Applications of conductivity measurements; determination of degree of dissociation, determination of Ka of acids, determination of solubility product of a sparingly soluble salt, conductometric titrations.

Unit IV

Electrochemistry –II

Types of reversible electrodes-gas-metalion, metalinsoluble salt anion and redox electrodes. Electrode reactions, Nernst equation, derivation of cell E.M.F. and single electrode potential, standard hydrogen electrode-reference electrodes-standard electrode potential, sign conventions, electrochemical series and its significance. Electrolytic and Galvanic cells-reversible and irreversible cells, conventional representation of electrochemical cells. EMF of a cell and its measurements.Computation of cell EMF.Calculation ofthermodynamic quantities of cell reactions (ΔG, ΔH, and K), polarization, over potential and hydrogen overvoltage.Concentrationcell with and without, liquid junction potential, application of concentration cells, valency of ions, solubility product and activity coefficient, potentiometric titrations. Definition of pH and pKa determination of pH using hydrogen, quinhydrone and glass electrodes, by potentiometric methods. Buffers-mechanism of buffer action, Handerson-hazel equation.Hydrolysis of salts.Corrosion-types, theories andmethods of combating it.

Unit V

Chemical Kinetics and Catalysis

Chemical Kinetics: Chemical kinetics and its scope, rate of a reaction, factors influencing the rate of a reaction – concentration, temperature, pressure, solvent, light catalyst, concentration dependence of rates, mathematical characteristics of simple chemical reactions – zero order, first order, second order, pseudo order, half-life and mean life, Determination of the order of reaction – differential method, method of integration, method of half-life period and isolation method. Radioactive decay as a first order phenomenon; Experimental methods of chemical kinetics: conductometric, potentiometric, optical methods, polarimetry and spectrophotometer. Theories of chemical kinetics: effect of temperature on rate of reaction, Arrhenius equation, concept of activation energy. Simple collision theory based on hard sphere model, transition state theory (equilibrium hypothesis), Expression for the rate constant based on equilibrium constant and thermodynamic aspects.

Catalysis: characteristics of catalysed reactions, classification of catalysis homogeneous and heterogeneous catalysis, enzyme catalysis, miscellaneous examples.

Textbooks and References

1. S Lewis and D Gladstone, Elements of Physical Chemistry, Macmillan.
2. Moudgil, H. K. Textbook of physical chemistry second edition, PHI
3. B S Bahl, G D Tuli & Arun Bahl, Guide to Essentials of Physical Chemistry S. Chand Publishing.
4. Alberty & Bawendi Silbey, Physical Chemistry 4th Economy Edition, Wiley.
5. Christopher M. A. Brett, Ana Maria Oliveira Brett, Electrochemistry: Principles, Methods, and Applications, Oxford science publications
6. Keith J. Laidler, Chemical Kinetics (3rd Edition) 3rd Edition, Prentice Hall.
7. Michael J. Pilling, Paul W. Seakins, Reaction Kinetics 2nd Edition, Oxford Science Publications.

B. Sc. Part-II

CHEMISTRY PRACTICALS

Duration: 5 Hours **Min.Pass Marks: 18**
Max. Marks: 50

	Exercises	Marks
1.	Volumetric Estimation	15
2.	Identification of given organic compounds through functional group analysis	10
3.	Physical Chemistry Experiments	10
4.	Vice-voce	5
5.	Records	10
	Total	50 marks

Inorganic Chemistry Quantitative Analysis: Volumetric Analysis

a. Determination of acetic acid in commercial vinegar using NaOH.
b. Determination of alkali content – antacid tablet using HCl.
c. Estimation of calcium content in chalk as calcium oxalate by permanganometry.
d. Estimation of ferrous and ferric by dichromate method. e. Estimation of copper using thiosulphate.

A. **Organic Chemistry Qualitative Analysis:** Detection of extra elements (N, S and halogens), solubility behaviour and functional groups (Alcoholic, phenolic, carboxylic, carbonyl, esters, carbohydrates, amines, amides, nitro and anilide) in simple organic compounds. Identification of an organic compound through the functional group analysis and preparation of suitable derivatives.

B. Physical Chemistry

I. Determination of the transition temperature of the given substance by thermometric/ dialometric method (e.g.$MnCl_2$. $4H_2O$/$SrBr_2$. $2H_2O$).

II. **Phase Equilibrium** a. Study of the effect of a solute (e.g. NaCl, succinic acid) on the critical solution temperature of two partially miscible liquids (e.g. phenol-water system) and to determine the concentration of that solute in the given phenol-water system. b. Construction of the phase diagram of two component (e.g. diphenylamine, benzophenone) system by cooling curve method.

Thermo chemistry

a. Determination of the solubility of benzoic acid at different temperatures and to determine ΔH of the dissolution process.
b. Determination of the enthalpy of neutralization of a weak acid/weak base versus strong base/strong acid and determine the enthalpy of ionization of the weak acid/weak base.
c. Determination of the enthalpy of solution of solid calcium chloride and calculate the lattice energy of calcium chloride from its enthalpy data using Born Haber cycle.

III. Distribution Law

a. Determination of the distribution coefficient for the distribution of iodine between water and CCl_4.
b. Study the distribution of benzoic acid between benzene and water.

B. Sc. Part-II
ZOOLOGY
PAPER I: Chordata
BSCZO-201

Maximum Marks: 50 **External Marks: 40**

Internal: 10 Marks

Learning outcomes:-After completion of the course, student-teachers will be able:

- To understand in respect of vertebrates – theirorganizational hierarchies and complexities, the evolutionary trends in external morphologyand comparative studies of internal structures; identification and classification with examples; to enable them to understand various modes of adaptions in animals.

Note: The paper is divided in five independent units. Two questions will be set fromeach unit. The candidates are required to attempt one question from each unit.

Unit – I

- An outline classification of chordates up to orders but up to sub-classes only in case of protochordate groups and mammals.
- Comparative anatomy of vertebrates from an evolutionary point of view of the following:
  Alimentary canal, Heart and aortic arches. Kidney and associated urinogenital ducts

Unit- II

- Habit and habitat, structure, reproduction (excluding development) of following types:-
  Hemichordate: *Banlanoglossus*
  Urocohordata: *Herdmania*, ascidian tadpole larva and its metamorphosis.
  Cephalochordata: *Amphioxus*
  Agnatha: Petromyzon

Unit-III

- Habit and habitat, structure (morophology, digestive system, respiratory system, blood vascular system, nervous system (central and peripheral) and urinogenital system of the following types –
  Pisces: scoliodon
  Structure and development of placoid scales, Amphibia: frog
  Parental care in Amphibia.

Unit- IV

- Habit and habitat, structure (morophology, digestive system, respiratory system, blood vascular system, nervous system (central and peripheral) and urinogenital system of the following types –
  Reptile: uromastix, Poisonous and non-poisonous snakes, poison apparatus and biting mechanism.First aid of snake bite.

Unit- V

- Habit, habitat, structure, morophology, digestive system, respiratory system, blood vascular system, system nervous system (central and peripheral) and urinogenital syestem of the following types:-
  Aves: *Columba*
  Mammalia: *Rabbit*. Origin of birds, migration & flight adaptation of birds.

Textbooks and References

1. Barnes, R. D. (1987). Invertebrate zoology(No. Ed. 5). WB Saunders company.
2. Brooks, W. K. (1882). Handbook of invertebrate zoology: for laboratories and seaside work. SE Cassino.
3. Brooks, W. K. (1882). Handbook of invertebrate zoology: for laboratories and seaside work. SE Cassino.
4. Curtis, W. C., Guthrie, M. J., & Jeffers, K. R. (1938). Textbook of general zoology. Wiley.
5. Hegner, R. W., &Engemann, J. G. (1968). Invertebratezoology(No. QL362 H4 1968). Macmillan.
6. Hyman, L. H. (1940). The invertebrates: mollusca I(Vol. 6). McGraw-Hill.
7. Jordan, E. L., &Verma, P. S. (1996). Invertebrate Zoology sixth revised and Enlarged edition. S. Chand and Company, Ltd. 857pp.
8. Jordan, E. L., &Verma, P. S. (2009). Invertebrate zoology. S. Chand & Company.
9. Light, S. F. (1941). Laboratory and field text in invertebrate zoology. Associated Students Store, University of California.
10. McEdward, L. (2020). Ecology of marine invertebrate larvae. CRC press.
11. Parker, T. J., & Haswell, W. A. (1967). Textbook of zoology. Macmillan International Higher Education.
12. Scott-Ram, N. R., & Scott-Ram, N. R. (1990). Transformed cladistics, taxonomy and evolution. Cambridge University Press.
13. Sedgwick, A. (1905). A Student's Text-book of Zoology(Vol. 2). Allen & Unwin.
14. Verma, P. S. (2001). Invertibrate *Zoology*. S. Chand Publishing.

B. Sc. Part-II

ZOOLOGY

PAPER II: Animal Physiology And Endocrinology

BSCZO-202

Maximum Marks: 50 **External Marks: 40**

Internal: 10 Marks

Learning outcomes:-After completion of the course, student-teachers will be able:

1. To enable students to comprehend the modern concepts of physiological aspects on various organs and systems of animals and human being to comprehend chemical nature, biological molecules and physiological roles.

Unit-I

- **Physiology of digestion:** Chemical nature of food stuff (including micronutrients), various types of digestive enzymes and their digestive action in the alimentary canal, role of GI hormones in digestion, mechanism of absorption of digested food.
- **Physiology of respiration:** Mechanism and control of breathing, exchange of gases transport of respiratory gases (oxygen and carbon dioxide)

Unit-II

- **Physiology of blood circulation:**
  Composition and function of blood.
  Blood groups (ABO and Rh)
  Blood coagulation – factors, mechanism, theories and anticoagulants.
  Origin, conduction and regulation of heart beatin mammals.
  Cardiac cycle, ECG

Unit-III

- **Nerve physiology:** structure and types of neuron, origin and conduction of nerve impulse, Synapse-structure, types, properties and signal transmission through synapses.
- **Muscle physiology:** Ultra-structure and mechanism of contraction of skeletal muscle, summation and fatigue.

Unit-IV

- **Physiology of Excretion:** Nitrogenous wastes, anatomy of mammalian kidney, structure of nephron, mechanism of urea and urine formation (including hormonal regulation)
- Osmoregulation
- **Physiology of Reproduction:** Hormonal control of male and female reproduction, implantation, parturition and lactation in mammals, Reproductive cycles

Unit-V

- **Endocrinology**

  Hormones: Classification, properties of hormones.

  Mechanism of hormone action (peptide and steroid hormones)

  Endocrine glands:

  Pituitary gland: Location, anatomy and functions of hormones with hypothalamic regulation

  Thyroid gland: Location, anatomy, synthesis and function of T3 &T4

  Adrenal gland, Islets of Langerhans, Tests and Ovaries

Textbooks and References

1. Guyten and hall (2013), A text book of Medical physiology, Elsvier Pub (South Asia)
2. K Schmidt – Nielson, (2013).Animal Physiology, 5thed, Cambridge Pub
3. D Voet& JG Voet (2011).Biochemistry,Wiley Arumugam Animal Physiology– (Saras Publication, Nagercoil, Tamil Nadu).
4. K.V. Sastry (2008).Animal Physiology and biochemistry– (Rastogi Publications,
5. kamleshwarpandey and J.P. Shukla Regulatory mechanism in Vertebrates - (Rastogi Publications, 2008)
6. Goyal,K.A. and K.V. Sastry (2008).Animal Physiology, Rastogi Publication.
7. K.V. Sasyry(2008).Endocrinology and Reproductive Biology, Rastogi Publication 2008.
8. Arora M.P. (1989).Animal Physiology - Himalaya Pucations House.
9. Guyton A.C. & Hall J.E (1996)-(W.B. Saunders & Co.)Textbook of medical Physiology
10. Hoar W.S. (1983) General and Comparative Physiology– Prentice Hall Publication)
11. Hurtkar P.C. & Mathur P.N. (1976) – S Chand &Co.A textbook of Animal Physiology
12. Turner C.D. &Gangara J.T. (1971)General Endocrinology - W.B. Saunders & Co.
13. Soni,KC(2001). Animal Physiology and Immunology, Hindi Edition, College book centre, Chaura Rasta, Jaipur
14. Pawar, VS (2001). Mammalian Endocrinology and Animal Behavior, Hindi Edition, College book centre, Chaura Rasta, Jaipur

B. Sc. Part-II
ZOOLOGY
Paper III: Evolution and Palentology
BSCZO-203

Maximum Marks: 50 **External: 40**
Internal: 10 Marks
Learning outcomes: -After completion of the course, student-teachers will be able:

1. To know about Origin of life, Molecular basis of evolution and Variation.
2. To get familiar with concepts of species/subspecies/sibling, Isolation, Embryology and Paleontology.
3. To apply the Theories of evolution in understanding of real life.
4. To learn the Mimicry and protective coloration.

Unit –I

- **Origin of life**(Abiogenesis and biogenesis):Evidence in favor of evolution: Evidences from morphology and comparative anatomy, Embryology and Paleontology.Molecular basis of evolution.

Unit – II

- **Theories of evolution:** Lamarckism, inheritance of acquired characters and Neo-Lamarckism. Darwinism, theory of natural selection and Neo Darwinism, Mutation theory of Hugo de Vries, Weismann theory of germplasm, Recapitulation theory.

Unit –III

- **Variation:**Kinds, sources of variation, origin of new mutations.
- **Isolation:** Definition, mechanism and role of isolation in evolution.
- **Adaptation:** Introduction, kinds (structural, physiological and behavioural), Mimicry and protective coloration: Definition, kinds, condition necessary for mimicry, significance, divergent evolution, convergent evolution,

Unit –IV

- **Origin of species:** Concept of species/subspecies/sibling, Factors causing genetic divergence in the population of species, genetic drifts, BottleNeck effect founder's effect.Zoogeographical distribution of animals, geological time scale, eras origin and evolution of amphibian, reptiles, birds and mammals.

Unit –V

- Introduction, formation, kinds, determination of age of fossil and its significance.
- Dinosaurs, fossil evidence & reasons for extinction of dinosaurs.
- **Evolution of man:** Time of origin, compelling causes, ancestor of man, evolution from apes and evolutionary trends.

Textbooks and References

1. Becker, J. B., Breedlove, S. M., Crews, D., & McCarthy, M. M. (Eds.). (2002). *Behavioral endocrinology*. Mit Press.
2. Blackwelder, R. E., &Blackwelder, R. E. (1967). *Taxonomy: a text and reference book* (No. QL351 B54). New York: Wiley.
3. Cope, E. D. (1904). *The primary factors of organic evolution*. Open Court.
4. Darlington, C. D. (1969). *The evolution of man and society* (p. 69ff). New York: Simon and Schuster.
5. Gilbert, W. (1986). Origin of life: The RNA world. *nature*, *319*(6055), 618-618.
6. Haeckel, E. (1897). *The evolution of man* (Vol. 1). D. Appleton.
7. Harvey, P. H., &Pagel, M. D. (1991). *The comparative method in evolutionary biology* (Vol. 239). Oxford: Oxford university press.
8. Küppers, B. O. (1990). *Information and the Origin of Life*. Mit Press.
9. Nelson, R. J. (2005). *An introduction to behavioral endocrinology*. Sinauer Associates.
10. Provine, W. B. (1989). *Sewall Wright and evolutionary biology*. University of Chicago Press.
11. Rose, M. R. (1994). *Evolutionary biology of aging*. Oxford University Press on Demand.
12. Spencer, H. (1887). *The factors of organic evolution*. D. Appleton.
13. Washburn, S. L. (1978). The evolution of man. *Scientific American, 239* (3), 194-211.

B. Sc. Part-II
ZOOLOGY
Practical

Duration: 4 hrs. **Maximum Marks - 50**

Course Content

- Study of Museum specimen with respect to levels and patterns of organization, biosystematics, biodiversity, adaptations, development stages, population dynamics, ecological implications ets.
- Hemichordata:*Balanoglossus*.
- *Urochordata: Herdmania, Pyrosoma*
- *Cephalochordata: Petromyzon, Myxine*
- *Cyclostomata: Petromyzon, Myxine*
- *Pisces: Scoliodon, Sphyrna, Torpedo, Pristis, Trygon Lepidosteus, Clarias, Ophiocephalus, Anabas. Exocoetus, Hippocampus, Tetradon, Protopterus*
- *Amphibia: Icthyophis, Necturus, Proteus, Ambystoma, Axolotl larva, Triturus. Amphiuma, Alytes Bufo.*
- *Reptilia: Testudo, Trionyx, Sphenodon, Hemidactylus, Draco, Calotes, Chamaeleon, Varanus, Heloderma, Typhlops, Eryx, Hydrophis, Viper, Bungarus, Naja Alligator,*
- *Aves: Pavo, Columba, Psitacula, Passer, Corvus, Archaeopteryx.*
- *Mammals: Ornithorhynchus, Echidna, Macropus, Loris, Manis, Rattus*.

Study of Permanent Sildes

- *Balanoglossus:* T.S. of proboscis, collgar region and trunk
- *Amphioxus:*T.S. or oral hood, pharynx.
- *Mammals:* T.S., skin Stomach, Duodenum, IIeum, liver, Pancreas, spleen, lung, kindney Testis, Ovary.
- Study of skull bone of Frog, Varanus, Bird and Rabbits.
- Study of vertebral of Frog. Varanus, Bird and Rabbit.
- Study of girdles, forelimb and hind limb bones of Frog, Varanus, Bird and Rabbit.
- Dissections and/or its demonstration through Charts / Models/Video/CD/digital alternatives etc and/or preparation of working
- Models of the different system of the following animals.
- *Scoliodon:* Afferent brachial systems, efferent branchial system, cranialnerves and internal ear.
- Frog: Anatomy, digestive, system, Urino-genital system

- Permanet /Temporary preparation of the follwing-:
- Scales: Placoid, Cycloid
- Blood film of any vertebrate
- Filoplumes of birds
- Thigh muscles of frog
- Estimation ofHemoglobin.
- Enumeration of RBC in blood samples.
- Enumeration of WBC in blood samples.
- Preparation of Haemin Crystals.
- Effect of different concentrations of NaCI on RBC.
- Measurement of blood pressure, Heart beat and Pulse rate.
- Study of bleeding time, Coagulation time of blood.
- Study of Histological slides of the following endocrine gland of mammal testis, ovary, thyroid, adrenal, pituitary, Islets of Langerhans.

Note:

Use of animals of materials for dissection or otherwise is subject to the condition that these are not banned under the Wildlife Protection Act.

S. No.	Exercise	Marks
1.	Dissection* (Exposition, labeled diagram)	**6**
2.	Temporary mounting –one (Staining, identification, sketch	**3**
3.	Museum specimens – four or six (identification and classification	**12**
4.	Ecological note –one specimen	**2**
5.	Permanent slides – two (Identification with reasons)	**2**
6.	Osteology	**3**
7.	Physiological exercise	**5**
8.	Practical record and slides	**5**
9.	Viva-voce	**4**
10.	Project report assignment	**8**

B.Sc.Part-II

BOTANY
PAPER –1: Diversity of Seed Plants
BSCBO-201

Maximum Marks: 50 **External Marks: 40**
Internal: 10 Marks
Learning outcomes:-After completion of the course, student-teachers will be able to:-

- Know aboutCharacteristics, Origin and evolution of seed plants.
- Get familiar with General features of gymnosperms.
- Apply the principles of Asymptotes, multiple points, curve tracing in real situations.
- Learn Morphology and anatomy of vegetative and reproductive parts.

Unit – I

Characteristics of seed plants, (Gymnosperm & Angiosperm), Homospory, Heterospory & orgion of Seed Plants, Fossil and Living seed Plants, Fossil Gymnosperms.(williamsonia)

Unit – II

Angiosperms: Origin and Evolution, Primitive Angiosperms, Diversity in Plant Forms-annuals, Biennials and Perennials, Convergence of Evolution of Tree Habit in Gymnosperms, Monocotyledons and di-cotyledons, Trees-Largest and Longest-Lived Seed Plants.

Unit –III

General features of Gymnosperms, Distribution and Their Classification, Morphology and Anatomy of Vegetative and Reproductive Parts and Life Cycle of Cycas.

Unit – IV

Morphology and Anatomy of Vegetative and reproductive Parts and life cycle of PinusandEphedra, Economic importance of Gymnosperms.

Unit – V

Principles of Plant breeding, Methods of Breeding, Introducation and Acctimatisation, Selection (mass, purelme, and clonal), Hydridizaion, pedi-gree analysis, Hybrid vigour, use of mutation and Polyploidy in breeding.

Suggested Readings

1. Bhatnagar, A.P. and Moitra, A. (1996). *Gymnosperms*. New Delhi: New Age International Limited.
2. Gifford, E.M. and Foster, A.S. (1988). *Morphology and Evolution of Vascular Plants*. New York:W. H. Freeman & Company.
3. Singh, D. (2009). *Diversity and Systematics of Seed Plants*. Jaipur: Rastogi Publications.
4. Sporne, K.R. (1965). *The Morphology of Gymnosperms*. London: Hutchinson & Co. (Publishers) Ltd., London. Stewart, W. M. (1983). Paleobotany and the Evolution of Plants. Cambridge University Press. Cambridge.
5. Van Balgooy, M. M. J. (1997). *Malesian seed plants* (Vol.1). Rijksherbarium/Hortus Botanicus.

B.Sc.Part-II
BOTANY
PAPER – II: Systematics of Angiosperms
BSCBO-202

Maximum Marks: 50 **External Marks: 40**

Internal: 10 Marks

Learning outcomes: -After completion of the course, student-teachers will be able:

1. To know about the Continuity and differentiability of vector functions, unit tangent vector.
2. To get familiar with concepts of artificial, natural and phylogenetic system of classification.
3. To apply the principles of Principles and rules of ICBN in real situations.
4. To Learn about the Botanical Nomenclature.
5. To Lern about the Develop Herbarium and identified on the bases of diversity of flowering plants as illustrated by members of the families.

Unit – I

Angiosperm taxonomy: Brief history, aims and fundamental concepts of artificial, natural and phylogenetic system of classification, Bentham & Hooker, Engler & Prantle and Hutchinson, system of classification.Herbarium; Tools and techniques, important herbaria and botanical gardens of India and their importance.

Unit – II

Botanical Nomenclature: Principles and rules of ICBN, type of concept, taxonomical categories, principle of priority, identification keys, floras.

Unit – III

Diversity of flowering plants as illustrated by members of the families– Brassicaceae, Malvaceae, Rutaceae, and Fabaceae (Lotoidae, Caesalpinoidae, and Mimosoidae) Apiaceae.

Unit – IV

Diversity of Flowering plants as illustrated by members of the families– Apocynaceae, Asclepiadaceae, Asteraceae, Solanaceae, and Lamiaceae.

Unit –V

Diversity of flowering plants as illustrated by members of the families– Amaranthaceae, Cucurbitaceae, Euphorbiaceae, Liliaceae, and Poaceae.

Suggested Readings

1. Davis, P.H. and Heywood, V.H. 1963. Principles of Angiosperm Taxonomy. Oliver and Boyd, London. Heywood,
2. V.H. and Moore, D.M. (eds) 1984. Current Concepts in Plant Taxonomy. Academic Press. London.
3. Jaffrey, C, 1982. an Introduction to Plant Taxonomy, Cambridge University Press, Cambridge, London.
4. Jones, S.B., Jr. and Luchsinger, A.E. 1986. Plant Systematics (2nd Mc Graw-Hill Book Co., New York.
5. Maheshwari, J.K. 1963. Flora of Delhi, CSIR, New Delhi. edition). Radrord, A.E. 1986. Fundamentals of Plant Systematics. Harper and Row, New York.
6. Singh, F. 1999. Plant Systematics: theory and Practice. Oxford and IBH Pvt. Ltd. New Delhi. State,
7. C.A. 1989. Plant Taxonomy and Biosystematics

B.Sc.Part-II
BOTANY
PAPER-III: Plant Cell Biology and Genetics
BSCBO-203

Maximum Marks: 50 **External Marks: 40**
Internal: 10 Marks
Learning outcomes: -After completion of the course, student-teachers will be able to:

1. To know about the Ultrastructure of cell and cell organelles.
2. To get familiar with concepts of Chromosome organization and genetic expression.
3. To apply the principles of Mendal's law of inheritance, Linkage and crossing over; allelic and non-allelic interactions in real situations.
4. To learn the Nuclear and extra nuclear genetic material.

Unit – I

Ultrastructure of cell and cell organelles; Cell wall, Plasma membrane, Golgi Complex, endoplasmic reticulum, Lysosomes, Ribosomes, peroxisomes, vacuoles, mitochondria, chloroplast, nucleus.

Unit – II

Chromosome organization: Structure/Morphology, centromere and telomere, chromosome aberrations: deletions, duplication, inversions and translocations, Variations in chromosome number – aneuploidy, euploidy, sex chromosomes.Cell division: Cell cycle and Mitosis and meiosis.

Unit – III

Nuclear and extra nuclear genetic material: DNA structure, replication, DNA protein interaction, nucleosome model, genetic code, satellite and repetitive DNA, mitochondrial and plastid DNA, plasmid, gene mapping

Unit – IV

Gene expression: Structure of gene, transfer of genetic information, protein structure and classification, transcription, translation, regulation of gene expression in prokaryotes and eukaryotes.

Unit – V

Genetic inheritance: Mendelism, Mendal's law of inheritance, Linkage and crossing over, allelic and non-allelic interactions.Genetic variations: Mutations-spontaneous and induced, transposable genetic elements, DNA damage and repair.

Mean, mode, median, $x^2\ test$, standard deviation, standard error

Suggested Readings

1. Alberts, B., Bray, D., J., Raff, M., Roberts, K and Watson, I. D. 2001.
2. Molecular Biology of Cell Garland, publishing Co. Inc., New York, USA.
3. Atherely,.G., Girton, J. R. and McDonald, J. F. 1999. The Science of Genetics Saunders College Publishing, Fort Worth, USA.
4. Gupta, P.K. 1999. A Textbook of Cell and Molecular Biology. Rastogi Publications, Meerut.
5. Kleinsmith, L. J. and Kish. V.M. 1995, Principles of Cell and Molecular Biology (3nd edition). Harper Collins College Publishers, New York, USA.
6. Lodish, H., Berk, A., Aipursky, S.L., Matsudaira, P., Baltimore, D. and Darnell, J. 2000.
7. Molecular Cell Biology. W.H. Freeman & Co. New York, USA. Russel, P. J. 1998. enetics.
8. The Benjamin/Cummings Publishing Co. Inc., USA. Snustad, D.P. and Simmons, M. J. 2000. Principles of Genetics.
9. John Wiley & Sons, Inc., USA. Stent, G.S. 1986. Molecular Genetics. CBS Publications, Delhi. Wolfe, S.L. 1993.
10. 10.Molecular and Cell Biology. Wodsworth Publishing Co., California, USA.

B.Sc.Part-II
BOTANY
PRACTICALS

Duration – 4 Hrs **Maximum Marks: 50**

Gymnosperms:

1. Cycas

- Habit, armour ofleaf bases on the stem, very young leaf (circinate vernation)and old foliage leaves, scale leaf, bulbils, male cone, microsporophyll, megasporophyll, and mature seed.
- Study through temporary micro preparations or permanent slides – normal root, coralloid root, stem, rachis, leaflet, microsporophyll, pollen grains, and ovule.

2. Pinus

- Habit, long and dwarf shoot showing cataphylls and scale leaves, T.S. wood showing growth rings, male cones, female cones, and winged seeds.
- Study through temporary micro preparations and/or permanent slides – stem (young and old), needle, pollen grains, root, female cone, ovule, embryo (W.M.) showing polycotyledonous condition.

3. Ephedra

- Habit and structure of whole male and female cones.Temporary micro preparations and/or permanent slides of node, internode, macerated stem to see vessel structure; epidermal peel mount of vegetative parts to study stomata, male cone, female cone, and pollen grains.

4. Angiosperms

- Familiarity with the terms used in technical description of plants. Study of representative plants of families included in the syllabus.

1. Cyto-genetics

- Study of cell structure from onion leaf peels; demonstration of staining and mounting methods.
- Comparative study of cell structure in onion cells, *Hydrill*a and *Spirogyra*. Study of cyclosis in Tradescantia, staminal hairs.
- Study of plastids to examine pigment distribution in plants (e.g., *Cassia*, *Lycopersicon*and *Capsicum*).
- Examination of electron micrographs of eukaryotic cells with special reference to organelles.

- Study of electron micrographs of viruses, bacteria, cyanobacteria and eukaryotic cells for comparative cellular organization.
- Examination of various stages of mitosis and meiosis using appropriate plant material (e.g. onion root tips, onion flower buds),
- Preparation of karyotypes from dividing root tip cells and pollen grains.
- Cytological examination of special types of chromosomes: bar body, lamp brush and polytene chromosomes.
- Working out the laws of inheritance using seed mixtures.
- Working out the mode of inheritance of linked genes from test cross and or F2 data.
- Plant breeding–Monohybrid, and dihybrid crosses, emasculation,

5. Biostastics - Mean, mode, median, $x^2 test$, standard deviation.

MARKING SCHEME

There shall be a practical examination of four hours duration and the distribution of marks shall be as follows:

1. A double stained section of plant part either of Gymnosperm glycerine mount Marks: 08
2. An angiosperm material for anato-mical study with (i) double stained, labelled cellular sector diagram, identification and (iv) special (anatomical/ecological) character. Marks: 08
3. Smear preparation for two stages of cell division. Marks: 03
4. Genetic exercise Or Emasculation technique. Marks: 03
5. Statistical exercise. Marks: 03
6. Spots five (At least one from each paper) Marks: 10
7. Vive-Voce Marks: 05
8. Practical Record Marks: 10

Suggested Readings

1. Fukui, K. an``d Nakayama, S. (1996). *Plant Chromosomes: Laboratory Methods*. Florida: CRC Press, Boca Ratin.
2. Gunning, B.E.S. and Steer, M. W. (1996). Plant Cell Biology: Structure and Function. Boston Massachusetts: Jones and Barlett Publishers.
3. Harris, N. and Oparka, K. J. (1996). Plant Biology: A Practical Approach. IRL Press at Oxford University Press. Oxford, UK.
4. Sharma A.K. and Sharma A. (1999).Plant Chromosomes: Analysis, Manipulation and Engineering. Harwood: Academic Publishers Australia.

B. Sc. Part-III

Physics

Paper-I: Nuclear and Solid State Physics

BSCPH-301

Maximum Marks: 50 **External Marks: 40**

Internal: 10 Marks

Learning outcomes: After completion of the course, student-teachers will be able to:

1. Discuss the Concept of Nuclear Properties and Theory of Nuclear Forces.
2. Applies the Concept of Detector and Accelerator.
3. Identify the concept of Crystal Binding and crystal Structure.
4. Study the Thermal and Electrical Properties of the Solids.
5. Classify the concept of Band Theory of Solids.

Unit I

Rutherford theory of alpha paticles cattering, properties of nucleus quadru pole moment and nuclear ellipticity. Quadrapole moment and nuclear spin. parity and orbit alangular momentum, nuclear mass and mass spectroscopy . Nuclear potential, Mass defect and Binding energy, Theory of Nuclear forces and properties of nuclear forces. Beta decay, range of alpha particles, Geiger-Nuttall law, Gamow's explanation of alpha decay, gamma decay, continuous and discrete spectra.

Unit II

Theory of nuclear fission and liquid drop model, Semi-emperical mass formula. Barrier penetration theory of spontaneous fission. Nuclear fission as a source of energy, chain reaction and condition of controlled chain reaction, the principle of nuclear reactor, usesof atomic energy.

Unit III

Nuclear fussion.energy production in stars by p.p and carbon cycle. Interaction of charge particles and neutron with matter and regions of multplicative operation, working ofnuclear detectors G.M. counter, proportional counter, scintillation counter cloud and spark chamber, Linear accelerator. cyclotron, synchro cyclotron. Betatron. Electron synchroton.

Unit IV

Bonding: Potential between a pair of atom, concept of cohesive energy, covalent, Vander walls, ionic, and metallic crystals.

Crystal Strusture: Space lattice and crystal structure, Bravis lattice. Miller Indices, spacing of planes incrystal lattice. Unit cell, wigner-seitzcell Atomic packing fraction. Common crystal structures. Laue'stheory of X-ray diffraction.Bragg's law. Laue pattern.

Unit V

Thermal Properties: Lattice vibration. Concept of phonon, classical view of lattic specific heat of solid, the Einstein model, Debye model, thermal conductivity.

Band Structure: Formation of bands.periodic potential of a solid, Bloch theorem.Kroing Penny model, Drude-Lorentz theory of electrical conductivity, Boltzmann transport equation Sommerfeld theory of electrical conductivity thermal conductivity & WidemannFrenz law,Hall Effect.

Textbooks and References

1. Kittel, C., & McEuen, P. (1976). Introduction to solid state physics (Vol. 8). New York: Wiley.
2. Srivasatava, J. P. (2014). Elements of solid state physics. PHI Learning Pvt. Ltd.
3. Truell, R., Elbaum, C., & Chick, B. B. (2013). Ultrasonic methods in solid state physics. Academic press.
4. Semat, H. (2012). Introduction to atomic and nuclear physics. Springer Science & Business Media.
5. Sharma, S. K. (2004). Atomic and nuclear physics. Pearson Education India.
6. Yang, F., & Hamilton, J. H. (2010). Modern atomic and nuclear physics. World scientific.

B. Sc. Part-III

Physics

Paper-II: Quantum Mechanics, Atomic and Molecular physics

BSCPH-302

Maximum Marks: 50 **External Marks: 40**

Internal: 10 Marks

Learning outcomes: After completion of the course, student-teachers will be able to:

1. Discuss the Origin and Experimental Evidence of Quantum theory.
2. Apply the Uncertainty Principles and Schrodinger's Wave Mechanics.
3. Identify the Postulates and Operators of Quantum Mechanics.
4. Applies Quantum Theory to Atomic Spectroscopy.
5. Identify the Concept of Molecular Spectroscopy.

Quantum Mechanics

Unit-I

Origin of Quantum theory: Failure of classical Physics to explain the phenomenon such as black body spectrum. Planck's radiation law. Photoelectric effect and Einstein explanation. Compton effect, "de-Broglie" hypothesis, evidence for diffraction and interference of particles. Uncertainly principle and its consequences: diffraction at a single slit, particle in a box and its applications (i) Non existence of electron in nucleus, (ii) Ground state energy of H-atom (iii) Ground slate energy of harmonic oscillator.Energy-time uncertanity.

Unit- II

Schrodinger equation- Time dependent and lime independent form. Physical significance of the wave function & its interpretation. Probability current density, Operators in quantum mechanics, linear and Hermitian operators. Expectation values of dynamical variables, the position, momentum, energy, fundamental postulates of quantum mechanics, eigen function and eigen value, degeneracy. orthogonality of eigen functions' commutation relations. Ehrenfest theorem, concept of group and phase velocities, wave packet.

Unit- III

Simple Solutions of Schrodinger equation: Time independent Schrodinger equation and stationary state solution. Boundary and continuity conditions on the wave function, particle in one dimensional box.eigen function and eigen values. discrete energy levels, extension of results for three dimensional case and degeneracy of levels. Potential step and rectangular potential barriar. Calculation of reflection and transmission cofficient. Qualitative discussion of

the application to alpha decay (tunnel effect), square well potential problem, calculation of transmission cofficient.

Unit- IV

Bound State Problems : Particle in one dimensional infinite potential well and finite depth potential well energy value and eigen functions, simple harmonic oscillator (one dimensional) eigen function energy eigen values zero point energy. Schrodinger equation for a spherically symmetric potential.Separation of variables. Orbital angular momentum and its quantisation spherical harmonics, energy levels of H-atom shape of n=l, n=2 wave functions, comparision with Bohr model and Correspondence principle.

Statistical Physics

Unit -V

Atomic and Molecular Physics: Frank-Hertz experiment spectra of hydrogen, spectral terms, fine structure, screening constant for alkali spectra for s, p, d, f states, selection rules. L-S and J-J couplings, Atoms in a magnetic field, Zeeman effect, Zeeman splitting.

Discrete set of electronic energies of molecules, quantisation of vibrational and rotational energies, determination of internuclear distance pure rotational and rotation vibration spectra, transition rules for pure vibration and electronic vibration spectra. Raman effect.

Textbooks and References:

1. Ghatak, A. K., & Lokanathan, S. (2004). Quantum mechanics: theory and applications. Macmillan.
2. Lifshitz, E. M., & LD and Sykes Landau (JB). (1965). Quantum Mechanics; Non-relativistic Theory. Pergamon Press.
3. Semat, H. (2012). Introduction to atomic and nuclear physics. Springer Science & Business Media.
4. Sharma, S. K. (2004). Atomic and nuclear physics. Pearson Education India.
5. Haken, H., & Wolf, H. C. (2013). Molecular physics and elements of quantum chemistry: introduction to experiments and theory. Springer Science & Business Media.
6. Littlefield, T. A. (2012). Atomic and nuclear physics: an introduction. Springer Science & Business Media.

B. Sc. Part-III

Physics

Paper-III: Electronics and Solid State Devices

BSCPH-303

Maximum Marks: 50 **External Marks: 40**

Internal: 10 Marks

Learning outcomes: After completion of the course, student-teachers will be able to:

1. Applies the Kirchhoff's law (first and second) and circuit analysis.
2. Discuss the concept of the semiconductor, type of semiconductor, zener diode.
3. Identify characteristics of transistor.
4. Discuss on the amplifiers with feedback.
5. Discuss on the concept of operational amplifier & oscillators.

Unit – I

Circuit Analysis: Network-some important definitions, Kirchoff's laws.Voltage and current divider rules.Node and Mesh analysis.Driving point and transfer impedance four terminal networks parameters. Open circuit short circuit and hybrid parameters of any four terminal network. T and π Networks.

Network Theorems: Superposition, Thevenin, Norton, Reciprocity, Compensation and Maximum power transfer theorem.

Unit II

Semiconductor diodes: Instrinsic semicondutor, extrinsic semiconductor, Fermi level calculation of electron and hole concentration along with their temprature dependance, law of mass action .Semiconductor devices, p-n junction, majority and minority carriers, diode.Zener and tunnel diodes. Light emitting diode, solar cell.

Rectification: halfwave and full wave rectifiers, bridge rectifier ripple factor. different types of filters (shunt capacitor, inductor filter, L section and π filters), voltage stabilization, voltage multiplier circuits.

Unit III

Transistors: Notations and volt-ampere relation for bipolar junction transistor concept of load line and operating point, hybrid parameters. CB,CE,CC configuration and their characteristics curves and their equivalent circuits, Analysis of a transistor amplifier using h- parameter (A_i, A_v, Z_{in}, Z_o), fixed and

emitter bias, bias stability in transistor circuit. FET, its characteristics and constants, biasing JFET and operation of JFET, MOSFET.

Unit IV

Small Signal Amplifiers: General principles of operation, classification, distortion, RC coupled amplifier, gain, frequency response, input and output impedance, multistage amplifiers, transformer coupled amplifiers, Equivalent circuits at low, medium and high frequencies, emitter follower, low frequency common-source and common-drain amplifier, Noise in electronic circuits.

Operational Amplifiers: Differential amplifier DC level shifter input & output impedance input offset current. Application: unity gain buffer, adder subtractor, integrator and differentiator.

Logic circuits: Numbers systems, Binary arithmetic, fundamental Logic gates, Boolean theorems and circuit realization of logic functions using diodes (DL).

Unit V

Amplifiers with feedback: Concept of feed-back, Effect of negative feed-back on stabilization of gain, output and input impedance, reduction of nonlinear distortion, voltage & current feed-back circuits.

Oscillators: Positive feedback, Barkhausen criterion, Phase shift oscillator, Colpitt‟s and Hartley oscillators, and Crystal oscillator.

Textbooks and References:

1. Stanley, W. D. (1989). Electronic Devices: Circuits and Applications. Prentice Hall.
2. Digital fundamentals by Thomas L Floyd (Unuited Book Stall, New Delhi).
3. Electronic fundamentals and applications by John D. Ryder (Prentice Hall of India).
4. Stanley, W. D. (1989). Electronic Devices: Circuits and Applications. Prentice Hall.
5. Millman, J., & Grabel, A. (1987). Microelectronics. McGraw-Hill, Inc.

B. Sc. Part-III

PHYSICS PRACTICALS

Duration:4 hrs **Min.PassMarks:27** **Max. Marks 50**

Total number of experiments to be performed by the students during the session should be 16, selecting any eight from each section. In examination two experiments are to be performed taking at least one from each section.

The distribution of marks in the practical examination will be as follows:

(i) Two experiments	30 Marks

For each experiment, distribution of marks will be as follows:

Figure:	2
Formula/Theory:	2
Observation:	7
Calculation and Result:	3
Precautions:	1
(ii) Viva voce	10
(iii) Records	10
Total	**50 Marks**

LIST OF EXPERIMENTS

Section: A

- Study the characteristic of a given transistor PNP/NPN (CE, CB and CC configuration) and determine alpha and beta values.
- Study the characteristic of junction diode & Zener diode.
- Designs a Zener regulated power supply and study the regulation with various loads.
- Study of Half wave & Full wave rectification and application of L and P section filters.
- Study the characteristics of a field effect transistor (FET) and design and study of amplifier of finite gain.
- Study the characteristics of a uni junction transistor (UJT).
- Determination of Stefan’s constant.
- Study the frequency responses of a transist or amplifier (bipolar/FET) obtain the input and output impedance of the amplifier.

- To study hysteresis by B-H curve using CRO.
- Using discrete component, study OR, AND, NOT logic gates, compare with TTL integrated circuits IC's.
- Application of operational amplifier as: (i) Inverter (ii) Non-Inverter (iii) differentiator (iv) Integrator.
- Design and study of an R-Cphase shift oscillator.
- Study of a RC transmission line at 50 Hz.
- Study of LC transmission line at fixed and variable frequency.
- Study of RC circuits as integrating and differentiating systems with square input.
- To study the Networks theorems.
- To study the characteristics of a Thermistor.

Section-B

- Determination e/m by Thomson method.
- e/m measurement by Helical Method.
- Measurement of Hall coefficient of given material.
- Verification of inverse square law by photo cell.
- Determination of Planck's costant by photo cell.
- Determination of Planck's constant using solar cell.
- To study V-I characteristics of Light Emitting Diode (LED).
- To find the magnetic susceptibility of paramagnetic solution using Quinck's method.
- Study of Magnetic Hysteresis parameters using a CRO.
- Study of characteristics of a GM counter and verification of inverse square law for the same strength of radioactive source.
- Study of resistance characteristics of semi-conductor Material using four probe method.
- Polarization of light by reflection, verify Brewster's law & Law of Malus.
- To determine the value of a High resistance by Leakage method.
- To determine small thickness by using thin film interference.
- The study of frequency response and phase relationship in a series LCR circuit.
- Measurement of magnetic susceptibility.
- Study of statistical distribution: Gaussian and Poisson's spectral distribution using dices.

B. Sc. Part-III
Mathematics
Paper-I: Complex Analysis
BSCMA-301

Maximum Marks: 66 **External: 56**

Internal: 10 Marks

Learning Outcomes: -After completion of the course, student-teachers will be able:

1. To acquaint students with the Complex number and integration.
2. To understand the Harmonic functions, Construction of an analytic function.
3. To apply the various theorem & modulus principle in further study.
4. To know about the Residuetheorem, residue at a pole, residue at infinity computation of residue, Rouche's theorem, fundamental theorem of algebra.

Unit I

Complex numbers, function of a complex variable, limits, Cauchy Riemann equations (Cartesian & polar forms), continuity, differentiability of a function. Analytic functions.

Unit II

Harmonic functions, Construction of an analytic function Conformal mapping, Bilinear transformation, and its properties, Elementary maps. F (z) = ½ (z+1/z), z2, 2z, Sin z and Log z.

Unit III

Complex integration, Complex line integrals, Cauchy's integral theorem, Indefinite integral, Fundamental theorem of Integral calculus, Derivative of an analytic function, Liouville's theorem, Poisson's integral formula.

Unit IV

Morera's theorem, Taylor's & Laurents series, Maximum, modulus principle, Schwarz's Lamma, Singularities, Zeros of an analytic function, branch point, Moromorphic functions and Entire functions, Reimann's theorem, Casorati Wierstrass theorem,

Unit-V

Residue theorem, residue at a pole, residue at infinity computation of residue, Rouche's theorem, fundamental theorem of algebra, mittag-leffet expansian theorem, evaluation of real definite integrals by contour integration.

Textbooks and References:

1. Ahlfors, L. V. (1973). Complex Analysis. McGraw Hill.
2. Conway, J. B. (2012). Functions of one complex variable II (Vol. 159). Springer Science& Business Media.
3. Stein, E. M., & Shakarchi, R. (2003). Princeton lectures in analysis. Princeton University Press.
4. Stein, E. M., & Shakarchi, R. (2005). Real Analysis, Princeton Lectures in Analysis III.
5. Stein, R. Shakarchi (2003) Complex Analysis: Princeton Lectures in Analysis. Princeton University Press.
6. Purohit and Goyal (2005). Complex Analysis, JPH.
7. Vasishtha, A. R. (2010). Complex Analysis: Krishna Prakashan Media (P) Ltd., Meerut, 11^{th} edition.
8. Rudin, W. (2006). Real and complex analysis. Tata McGraw-hill education.
9. Rudin, W. (1970). Real and Complex Analysis P. 2. McGraw-Hill.

B. Sc. Part-III
MATHEMATICS
Paper-II: Mechanics
BSCMA-302

Maximum Marks: 66 **External: 56**

Internal: 10 Marks

Learning Outcomes:-After completion of the course, student-teachers will be able:

1. To know about conditions of equilibrium of coplanar forces and frictions.
2. To know about simple problems on virtual work, catenary, forces in three dimensions.
3. To know about Simple Harmonic Motion and rectilinear motion under variable laws.
4. To know about Hook's law, constrained, circular and cycloidal motion.
5. To know about impact, central forces, central orbits and Kepler's laws of planetary motion.

Unit - I

Analytical conditions of equilibrium of coplanar forces, friction.

Unit - II

Simple problems on Virtual Work, Catenary, Forces in three dimensions, Poinsot's centralaxis, Wrenches, Null lines and planes.

Unit - III

Velocities and accelerations along radial and transverse directions, and along tangential andnormal directions, Simple Harmonic Motion, Rectilinear motion under variable laws.

Unit - IV

Hook's law, related problems on horizontal and vertical elastic strings. Constrained motion,Circular and Cycloidal motion.

Unit - V

Impact, Central forces, Central orbits, p-r equation, Apses, Time in an orbit, Kepler's laws ofplanetary motion.

Books Recommended:

1. Statics : R. S. Verma.
2. Statics (English/Hindi Ed.) : Gokhroo et. al.
3. Statics : S. M. Mathur.
4. Text book of Dynamics : M. Ray.
5. Dynamics : Gupta and Juneja 6. Dynamics (English/Hindi Ed.) : Gokhroo et. al.,Navkar Prakashan, Ajmer.

B. Sc. Part-III

MATHEMATICS

Paper-III: Numerical Analysis and Optimization Techniques

BSCMA-303

Maximum Marks: 68 **External: 58**

Internal: 10 Marks

Learning Outcomes:-After completion of the course, student-teachers will be able to:

1. To know about various difference operators and Newton's forward and backward interpolation formulae for equal intervals.
2. To know about Newton's general interpolation formula, Lagrange's interpolation formula, Gauss central difference, Stirling and Bessel interpolation formula.
3. To know about numerical differentiation and integration.
4. To know about Linear Programmeming problems and their solutions by simplex method.
5. To know about assignment and transportation problems and their solutions.

Unit - I

Difference operators and factorial notation.Relation between difference and derivatives.Difference of polynomial.Newton's formulae for forward and backward interpolation forequal intervals.

Unit - II

Divided difference.Relation between divided differences and simple differences.Newton'sgeneral interpolation formula.Lagrange's interpolation formula.Gauss central differenceformula.Stirling and Bessel interpolation formula.Inverse interpolation.

Unit - III

Numerical differentiation and integration.Trapezoidal rule, Simpson's 1/3.3/8 rules.Weddle's rule. Solution of algebraic Transcendental equations. Bisection method.RegularFalsi method.Newton-Raphson method.

Unit - IV

The simplex algorithm and its application to simple linear Programmeming problems. Concept of duality in Linear Programmeming problems, Formation of dual problem, Elementary theorems duality.

Unit - V

Assignment problems, Transportation Problems.

Books Recommended:

1. Saxena, H. C. : Numerical Analysis.
2. Goyal and Mittal : Numerical Analysis.
3. Gokhroo et. al. : Numerical Analysis (Hindi / EnglishEdn.) Navkar prakashan, Ajmer.
4. Bansal and Ojha : Numerical Analysis (Hindi Edition).
5. Gokhroo et. al. : Linear Programmeming (Hindi / EnglishEdn.) Navkar Prakashan, Ajmer.
6. Hadley G. : Linear Programmeming Problems.

B. Sc. Part-III

CHEMISTRY

Paper-I: Inorganic Chemistry
BSCCH - 301

Maximum Marks: 50 **External Marks: 40**

Internal: 10 Marks

Learning outcomes: -After completion of the course, student-teachers will be able:

1. To know about the Atomic, ionic radii & ionization energy.
2. To under stand the Metal Legand Bonding in Transition Metal Complexes.
3. To Know about the Electronic Spectra of Transition Metal Complexes.
4. To know about the Bio Inorganic Chemistry Essential and trace elements in biological process.

Unit-I

Periodic Properties: Atomic and ionic radii, ionization energy, electron affinity and electro negativity, different, methods of determination, trends in periodic table and applications in predicting and explaining the chemical behavior.

Unit-II

Metal Legand Bonding in Transition Metal Complexes: Limitation of Valence Bond Theory, An elementary ideas of crystal field theory, Crystal field splitting in octahedral and square planar complexes, Factors affecting the crystal field parameter

Unit-III

Electronic Spectra of Transition Metal Complexes: Types of electronic transition, Selection rules of D-D Transition, Spectroscopic ground state, Spectro chemical series, Or gel - energy level diagram for D1 and D9 series, Discussion of the electronic spectrum of $[Ti(H_2O)_6]^{3+}$ complex ion.

Unit-IV

Bio Inorganic Chemistry: Essential and trace elements in biological process, Metallopophyrins with special reference to Haemoglobin and Myoglobin, Biological Rule of alkali and alkaline earth metal ion with special reference to Ca^{2+}, Nitrogen fixation

UnitV

Chromatography: Definition, classification, Rf-value, law of differential migration eluantic and elution, paper, TLC, chromatography and their application

Silicones and Phosphazenes Silicones and Phosphazenes asexamples of inorganic polymers, nature of bonding in tri phosphazenes

Books and References

1. Donald L. Pavia Gary M. Lampman George S. Kriz James A. Vyvyan, Introduction to Spectroscopy, 5th Edition.
2. Madan R L, Chemistry for Degree Students B.Sc. 3Rd Year S. Chand Publishing.
3. Inorganic Polymers by Stone and Graham.
4. Snyder, Lloyd R. & Dolan John W., High-Performance Gradient Elution (3rd Ed.), Wiley-Interscience A. John Wiley & Sons, Inc, Publication.
5. Day. M.C. and Seblin. J. Theoritical Inorganic Chemistry. ACS Publication.

B. Sc. Part-III
CHEMISTRY
Paper II: Organic Chemistry
BSCCH-302

Maximum Marks: 50 **External Marks: 40**

Internal: 10 Marks

Learning outcomes: -After completion of the course, student-teachers will be able to:

1. To develop an understanding of chemistry of hydrocarbons and their halogenated derivatives.
2. To get familiar with chemistry of main group elements.
3. To apply the principles of Alcohols classification and nomenclature in real life situation.
4. To apply the knowledge of Ultraviolet (UV) and Infrared (IR) absorptionspectroscopy to explain natural physical phenomena.
5. To define the characteristics of carbonyl compounds, Carboxylic Acids and its derivatives.

Unit I

Chemistry of hydroxy compounds

Alcohols classification and nomenclature.Monohydric alcohols-nomenclature, methods of formation by reduction of aldehydes, ketones, carboxylic acids and esters.Hydrogen bonding.Acidic nature.Reactions of alcohols. Dihydric alcohols-nomenclature, methods of formation, chemical reactions of vicinal glycols, oxidative cleavage [$Pb(OAc)_4$ and HlO_4] and pinacolpinacolone rearrangement. Trihydric alcohols- nomenclature and methods of formation, chemical reactions of glycerol.

Phenols: Nomenclature, structure and bonding. Preparation of phenols, physical properties and acidic character.Acidic strengths of alcohols and phenols, resonance stabilization of phenoxide ion.Reactions of phenols- electrophilic aromatic substitution, acylation and carboxylation.Mechanism of Fries rearrangement, Claisen rearrangement, Gatterman synthesis, Hauben- Hooesch reaction, Lederer-Manasse reaction and Reimer-Tiemann reaction.

Ethers and Epoxides: Nomenclature of ethers and methods of their formation, physical properties, Chemical reactions – cleavage and auto oxidation, Ziesel‘s method.Synthesis of epoxides. Acid and base-catalyzed ring opening of epoxides, orientation of epoxide ring opening, reactions of Grignard and Organolithium reagents with epoxides.

Unit II

Carbonyl compounds

Aldehydes and Ketones: Nomenclature and structure of carbonyl group. Synthesis of aldehydes and ketones with particular reference to the synthesis of aldehydes from acid chlorides, synthesis of aldehydes and ketones using 1, 3-dithianes, synthesis of ketones from nitriles and from carboxylic acid.Physical properties, Mechanism of nucleophilic additions to carbonyl group with particular emphasis on Benzoin, Aldol, Perkin and Knoevenagel condensations, Condensation with ammonia and its derivatives, Witting reaction, Mannich reaction. Use of acetals as protecting group, Oxidation of aldehydes, Baeyer-villiger oxidation of ketones, Cannizzaro reaction, MPV, Clemmensen, Wolff-kishner, LiAlH4 and NaBH4 reductions, Halogenation of enolizable ketones. Introduction to α, β unsaturated aldehydes and ketones.

Unit III

Carboxylic Acids and its derivatives

Carboxylic Acids: Nomenclature, structure and bonding, physical properties, acidity of carboxylic acids, effects of substituents on acid strength. Preparation of carboxylic acids.Reactions of carboxylic acids. Hell-Volhard-Zelinsky reaction.Synthesis of acid chlorides, esters and amides. Reduction of carboxylic acids. Mechanism of decarboxylation. Methods of formation and chemical reactions of unsaturated monocarboxylic acids. Dicarboxylic acids: Methods of formation and effect of heat and dehydrating agents.

Carboxylic Acid Derivatives: Structure and nomenclature of acid chlorides, esters, amides and acid anhydrides. Relative stability of acyl derivatives.Physical properties, interconversion of acid derivatives by nucleophilic acyl substitution.Preparation of carboxylic acid derivatives, chemical reactions, mechanisms of esterification and hydrolysis (acidic and basic).

Unit IV

Nitrogen containing compounds and Enolates

Itroalkanes and Nitroarenes: Preparation of nitroalkanes and nitroarenes. Chemical reactions of nitroalkanes.Mechanisms of nucleophilic substitution in nitroarenes and their reductions in acidic, neutral and alkaline media.Picric acid. Halonitroarenes: Reactivity.

Amines: Structure and nomenclature of amines, physical properties. Stereochemistry of amines, Separation of a mixture of primary, secondary and tertiary amines, Structural features effecting basicity of amines, Amines salts as phase-transfer catalysts, Preparation of alkyl and aryl amines (reduction of nitro compounds, nitriles), reductive amination of aldehydic and ketonic compounds, Gabriel phthalimide reaction, Hofmann bromamide reaction. Reactions of amines: Electrophilic aromatic substitution in aryl amines, reaction of amines with nitrous acid. Synthetic transformation of aryl diazonium salts, azo coupling.

Organic Synthesis via Enolates: Acidity of α-hydrogens. Synthesis of ethyl acetoacetate by Claisen condensation and Synthesis of diethylmalonate.Keto-enol tautomerism in ethyl acetoacetate.Synthetic applications of ethyl acetoacetate and diethylmalonate. Alkylation of 1,3-dithianes.

Unit V

Electromagnetic Spectrum: Absorption Spectra

Ultraviolet (UV) absorption spectroscopy – absorption laws (Beer-Lambert law), molar absorptivity, types of electronic transitions, effect of conjugation. Concept of chromophore and auxochrome. Bathochromic, hypsochromic, hyperchromic and hypochromic shifts. UV spectra of conjugated enes and enones. Woodward Fieser rules for calculation of absorption maxima in dienes and α, β unsaturated carbonyl compounds.

Infrared (IR) absorption spectroscopy – molecular vibrations, Hooke‘s law, selection rules, intensity and position of IR bands, fingerprint region, characteristic absorption of various functional groups and interpretation of IR spectra of simple organic compounds.

Text Books and References

1. Bruckner, R. Advanced organic chemistry : reaction mechanisms Academic Press
2. Lowry, Thomas H. Mechanism and theory in organic chemistry AddisonWesley
3. Kalsi P S Reaction Mechanism 6th Edition
4. Singh Mukherjee, Reaction Mechanism
5. Robert M. Silverstein, Spectrometric Identification of Organic Compounds,Wiley
6. Lowry, Thomas H. Mechanism and theory in organic chemistry AddisonWesley
7. Francis A Carey Organic Chemistry fourth edition.
8. Bahl, Arun A textbook of organic chemistry S. Chand and Co. Ltd.

B. Sc. Part-III
CHEMISTRY
Paper-III: Physical Chemistry
BSCCH-303

Maximum Marks: 50 **External Marks: 40**

Internal: 10 Marks

Learning outcomes: -After completion of the course, student-teachers will be able:

1. To understand the Elementary Quantum Mechanics and Chemical Bonding.
2. To get familiar with Molecular Orbital Theory.
3. To define the Rotational and Vibrational Spectrum.
4. To apply the Fundamentals of Spectroscopyin real life situation.

Unit I

Elementary Quantum Mechanics: Black-body radiation, Planck‘s radiation law, photoelectric effect, heat capacity of solids, Bohr‘s model of hydrogen atom (no derivation) and its defects, Compton effect, De Broglie hypothesis, the Heisenberg‘s uncertainty principle, Sinusoidal wave equation, Hamiltonian operator, Schrodinger wave equation and its importance, physical interpretation of the wave function, postulates of quantum mechanics, particle in a one dimensional box. Schrodinger wave equation for H-atom, separation into three equations (without derivation), quantum numbers and their importance, hydrogen like wave functions, radial wave functions, angular wave functions.

Unit II

Molecular Orbital Theory: Basic ideas, criteria for forming M.O from A.O , construction of M.O‘s by + LCAO-H_2 , ion, calculation of energy levels from wave functions, physical picture of bonding and ant bonding wave functions, concept of σ, σ*, π, π* orbitals and their characteristics. Hybrid orbitals – sp, sp coefficients of A.O.‘s used in these hybrid orbitals. SP^2 , sp3 , calculation of Introduction to valence bond model of H_2, comparison of M.O. and V.B. models.

Unit III

Fundamentals of Spectroscopy-I

Spectroscopy: Introduction: electromagnetic radiation, regions of the spectrum, basic features of different spectrometers, statement of the Born-Oppenheimer approximation, degrees of freedom.

Rotational Spectrum: Diatomic molecules, Energy levels of a rigid rotor (semiclassical principles), selection rules, spectral intensity, distribution using population distribution (Maxwell-Boltzmann distribution) determination of bond length, qualitative description of non-rigid rotor, isotope effect.

Vibrational Spectrum: Infrared spectrum: energy levels of simple harmonic oscillator, selection rules, pure vibrational spectrum, intensity, determination of force constant and qualitative relation of force constant and bond energies, effect of anharmonic motion and isotope on the spectrum, idea of vibrational frequencies of different functional groups.

Unit IV

Fundamentals of Spectroscopy-II

Raman Spectrum: Concept of polarisability, pure rotational and pure vibrationl Raman spectra of diatomic molecules, selection rules. σ, π- and n M.O., their energy levels and the respective transitions.

Electronic Spectrum: Concept of potential energy curves for bonding and antibonding molecular orbitals, qualitative description of selection rules and Frank-Condon principles. Qualitative description of σ, π- and n M.O., their energy levels and the respective transitions.

Unit V

Photochemistry and physical properties of matter

Photochemistry: Interaction of radiation with matter, difference between thermal and photochemical processes. Law of photochemistry: Grothus- drapper law, StarkEinstein law, Jablonski diagram depicting various processes occurring in the excited state, qualitative description of fluorescence, phosphorescence, non-radiative processes (internal conversion, intersystem crossing), quantum yield, photosensitized reactions – energy transfer processes (simple examples).

Physical properties of matter: Optical activity, polarization – (Clausius – Mossotti equation), orientation of dipoles in an electric field, dipole, moment, induced dipole moment, measurement of dipole moment temperature method and refractivity method, dipole moment and structure of molecules, magnetic propertiesparamagnetism, diamagnetism and ferromagnetics.

Text Books and References

1. Mahendra R Awode, Quantum Chemistry S. Chand Publishing.
2. A K Chandra, Introductory Quantum Chemistry, Tata McGraw-Hill Education
3. Peter Atkins Julio de Paula, Atkins' Physical Chemistry Oxford University Press.
4. Robert J. Silbey, Robert A. Alberty , Moungi G. Bawendi, Physical Chemistry 4th Edition, Wiley
5. Colin N. Banwell, Fundamentals of Molecular & Spectroscopy, Tata McGraw- Hill Education
6. Walter S. Struve, Fundamentals of Molecular Spectroscopy, Wiley

B. Sc. Part-III
CHEMISTRY PRACTICAL

Duration: 5 Hours **Min.Pass Marks: 18** **Max. Marks: 50**

Note: The students should be given exposure of any research labs and instrumentation center/ reputed university lab/ industry/ government labs of northern region.

Distribution of Marks

	Exercises	Marks
1	Synthesis of Inorganic complex and Inorganic compound OR Gravimetric Analysis	10
2	Synthesis and Analysis of Organic complounds	7
3	Qualitative analysis : Organic mixture analysis	7
4	One Physical experiment	10
5	Vice-voce	8
6	Records	8
	Total	50 marks

A. Inorganic Chemistry

1. Synthesis and analysis

a. Preparation of sodium tri oxalate ferrate (III), $Na_3[Fe(C_2O_4)_3]$ and determination of its composition by permaganometry.
b. Preparation of copper tertraammine complex. $[Cu(NH_3)_4]SO_4$.
c. Preparation of Ni-DMG complex, $[Ni(DMG)_2]$.
d. Preparation of cis- and trans – bisoxalatodiaqua chromate (III) ion.
e. Quantitative estimation of one metal volumetrically from a given mixture.
f. To estimate magnesium volumetrically from a mixture containing Ba^{2+} and Mg^{2+} Ions/ Zn^{2+} and Mg^{2+} ions.
g. To estimate copper iodometrically from a given mixture containing Pb^{+2} and Cu^{2+} ions.
h. Estimation of Glucose with the help of Fehling‘s solution.
i. Determination of Total hardness of water.

2. Gravimetric Analysis

a. Cu as Copper thiocyanate.
b. Ni as Nickel dimethylgloxime

B. Organic Chemistry Synthesis of Organic Compounds

a. Acetylating of salicylic acid, aniline, glucose and hydroquinone.
b. Benzoylation of aniline and phenol.
c. Aliphatic electrophilic substitution: Preparation of iodoform from ethanol/ acetone
d. Aromatic electrophilic substitution: ÿ Nitration: Preparation of m-dinitrobenzene and p-nitroacetanilide ÿ Halogenation: Preparation of p- bromoacetanilide and 2, 4, 6- tribromophenol ÿ Diazotization/ coupling: Preparation of methyl orange and methyl red ÿ Oxidation: Preparation of benzoic acid from toluene ÿ Reduction: Preparation of aniline from nitrobenzene and m-nitroaniline from m-dinitrobenzene.

C. Physical Chemistry

1. pH metric: Acid-Base Titration.
2. To determine the strength of the given acid conductometrically using standard alkali solution.
3. To determine the solubility and solubility product of a sparingly solubility product of a sparingly soluble electrolyte conductometrically.
4. To determine the ionization constant of a weak acid conductometrically.
5. (a) To titrate potentiometrically the given ferrous ammonium sulphate solution using $KMnO_4$/ $K_2Cr_2O_7$ as titrant and calculate the redox potential of Fe /Fe system on the hydrogen scale.
   (b) Chemical Kineticsto study the saponification of ethyl acetate kinetically.

B. Sc. Part-III

ZOOLOGY

Paper I: Developmental Biology

BSCZO-301

Maximum Marks: 50 **External: 40 Marks**

Internal: 10 Marks

Learning outcomes: -After completion of the course, student-teachers will be able:

1. To comprehend the modern concepts of developmental biology;
2. To understand the developmental sequences in vertebrates;
3. To compare the development of organs and systems;
4. To identify the useful animals for harvesting the benefits and preventing the harmfulness with effective control measures

COURSE CONTENT:

Unit - I

Gametogenesis and Early Development

- **Concepts and seope of developmental biology**
- **Gametogenesis:** Differentiation of spermatozoa and oocyte in mammals, Different types of eggs-classification based on amount and distribution of yolk
- **Fertilization:** Approach of gamete, interaction of gametes, monospermy, polyspermy, Parthenogenesis and its significance
- **Cleavage:** Types of Cleavages-Holoblastic, Meroblastic, Radial, Spiral, Discoidal, Superficial. Planes of Cleavages-Meridional, Vertical, Equatorial, Latitudinal.Factors influencing Cleavage. Fate maps of Blastula of Frog and chick

Unit- II

- **Gastrulation**: Morphogenetic movement of cells, mechanism of gastrulation andchange in cell shape
- **Neurulation:** Formation, position and fate of three germinal layers, role ofmicrotubules and microfilaments in neurulation
- **Organizer-phenomenon:** Organizer concept of Spemann, chemical nature anddistribution of inductors-Competence, Determination and Differentiation, Outline of organogenesis.

Unit- III

Development of frog

- Development of frog upto formation of advanced tadpole.

- Metamorphosis of tadpole
- Hormonal control of metamorphosis.

Unit - IV

Development of Chick

- Embryogenesis of chick upto Neurulation
- Development of chick according to the hours of incubation- 18 hours, 21 hours, 24 hours, 33 hours, 48 hours, 56 hours, 72 hours and 96 hours.
- Extra embryonic membranes of chick- Development and functions.

Unit - V

- **Placenta in Mammals:** Structure, Classification, Physiology and Hormonal controlof Placenta
- Parthenogenesis- Natural and artificial.
- **Regeneration**: Regeneration mechanism in animals, steps of limb regeneration in amphibians
- Teratogenesis aging and Senescence.

References

1. Sastry K.V. & Shukla Vinita (2008).*Developmental Biology*. Rastogi Publications,
2. Balinsky B.I.(1976). Introduction to Embryology– (W.B. Saunders, Philadelphia,
3. Paten B.M and Carison B.M(2001). Foundations of Embryology.
4. Hopper A.F. and N.H.Hart (1981). Foundations of Animal Development (Oxford University Press, New York, 1980).
5. McEwen R.S. (1999). Vertebrate Embryology (Oxford & IBM Publishing CO., New Delhi).
6. Jhingran. V.G. (2001). Fish and Fisheries of India (Hindustan Publishing Corpn; New Delhi)
7. Barth I.G (1966). Embryology– Holt Rinehart & Winston.
8. Berril N & Karp G (1978). Development– Tata McGraw Hill Publ. Co.
9. Bodemer CW (1960). Modern Embryology - Holt Rinehart & Winston.
10. Huettner AF (1967).&McMillan.Co. Fundamentals of Comparative Embryology of Vertebrates
11. Arora Mohan (1985). Chordate Embryology– Atma Ram & Sons.
12. Rugh R. (1998). Laboratory manual of Vertebrate Embryology– Allied Pacific Pvt. Ltd.
13. Verma PS & Agarwal VK (2002).Chordate Embryology Chand & Co.

B. Sc. Part-III

ZOOLOGY

PAPER II: Environmental Studies

BSCZO-302

Maximum Marks: 50 **External: 40**

Internal: 10 Marks

Learning outcomes: -After completion of the course, student-teachers will be able:

1. To enable students to understand the energy sources, flow of energy and conservation;
2. To understand the recycling of minerals and nutrients in ecosystem;
3. To understand the dynamics of population; to understand causes of pollution;
4. To comprehend origin of life, animal behavior and economic importance of animals with wild life protection.

Unit –I

Environment: - Atmosphere, lithosphere and hydrosphere as habitats and ecological factors.

Abiotic factors: - Light and Temperature as ecological factors, limiting factors,

Liebig's law of minimum and Shelford Law of tolerance

Ecosystem: Types, structure, functions and example, Dynamics of Ecosystem, Ecological, Pyramids, energy in ecosystem, productivity.

Unit –II

Population: - Definition and attributes – density – natality, vital index, age distribution, growth patterns, migration, dispersal, dispersions, Enviromental resistance, carrying –Definition Structure, Species.

Biotic Community – Definition Structure, Species, Ecotone, edge effects, niche, community stability

Ecological succession, Intra and Interspecific interaction. All types of animal association.

Elementary statistics: central tendency, test of significance.

Unit-III

Pollution Types and Causes

Air pollution: sources, acid rain, photochemical smog, prevention and control

Water pollution, sources, prevention and control, eutrophication, Noise pollution; sources, prevention and control, Soil pollution; sources, prevention and control, Thermal pollution.

Unit –IV

Biochemical cycle- water, nitrogen, suphur Phosphorus cycles

Biome

- Desert Biome
- Tundra Biome
- Forest Biome
- Grass lans biome
- Cave Biome

Unit – V

Green house effect and global warming

Depletion of ozone layer.

Natural Disaster – Earthquake, Tsunami

Natural Resources and conservation – Non-Renewable and Renewable

Biomagfications

Textbooks and References

1. Nobel, P. S. (2003). *Environmental biology of agaves and cacti*. Cambridge University Press.
2. Bailer, A. J. (2020). *Statistics for environmental biology and toxicology*. Routledge.
3. Odum, E. P., & Barrett, G. W. (1971). *Fundamentals of ecology* (Vol. 3, p. 5). Philadelphia: Saunders.
4. Odum, E. P., & Barrett, G. W. (1971). *Fundamentals of ecology* (Vol. 3, p. 5). Philadelphia: Saunders.
5. Dash, M. C. (2001). *Fundamentals of ecology*. Tata McGraw-Hill Education.
6. Agarwal, S. K. (2008). *Fundamentals of ecology*. APH Publishing.
7. Coleman, D. C., Callaham, M. A., & Crossley Jr, D. A. (2017). *Fundamentals of soil ecology*. Academic press.
8. Kormondy, E. J., & Brown, D. E. (1998). *Fundamentals of human ecology*. Pearson College Division.
9. Chapman E (1988).*Ecology: Principle and Applications*– CambridgeUniversityPrss
10. Kumar HD (1986).*Modern concept of ecology* Vikas Publication House.
11. Sharma PD (1991).*Ecology and Environment*– Rastogi Publication
12. Trievedi PR &Gurudeep Raj (1992)*Environmental Biology*
13. Soni.KC(1999). Animal Ecology and Biostatistics. Hindi Edition college book centre, Chaura Rasta, Jaipur
14. Pawar.V. S, (1998). Mammalian Endrocrinology and Animal Behavior, Hindi Edition, College book centre, Chaura Rasta Jaipur

B. Sc. Part-III
ZOOLOGY
PAPER III: Ethology, Economic Zoology& Wild Life
BSCZO-303

Maximum Marks: 50 **External: 40**
Internal: 10 Marks
Learning outcomes: -After completion of the course, student-teachers will be able:

1. To enable students to understand the energy sources, flow of energy and conservation;
2. To understand the recycling of minerals and nutrients in ecosystem;
3. To understand the dynamics of population; to understand causes of pollution;
4. To comprehend origin of life, animal behavior and economic importance of animals with wild life protection.

Unit –I

Introduction and history of Ethology

Behavior: - Innate (tropism, Texas, reference instincts) and Acquired (learning and reasoning)
Motion: Classification of directional movements: - kinesis, tropism & taxes
Communication: - Definition, types of signal (touch, sound, Chemical, and visual), metacomunication) phenomenon
Societies: characteristics and advantage with special reference to honey bee, and monkey

Unit –II

Methods of Studying Behavior

Study in the Laboratory
Study in the Wild
Biological Rhythms
Inter Specific Relationships: Symbiosis, Predation, Parasitism, Commensalism, Mutualism

Unit –III

Insect Pests:

Agricultural**: -** Pest of Sugarcane**,** Pest of Rice, Pest of Pulses.Principals of Insect management

Mechanical & Physical control, Manipulation of Physical factors, Biological control, Male sterilization technique, Legislative control, Pest control by chemicals.

Termite control, locust control.

Precaution during the use of pesticides.

Unit –IV

Insect Pests:

Pisciculture: Pond culture ; Layout and management of fish farm.

Composite fish culture.

Induced breeding

Types of fish Hatcheries.

Bye products of fishing industry.

Unit –V

Sericulture : Type of silk moths, their host plants & distribution, process of sericulture.

Apiculture : Types of honey bees & their artificial culture of honey bee distribution, production & uses.

Wild protected habitats: Wild life of India causes of depletion, wild life, modes of wild life conservation, Red data book. Environmental legislations (Wildlife Protection Act, Environment act.Bio divergent act).Wild life scenario in and around central foot hills of the Arawali and the thar.

Textbooks and References

1. Nobel, P. S. (2003). *Environmental biology of agaves and cacti*. Cambridge University Press.
2. Bailer, A. J. (2020). *Statistics for environmental biology and toxicology*. Routledge.
3. Odum, E. P., & Barrett, G. W. (1971). *Fundamentals of ecology* (Vol. 3, p. 5). Philadelphia: Saunders.
4. Odum, E. P., & Barrett, G. W. (1971). *Fundamentals of ecology* (Vol. 3, p. 5). Philadelphia: Saunders.
5. Dash, M. C. (2001). *Fundamentals of ecology*. Tata McGraw-Hill Education.
6. Agarwal, S. K. (2008). *Fundamentals of ecology*. APH Publishing.
7. Coleman, D. C., Callaham, M. A., & Crossley Jr, D. A. (2017). *Fundamentals of soil ecology*. Academic press.
8. Kormondy, E. J., & Brown, D. E. (1998). *Fundamentals of human ecology*. Pearson College Division.
9. Chapman E (1988).*Ecology: Principle and Applications*– CambridgeUniversityPrss
10. Kumar HD (1986).*Modern concept of ecology* Vikas Publication House.
11. Sharma PD (1991).*Ecology and Environment*– Rastogi Publication
12. Trievedi PR &Gurudeep Raj (1992)*Environmental Biology*
13. Soni.KC(1999). Animal Ecology and Biostatistics. Hindi Edition college book centre, Chaura Rasta, Jaipur
14. Pawar.V. S, (1998). Mammalian Endrocrinology and Animal Behavior, Hindi Edition, College book centre, Chaura Rasta Jaipur

B. Sc. Part-III
ZOOLOGY
PRACTICAL

Duration:4 hours **Max .Marks: 50**

Practical work based on Paper I and II Course content-

- Study of types of sperm smears preparation.
- Study of different types of eggs (Insect, Frog, Hen)
- Study of eggs, cleavage, blastula, gastrula, neurula, tail bud, hatching, mature, tadpole larval metamorphic stages of toadle/forglet.
- Study of embryological slides of various stages of frog.
- Study of embryological slides of various stages of chick.
- Study of development of chick with the help of charts /CD/s /Video/ MM etc.
- Whole mounts: 18 hrs, 24 hrs, 33 hrs, 48 hrs, 56hrs, 72hrs, and 96 hrs, of incubation period embryos.
- Study of primitive streak stage in living embryo after removal of the blastoderm from the egg or though multimedia film etsc
- Study of the embryo at various stages of incubation in vivo by making a window in the egg shell.
- Frog embryology – Study of spawn, identification of different stages through model/charts/multimedia etc
- Microtomy – Fixation of tissue from cadaver/ unbanned animal, processing and infiltration of wax, preparation of blocks, cutting of blocks, spreading of ribbons and staining for permanent slides of histological studies.
- Simulation of an ecosystem in the laboratory.
- Determination of oxygen cotent of water sample by Winkler's method.
- Determination of chloride content of water sample
- Determination of sulphates content of water sample
- Determination of dissolved CO_2 content of water
- Determination of total solid content of water
- Determination of pH of soil sample
- Determination of water content in a given simple of soil
- Detection of salts i.e. phosphates, sulphates, nitrates and chlorides in a given sample of water.
- Exercise on mean, median, mode and test of significance

Note:-

1. The use of animal/ materials for dissection or otherwise is subject to the condition that these are not banned under the wildlife Protection Act and /or as per UGC guidelines.
2. The above content will be covered through model /charts / multimedia/slides etc.
3. The students are required to submit assignment on the following.
4. One assignment on the instrument /technique about its principle, working, precautions and applications; and /or regents / solutions preparations.
5. Report on study of wild life /ecosystem /industry etc from their natural habitat (excursion)

Guidelines/Instructions for Practical Examination		
Max. Marks: 50		**Time allowed: 4 Hrs.**
S. No.	**Exercise**	**Marks**
1.	Temporary mounting * one (Staining, identification, sketch)	**3**
2.	Simulated ecosystem	**3**
3.	Permanent slides –four (Identification with reasons)	**8**
5.	Ecological experiment	**6**
6.	Statistical exercise	**5**
7.	Practical record and slides	**5**
8.	Viva	**4**
9.	Project report and assignment	**8**

B.Sc.Part-III

BOTANY

Paper – I: Structure, Development and Reproduction in Flowering plants

BSCBO-301

Maximum Marks: 50 **External Marks: 40**

Internal: 10 Marks

Learning outcomes:-After completion of the course, student-teachers will be able:

1. To acquaint students with the morphology, anatomy, reproduction and classification of flowering plants.
2. To acquaint students with the structure, development and processes associated with Angiosperm embryology;
3. To acquaint students with basic body plan of a flowering plant.

UNIT- I

The basic body plan of a flowering plant; Types of Tissue and Tissue System. The shoot system: The shoot apical meristems and its histological organization; vascularization of primary shoot in monocotyledons and dicotyledons; formation of internodes, branching pattern; monopodial sympodial growth; can opy architecture; cambium and its functions; formation of secondary xylem; a general account of wood structure in relation to conduction of water and minerals; characteristics of growth rings, sapwood and heart wood; secondary phloem – structure – function relationships; periderm

UNIT II

Leaf: Origin, development, arrangement and diversity in size and shape; internal structure in relation to photosynthesis and water loss; adaptations to water stress; stomatal types and trichomes; senescence and abscission. The root system: The root apical meristem and its organisation; differentiation of primary and secondary tissues and their roles; structural modifications for storage, respiration, reproduction and for interaction with microbes.

UNIT – III

Flower: A modified shoot; development, structure and function of anther and pistil; Development of male and female gametophytes; Types of pollination; attractions and rewards for pollinators.

UNIT – IV

Pollen-pistil interaction: Sexual incompatibility; Genetic, physiological and biochemical basis of rejection reaction; methods to overcome incompatibility. Fertilization: Double fertilization, Apomixis, Parthenocarpy

UNIT – V

Embryo: Embryo development in Dicots and monocots; structure and function of suspensor; Polyembryony. Endosperm: Types, development, structure and functions of endosperm, haustorial and ruminate endosperm. Fruits: Development and types of fruits.

Suggested Readings:

1. Johri, B.M. (1984). Embryology of Angiosperms. Springer-Verlag, Berlin.
2. Pandey, A.K. (1997). Introduction to Embryology of Angiosperms. CBS Publishers & Distributors, New Delhi.
3. Shivanna, K.R. (2003). Pollen Biology and Biotechnology. Oxford & IBH Publishing • Co., New Delhi.
4. Singh, P.C. Pande, D.K. Jain (2005). A Textbook of Botany: Structure, Development and Reproduction in Angiosperms. Rastogi PublicationsMeerut, Uttar Pradesh.
5. Paula Rudall, (2007). Anatomy of flowering plants: an introduction to structure and development.: Cambridge University Press Cambridg, New York.
6. Bouman, (1978). Development of ovule and seed coat structure in angiosperms. Today & tomorrow's Printers & Publishers, New Delhi

B.Sc.Part-III
BOTANY
Paper – II: Plant Physiology
BSCBO-302

Maximum Marks: 50 **External Marks: 40**
Internal: 10 Marks
Learning outcomes: -After completion of the course, student-teachers will be able:

1. To acquaint students with the sub-cellular physiological phenomena in plants;
2. To understand the water relations in plants;
3. To understand the functioning of plant from the physiological point of view;
4. To understand various facets of growth, differentiation and physiology of flowering in angiosperms.

UNIT-I

Plant-water relations: Importance of water to plant life; physical properties of water; diffusion and osmosis; DPD and water potential concept, absorption and transport of water: Transpiration and mechanism of opening and closing of stomata. Factors affecting transpiration. Translocation of organic substances: mechanism of phloem transport; source – sink relationship; factors affecting translocation.

UNIT – II

Photosynthesis: Historical aspects; photosynthetic pigments; action spectra and enhancement effect; concept of two photosystems; photophosphorylation; C3cycle; 84 C4 cycle; CAM cycle; photorespiration; factors influencing photosynthesis; C3& C4 plants. Significance of photosynthesis.

UNIT – III

Respiration: Aerobic and anaerobic respiration; respiratory substrates; Glycolytic pathway of glucose degradation to pyruvic acid; tricarboxylic acid cycle; electron transport mechanism (chemi – osmotic theory); redox potential; oxidative phosphorylation; pentose phosphate pathway. Factors affecting respiration.

UNIT – IV

Mineral nutrition: criteria of essentiality of elements; essential macro – and microelements and their role; mineral uptake; deficiency and toxicity symptoms; water culture technique; foliar nutrition. Nitrogen and lipid metabolism: Biology of nitrogen – fixation; importance of nitrate reductase and its regulation; ammonium assimilation; structure and function of lipids; fatty acid biosynthesis; β-oxidation; saturated and unsaturated fatty-acids; storage and mobilization of fatty acids.

UNIT –V

Growth and development: Definitions; phases of growth and development; Growth Curve, kinetics of growth; seed dormancy, seed germination and factors of their regulation; plant movements; the concept of photoperiodism; physiology of flowering; florigen concept; biological clocks; physiology of senescence, fruit ripening; plant hormones auxins, gibberellins, cytokinins, abscisic acid and ethylene, history of their discovery, biosynthesis and mechanism of action, photomorphogenesis; phytochromes and cryptochromes, their discovery, physiological role and mechanism of action.

Suggested Readings:

1. Hopkins W.G. 1995, Introduction to Plant Physiology,
2. John Willey & Sons, New York USA. Salisbury F.B. & Ross C.W. 1992 Plant physiology,
3. Widsworth Publishing Co. California, U.S.A.
4. Taiz L. & Zeiger E, 1998,
5. Plant Physiology (Second Edition) Sinauer Associates Inc. Publishing U.S.A.

B.Sc.Part-III
BOTANY
Paper – III: Ecology & Economic Botany
BSCBO-303

Maximum Marks: 50 **External Marks: 40**

Internal: 10 Marks

Learning outcomes: -After completion of the course, student-teachers will be able:

1. To acquaint students with the Plant Ecology & Economic Botany
2. To understand the Ecology of Rajasthan desert;
3. To understand the functioning of plant from the physiological point of view;
4. To understand various pollution & its type.
5. To explain the Structure and function, Abiotic & biotic components,
6. To understand various Ecosystem, Energy flow & Renewable & non-renewable, management problem of depletion of natural vegetation.

UNIT-I

Plant Ecology: Defination, Scope, Branches & Ecological factor affecting the Vegetation.Ecology of Rajasthan desert.Atmosphere (gaseous composition), Climatic factors, Edaphic factors, morphological, anatomical and physiological, responses of plants to water, temperature light and Salinity.

UNIT-II

Population Ecology with special reference to Growth Curves, ecotypes, ecads and plant Indicators. Community ecology with special reference to life forms, biological spectrum, ecological succession.Ecosystem,Pollutionof Air.Water, Noice, their Causes,Consequences & Control.

UNIT-III

Structure and function, Abiotic & biotic components, food chain, food Web ecological pyramids, energy flow, Resources; Renewable & non-renewable, management problem of depletion of natural vegetation.

UNIT-IV

biogeochemical cycles of carbon, nitrogen & phosphorous General vegetation of India Intellectual property Rights (IPR) and Patent.

UNIT-V

Economic Botany: - Origin, Cultivation and value added products of following: Cereals: Rice, Wheat and Maize Oil Yielding Plants: Mustard, Groundnut and Coconut Fibre Yielding Plants: Cotton, Sun-hemp Spices : Cardamom, Fennel, Cumin, Coriander Medicinal plants : Opium, Cinchona, Sarpagandha. Beverages : Tea & Coffee Rubber : General Account

Suggested Readings:

1. Vasil. I.K. and Thorpe, T.A. 1994, Plant Cell and Tissue Culture, Kluwer Academic Publishers, The Netherlands.
2. Kochar, S.L. 1998. Economic Botany in Tropics 2 nd edition. Macmillan India Ltd. New Delhi.
3. Simpson. B.B. and Conner-Ogorzaly, M. 1986.
4. Economic Botany – Plants in Our World, Mc. Graw Hill, New Delhi. Practicals
5. To determine the minimum size of quadrate by species area curve method.
6. To determine the minimum number of quadrate to be laid down in field under study.
7. To study the vegetation structure through profile diagram
8. To determine moisture content and water holding capacity of different types of soil
9. To determine the dust holding capacity of different types to leaves.
10. Spices: Examine Coriander, Fennel and Cumin (hand sections) and opened fruits of cardamom and describe them briefly.
11. Preparation of an illustrated inventory of 5 medicinal plants used in indigenous systems of medicine or allopathy: Write their botanical and common names, parts and diseases/disorders for which they are prescribed.

B.Sc. Part-III
BOTANY PRACTICALS

Duration– 4 Hours **Maximum Marks - 50**

Course Content The following experiments are to be conducted:

1. Anatomy of primary and secondary growth in monocots and dicots using hand sections (or prepared slides). Structure of secondary phloem and xylem. Growth rings in wood. Microscopic study of wood in T.S., T.L.S. and R.L.S. Anomalous Sec. growth in Boerhaavia, Nyctanthus and Dracaena
2. Anatomy of leaf and Peel mount for stomatal types/trichomes.
3. Anatomy of the root. Primary and secondary structure.
4. Examination of a wide range of flowers available in the locality and methods of their pollination.
5. Structure of anther, microsporogenesis (using slides) and pollen grains (using whole mounts). Pollen viability using in vitro pollen germination.
6. Structure of ovule and embryo sac development (using serial sections).
7. Simple experiments to show vegetative propagation: leaf cuttings in Bryophyllum, Sansevieria, Begonia; stem cuttings in rose, salix, money plant, sugarcane and Bougainvillea.
8. Ecological instruments & their Working (a) Maximum & Minimum thermometer (b) Oven
9. Germination of non-dormant and dormant seeds.
10. To demonstrate osmosis using egg membrane, onion/tomato peels, potato osmoscope.
11. To study the effect of temperature and alcohol on the permeability of membranes.
12. To demonstrate plasmolysis.
13. To compare the water holding capacity of soils (clay, peat and sand),
14. 13. To demonstrate transpiration pull.
15. To compare the rates of transpiration in different environmental conditions.
16. To demonstrate the evolution of oxygen during photosynthesis.
17. To compare the rates of photosynthesis under different environmental conditions.
18. To demonstrate the necessity of light, CO2 and chlorophyll for photosynthesis.
19. Separation of photosynthetic pigments by paper chromatography.
20. Demonstration of aerobic respiration.
21. Demonstration of anaerobic respiration.
22. To demonstrate the liberation of CO2 during aerobic respiration. (B).

Maintenance of a record of all activities performed.

Marking Scheme- There shall be a practical examination of four hours duration and the distribution of marks shall be as follows –

Time: 4 Hrs. Maximum Marks-50 Minimum Marks- 18

Sr.no.	Questions	Marks
1.	Phsiology experiment	4
2.	Ecological exercise -Morphology & Anatomy	4
3.	SoiI Water tests and Field Exercise	4
4.	Experiments in tissue culture	5
5.	Phyto chemical tests (two)	5
6.	Spots (six). Two from each paper	12
7.	Viva-voce	8
8.	Records	8
Total		50