

B.Sc. Part-I, Exam.2010

Prospectus No.2010121

संत गाडगे बाबा अमरावती विद्यापीठ
SANT GADGE BABA AMRAVATI UNIVERSITY

(विज्ञान विद्याशाखा)
(FACULTY OF SCIENCE)

अभ्यासक्रमिका
विज्ञान स्नातक भाग-१ परिक्षा २०१०
त्रिवर्षीय अभ्यासक्रम

PROSPECTUS
OF
B.Sc. Part-I Examination , 2010
(Three Year Degree Course)



2009

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

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

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

- Ordinance No. 1 : Enrolment of Students.
- Ordinance No. 2 : Admission of Students
- Ordinance No. 4 : National cadet corps
- Ordinance No. 6 : Examinations in General (relevent extracts)
- Ordinance No. 18/2001 : An Ordinance to provide grace marks for passing in a Head of passing and Improvement of Division (Higher Class) and getting Distinction in the subject and condonation of defficiency of marks in a subject in all the faculties prescribed by the Statute NO.18, Ordinance 2001.
- Ordinance No. 9 : Conduct of Examinations (relevent extracts)
- Ordinance No. 10 : Providing for Exemptions and Compartments
- Ordinance No. 19 : Admission of Candidates to Degrees.

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

J.S.Deshpande
Registrar
Sant Gadge Baba Amravati University.

PATTERN OF QUESTION PAPER ON THE UNIT SYSTEM

The pattern of question paper as per unit system will be boradly based on the following pattern.

- (1) Syllabus has been divided into units equal to the number of question to be answered in the paper. On each unit there will be a question either a long answer type or a short answer type.
- (2) Number of question will be in accordance with the unit prescribed in the syllabi for each paper i.e. there will be one question on each unit.
- (3) For every question long answer type or short answer type there will be an alternative choice from the same unit. However, there will be no internal choice in a question.
- (4) Division of marks between long answer and short answer type question will be in the ratio of 40 and 60.
- (5) Each short answer type question shall Contain 4 to 8 short sub question with no internal choice.

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**Syllabus Prescribed for
B.Sc. Part-I Examination
(Three Year Degree Course)**

The permission to use Calculator/Electronic Slide Rule Log Table at all the examinations in the Faculty of science has been granted. The colleges should provide as far as possible the above equipment to the examinees.

The use of S.I. Unit is compulsory for examination from Summer 1982.

1. COMPULSORY ENGLISH

(Implemented from the Session 2007-2008)

Time : 3 Hrs]

[Total Marks : 100

A]	Basic Language Skills	20 Marks
	Grammar & Usages (Based on the prescribed text)	
B]	Comprehension of unseen passage	20 Marks
C]	Composition	15 Marks
D]	Precis/Summary writing	15 Marks
E]	Prose and Poetry for detailed study.	30 Marks
	" The Threshold " Edited by Jagdip Singh, Praveen Kumar(Second Edition) published by Macmillan India Ltd.	

PROSE :

- 1] **The Gift of the Magi : O.Henry**
Using your Dictionary Grammar: Voice, Narration
- 2] **A Duel : R.K. Narayan**
Grammar: Sentence - subject, predicate, object, complement, adjunct
- 3] **The Fatalist : I. B. Singer**
Grammar: Parts of Speech - -pronouns, determiners, articles, ordinals, demonstrative, qualifiers.

Essays

1. **Work in the Sun and in the Light : Jawaharlal Nehru**
Grammar : Parts of Speech - adjectives, adverbs, intensifiers
2. **My Financial Career : Stephen Leacock**
Grammar : Parts of Speech - prepositions, conjunctions, interjections.
3. **Principles of Good Writing : L.A. Hill**
Grammar : Phrases - noun phrase, adjectival phrase, prepositional phrase, adverbial phrase
4. **The Elixir of Life : C.V.Raman**
Grammar : Clauses - main clause, subordinate clause, coordinate clause.

5. **Streamlining : C.Bevers**

Grammar : Types of Sentences - complex sentence, compound sentence, simple sentence

POETRY :

- 1] **On His Blindness : John Milton**
Pronunciation : English Vowel Sounds.
- 2] **The Echoing Green : William Blake**
Pronunciation : English Consonant Sounds.
- 3] **The World Is TOO Much With Us : William Wordsworth**
Pronunciation : Word Stress-syllables.
- 4] **A Bird Came Down the Walk : Emily Dickinson**
Pronunciation : Disyllabic words stress - on first syllable,
- 5] **Stopping by Woods on a Snowy Evening : Robert Frost**
Pronunciation : Disyllabic words stress - on second syllable.
- 6] **Palanquin-Bearers : Sarojini Naidu**
Pronunciation words stress - in polysyllabic words.
- 7] **Night of the Scorpion : Nissim Ezekiel**

GRAMMER, COMPOSITION AND TRANSLATION

- 1] Punctuation
- 2] Spelling
- 3] Single Word for a Group of Words
- 4] Antonyms and Synonyms
- 5] Comprehension
- 6] Letter Writing and Invitations
- 7] Miscellaneous Exercises : Articles, Prepositions, Voice, Narration, Modals

DISTRIBUTION OF MARKS SHALL BE AS FOLLOWS :

UNIT-I :	Basic Language skills : Grammar and Usage	20 Marks
	a) Fill up the blanks with correct preposition, article.	02 Marks
	b) Correct errors	03 Marks
	c) Appropriate form of verb	02 Marks
	d) Clauses	03 Marks
	e) Write as directed (Voice, Remove, Too, Degree of Comparison, Interchange of sentences, change the narration)	05 Marks
	f) Idioms and Phrases	05 Marks
UNIT-II :	Comprehension of unseen passage	20 Marks
	a) Short answer questions based on understanding and Language skill.	05 Marks

- b) Synonyms and Antonyms 04 Marks
 c) Use other forms of verbs in the passage in own sentences. 03 Marks
 d) One word substitute 03 Marks
 e) Personal response 05 Marks

UNIT-III: Composition 15 Marks

- a) Essay (about 300 words) 10 Marks
 b) Letter writing Personal/Official 05 Marks

UNIT-IV: Precis / Summery writing 15 Marks

- a) Precis of a given passage 07 Marks
 b) Summery of a given poem 08 Marks

UNIT-V : Text 30 Marks**a) Prose**

There shall be 6 short answer type questions of which students will have to answer any four of five marks each.
20 Marks

b) Poems

There shall be 4 short answer type questions of which students will have to answer any two of five marks each.
10 Marks

Total 100 Marks

NOTE: Unit-I will strictly be based on the prescribed texts. For additional knowledge and practice in exercise the following books are suggested :

- 1] English for All - Edited by Nilanjana Gupta (Macmillan India Limited.)
- 2] Facets of English, Grammer II, R.N. Shukla, M.M. Nigarm. (Macmillan Ltd.)
- 3] Contemporary English Grammar - David Green.
- 4] Phrasal Verb Plus - Macmillan India Ltd.

2. LANGUAGES

(Any one of the following Languages)

(Marathi, Hindi, Urdu, Sanskrit or Supplementary English)

२. मराठी (अनिवार्य)

वेळ : ३ तास)

(गुण : १००)

या विषयाची एक प्रश्नपत्रिका राहिल.

१. सूक्ष्म वाचनाकरिता पाठ्यपुस्तक : 'संदेश' (अमरावती विद्यापीठ प्रकाशन)

या पाठ्यपुस्तकावर पुढीलप्रमाणे घटक, प्रश्न व गुणविभागणी राहिल.

प्रथम विभाग : 'अ' (वैचारिक)

घटक १ : पाठ क्रमांक १,२,३,४ आणि ५

घटक २ : पाठ क्रमांक ६,७,८,९

घटक १ आणि २ मधून प्रत्येकी एक दिर्घांतरी प्रश्न राहिल व प्रत्येक प्रश्नास २० गुण राहतील.

द्वितीय विभाग : 'ब' (ललित आणि कविता)

घटक ३ : पाठ क्रमांक १०,११,१२ आणि १३

घटक ४ : पाठ क्रमांक १४,१५,१६ आणि १७

घटक ५ : कविता क्रमांक १८, १९, २०,२१ आणि २२

घटक ६ : कविता क्रमांक २३, २४, २५, २६,२७ आणि २८

प्रत्येक घटकातून एक लघुतरी प्रश्न राहिल व प्रत्येक प्रश्नास १० गुण राहतील.

घटक ७ : (अ) पत्र लेखन ०५ गुण

(ब) उतारा शुद्ध करणे ०५ गुण

(क) निबंध १० गुण

१) पत्रलेखन १० ते १५ वाक्यांचे राहिल.

२) उतारा पाठ्यपुस्तकाबाहेरील असावा तसेच वर्णरचना वाक्य बांधणी किंवा उच्चारतात ज्या चुका नेहमी होतात त्यांच्या दुरुस्तीचा राहिल.

३) निबंध सामाजिक, सांस्कृतिक विषयावर सुमारे ४०० शब्दांचा राहिल.

सूचना : शुध्दलेखन मराठी साहित्य महामंडळाच्या नियमानुसार असावे.

३. हिन्दी (अनिवार्य)

(समय - ३ घंटे)

(पूर्णांक - १००)

१. नियोजित पाठ्यपुस्तक 'अस्मिता' - जयभारती प्रकाशन इलाहाबाद। यह पुस्तक अध्ययन तथा अध्यापन के लिए निर्धारित की गई है।
२. पाठ्यपुस्तक तीन भागों में विभक्त है।
अ- आधारभूत पाठ्यक्रम
ब- भाषागत पाठ्यक्रम
स- पद्यविभाग
३. सम्पूर्ण पाठ्यक्रम निम्न इकाईयों में विभाजित है।
क - प्रथम इकाई - आधारभूत पाठ्यक्रम - ३० अंक
ख - द्वितीय इकाई - भाषागत पाठ्यक्रम - ३० अंक
ग - तृतीय इकाई - पद्य विभाग - १० अंक
घ - चतुर्थ इकाई - व्यावहारिक भाषा एवं व्याकरण - ३० अंक

प्रश्नपत्र का स्वरूप :-

१. प्रथम इकाई - आधारभूत पाठ्यक्रम
क- दीर्घोत्तरी प्रश्न (एक) - १० अंक
ख- लघूत्तरी प्रश्न (चार) - २० अंक
२. द्वितीय इकाई - भाषागत पाठ्यक्रम
ग- दीर्घोत्तरी प्रश्न (एक) - १० अंक
घ- लघूत्तरी प्रश्न (चार) - २० अंक
३. तृतीय इकाई - पद्य विभाग
दो प्रश्न पूछे जायेंगे - १० अंक
४. चतुर्थ इकाई - व्यावहारिक भाषा एवं व्याकरण
(इस इकाई का अंक विभाजन निम्नानुसार है।)

१. अंग्रेजी से हिन्दी में अनुवाद - ५ अंक
२. मुहावरों का अर्थ लिखकर वाक्यों में प्रयोग (चार मुहावरे) - ४ अंक
३. पर्यायवाची शब्द (चार) - ४ अंक
४. श्रुतिसम भिन्नार्थक शब्द (चार) - ४ अंक
५. शब्द समूहके लिए एक शब्द (चार)- ४ अंक
६. पदनाम (चार) - ४ अंक
७. वाक्य शुद्धि (पाँच) - ५ अंक

सूचना : सभी प्रश्न विकल्प के साथ पूछे जायेंगे।

सहाय्यक पुस्तक सूची :-

- १) सामान्य हिन्दी बोधायन- लेखक - डॉ.रामदयाल कोष्टा एवं विजय कुमार सिंघई, प्रकाशक - खन्ना प्रकाशन, जबलपुर
- २) हिन्दी रचना प्रबोध - लेखक - डॉ.बच्चूलाल अवरथी, प्रकाशक - साहित्य भवन, प्रा.लि.के.पी.कक्कड रोड, इलाहाबाद
- ३) मानक हिन्दी का शुद्धि परक व्याकरण - डॉ.रमेशचंद्र मेहरोत्रा
- ४) प्रयोजनमूलक व्यावहारिक हिन्दी - ओमप्रकाश सिंहल, जगताराम एन्ड संस, नई दिल्ली

4. URDU COMPULSORY

Time : 3 Hours)

(Marks : 100

Text Prescribed : Shua-E-Adab (Part-I)

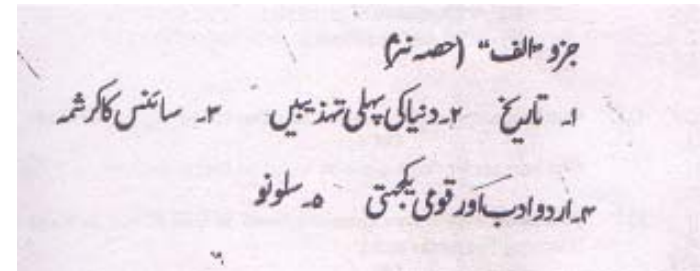
Published by TAFSA Printers & Publishers, Amravati.

Unitwise Distribution of Marks

Unit-I

The Following Five lessons from text

20 Marks



Unit-II The following poems from text 20 Marks

جزو "ب" (حصہ نظم)

۱۔ دنیا ۲۔ گلزارِ وطن ۳۔ نوجوانوں سے ۴۔ اجنتا ۵۔ ایک خواب اور

Unit-III The following three lessons from Text 20 Marks

جزو "ج"

۱۔ گھر کی تربیت ۲۔ کالے خال ۳۔ مردہ بدست زندہ

Unit-IV The following three lessons from Text 20 Marks

۱۔ گڈری کالال نور خاں ۲۔ بلٹ ٹرین میں کبھی نہ بیٹھو

Unit-V Communication Skill 20 Marks

- (a) Reporting of any function, incidence, match excursion etc.
(b) Expansion of given idea
(c) Idioms and Phrases

Q.1. One long answer type question based on Unit-I 20 Marks

OR

One long answer type question based on Unit-I

Q.2. Four Short answer type questions based on Unit-II 20 Marks
(Carrying five marks each)

OR

Four short answer type questions based on Unit-II
(Carrying five marks each)

Q.3. Four short answer type question based on Unit-III 20 Marks
(Carrying five marks each)

OR

Four short answer type questions based on Unit-III
(Carrying five marks each)

Q.4. One long answer type questions based on Unit-IV 20 Marks

OR

One long answer type questions based on Unit-IV

Q.5. a) Short answer type question- Reporting of any function, incident, match, excursion, etc. 08 Marks

b) Short answer type question- Expansion of given idea.

07 Marks

c) Idioms and Phrases from the Text Book

05 Marks

Total 100 Marks

५. संस्कृत (आवश्यक)

या विषयाची एक प्रश्नपत्रिका राहिल.

सूक्ष्म वाचनाकरिता पाठ्यपुस्तके -

१) कविकुलगुरुकालिदासाविरचित (गुण ५०)

रघुवंशम् या महाकाव्याचा द्वितीय सर्ग

२) भासविरचित कर्णभारम् (गुण ५०)

वरील पाठ्यपुस्तकाची पुढीलप्रमाणे पाच गटात विभागणी करावी.

गट १ - रघुवंशम् (द्वितीय सर्ग)

यातील श्लोक १ ते ३२

गट २ - रघुवंशम् (द्वितीय सर्ग)

यातील श्लोक ३३ ते ७५

गट ३ - 'कर्णभारम्' च्या आरंभापासून १४ व्या श्लोकानंतरच्या 'शल्यराजा यत्रासावर्जुनस्तत्रैव चोद्यतां मम रथः।' या वाक्यापर्यंत.

गट ४ - 'भो : कर्णा महत्तरां भिक्षां याचे।' या वाक्यापासून नाटकाच्या समाप्तिपर्यंत.

गट ५- अ) नान्दी, सूत्रधार, नेपथ्य, भरतवाक्य, जामदग्न्य, राधेय यावर परिच्छेद, मुळ महाभारतकथेत भासाने केलेले बदल, कर्णाचे व्यक्तिचित्र भासाची शैली, भासाविषयी सामान्य माहिती.

ब) कालिदासाची शैली, दिलीपाचे व्यक्तिचित्र, नन्दिनी, वसिष्ठ, वज्रपाणि; सुरविद सेनानी; गौरीगुरु : इतर परिच्छेद, कालिदासाची माहिती.

प्रश्नपत्रिकेचे स्वरूप व गुणविभागणी पुढीलप्रमाणे असावी.

वेळ ३ तास

एकूण गुण : १००

प्रश्न १ अ) गट २ मधील ३ श्लोकांपैकी दोहोंचा अनुवाद २०

ब) गट २ मधील ३ श्लोकांपैकी दोहोंचा अनुवाद

प्रश्न २ अ) गट ३ मधील ८ ओळींच्या दोन उताऱ्यांपैकी एकाचा अनुवाद.

२०

ब) गट ४ मधील ८ ओळींच्या दोन उताऱ्यांपैकी एकाचा अनुवाद

प्रश्न ३ अ) १) गट १ मधील दोन वाक्यांपैकी एकाचे संसंदर्भ स्पष्टीकरण

२०

२) गट २ मधील दोन दोन वाक्यांपैकी एकाचे ससंदर्भ स्पष्टीकरण.

ब) १) गट ३ मधील दोन वाक्यांपैकी एकाचे ससंदर्भ स्पष्टीकरण.

२) गट ४ मधील दोन वाक्यांपैकी एकाचे ससंदर्भ स्पष्टीकरण.

प्रश्न ४-अ) गट १ व गट २ वर प्रत्येकी एक-एक दीर्घांतरी प्रश्न राहून त्यापैकी एक सोडवावा लागेल. १०

ब) गट ३ व गट ४ वर प्रत्येकी एक-एक प्रश्न राहून त्यापैकी एक सोडवावा लागेल. १०

प्रश्न ५ - गट ५ मधील 'अ' व 'ब' वर प्रत्येकी दोन प्रश्न राहतील त्यातील प्रत्येकी एक प्रश्न सोडवावा लागेल. २०

6.SUPPLEMENTARY ENGLISH

Time : 3 Hrs.

Total Marks : 100

A]	Basic Language Skills	20
	Grammar and Usages (Based on prescribed text)	
B]	Comprehension of unseen passage	15
C]	Composition	15
D]	Precis and Story Building	10
E]	Prose and Poetry	40

Text "Voices and Visions"

(An anthology of English prose and poetry)

Edited by D.K.Samantaray and Kalidas Misra,

Published by S.Chand and Company Ltd., New Delhi.

Prose Section :

1. Hopes and Expectations for the Younger Generation : A.J.Toynbee
2. What is Science?: George Orwell
3. What is Courage : William Slim.
4. On Doing Nothing : J.B.Priestley
5. Speed : Robert Lynd.
6. Flight for Freedom : Alex Haley
7. Ha'penny : Alan Paton
8. After Twenty Years : O' Henry

Poetry Section :

1. The Chimney-Sweeper : William Blake
2. When I have Fears : John Keats
3. Crossing the Bar : Alfred, Lord Tennyson
4. O Where Are You Going? : W.H.Auden
5. When You Are Old : W.B.Yeats
6. Richard Cory : E.A.Robinson.

Unitwise distribution of Marks :

Unit-I	: Basic Language Skills	20
	A] Fill up the blanks with appropriate prepositions and articles	(04)
	B] Correct errors	(04)
	C] Use proper form of verbs	(04)
	D] Write as directed	(04)
	(Change the narration, voice, remove "too" and interchanging of sentences)	
	E] Idioms and Phrases	(04)
Unit-II	: Comprehension of Unseen Passage	15
	A] Synonyms and Antonyms	(04)

- B] Use of one word substitute (03)
 C] Personal Response (03)
 D] Five Short Answer Questions (05)
- Unit-III : Composition 15**
 A] Letter Writing - Personal / Business (05)
 B] Essay Writing (300 words) (10)
- Unit-IV : Precis and Story Building 10**
 A] Precis of a given passage (05)
 B] Story Building (05)
- Text : Voices & Visions 40**
- Unit-V : A] Prose (25)**
 There shall be six short answer questions carrying 5 marks each.
 Student will have to attempt any five questions.
B] Poetry (15)
 There shall be 4 short answer questions carrying 5 marks each.
 Student will have to attempt any 3 questions.
- Note :** 1) Unit-I will be strictly based on the prescribed text.
 2) For additional reading the following books are recommended;
- A) Macmillan Foundation English by R.K. Dwivedi and A.Kumar (Pub.Macmillan)**
B) An intermediate English - S.R.Muthe, Grammer and Composition.

7. MATHEMATICS**(W.E.F. session 2003-2004)****PAPER-I : ALGEBRA AND TRIGONOMETRY**

- Unit-I :** De Moivre's theorem and its applications. Direct and inverse circular and hyperbolic functions. Expansion of trigonometrical functions. Gregory's series. Summation of series.
- Unit-II :** Polynomial equations over R. Fundamental Theorem of Algebra (Statement only) Division algorithm for polynomials (Statement only) Remainder theorem. Factor theorem. Complex roots of Polynomial over R occurs in pair. Relations between the roots and coefficients of general polynomial equation in one variable. Transformation of equations. Descartes's rule of signs. Solution of cubic equations (Cardan method), Biquadratic equations.
- Unit-III :** Symmetric, skew symmetric, Hermitian and skew Hermitian matrices. Elementary operations on matrices. Inverse of a matrix. Linear independence of row and column matrices. Row rank, column rank, and rank of a matrix. Equivalence of column and row ranks. Eigenvalues, eigenvectors and the characteristic equation of a matrix. Cayley Hamilton theorem

- and its use in finding inverse of a matrix. Application of matrices of a system of linear (both homogeneous and non-homogeneous) equations. Theorems on consistency of a system of linear equations.
- Unit-IV :** Equivalence relations and partitions, order relation, well ordering principle, divisibility in the set of integers, Division algorithm (statement only) g.c.d., L.C.M. of two integers theorems on prime integers. Congruence modulus. Definition of a group with examples and simple properties. Subgroups. Generation of groups. Cyclic groups, Permutation groups. Even and Odd permutations. The alternating groups A_n .
- Unit-V :** Coset decomposition. Lagrange's theorem and its consequences. Fermat's and Euler's theorems. Homomorphism and Isomorphism. Normal subgroups. Quotient groups. The fundamental theorem of homomorphism. Introduction to rings, subrings, integral domains and fields. Characteristics of a ring.

References :

- 1] T.M. Karade, Maya S. Bendre, Lectures on Algebra and Trigonometry.
- 2] I.N. Herstein, Topics in Algebra, Wiley Eastern Ltd., New Delhi, 1975.
- 3] K.B. Datta, Matrix and Linear Algebra, Prentice Hall of India Pvt. Ltd. New Delhi, 2000.
- 4] P.B. Bhattacharya, S.K. Jain and S.R. Nagpaul, First course in Linear Algebra, Wiley Eastern New Delhi, 1983.
- 5] P.B. Bhattacharya, S.K. Jain and S.R. Nagpaul, Basic Abstract Algebra (2nd Edn.), Cambridge University Press, Indian Edition, 1997.
- 6] S.K. Jain, A. Gunawardena and P.B. Bhattacharya, Basic Linear Algebra with MATLAB, Key College-Publishing (Springer-Verlag), 2001.
- 7] H.S. Hall and S.R. Knight, Higher Algebra, H.M. Publications, 1994.
- 8] Chandrika Prasad, Text Book on Algebra & Theory of Equations, Pothishala Private Ltd., Allahabad.
- 9] S.L. Loney, Plane Trigonometry Part-II, MacMillan & Co., London.
- 10] R.S. Verma & K.S. Shukla, Text Book on Trigonometry, Pothishala Pvt. Ltd. Allahabad.
- 11] Ayres Jr Frank : Matrices : Schaum's outline series, McGraw Hill Book Company, Singapore, 1983.
- 12] Bartle R. G. & Sherbert D.R. : Introduction to Real Analysis, John Wiley & Sons, 1982.
- 13] Hohn Franz E : Elementary Matrix Algebra, Amerind Publishing Co., Pvt. Ltd. 1964.
- 14] McCoy Neal H : Introduction to Modern Algebra, Bacon Allyn &

- Bacon, Inc.1965.
 15] Spiegel M.R. :Comples Variables, Schaum's outline series, McGraw Hill, 1981.
 16] Shanti Narayan : A Test Book of Matrices, S.Chand & Co. Delhi.

PAPER-II: CALCULUS

- Unit-I** : Definition of the limit of a function. Basic properties of limits, Continuous functions and classification of discontinuities. Differentiability. Successive differentiation. Leibnitz theorem.
- Unit-II** : Differential, indeterminate forms and Hospital's rule. Rolle's theorem. Lagrange' s Mean Value theorem. Maclaurin and Taylor series expansions. Asymptotes. Curvature, tests for concavity and convexity. Points of inflexion,. Multiple points. Tracing of curves in cartesian coordinates.
- Unit-III** : Integration of Irrational algebraic functions and transcendental functions. Reduction formulae. Quadrature, Rectification, volumes and surfaces of solids of revolution.
- Unit-IV** : Degree and order of a differential equation. 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. Geometrical meaning of a differential equation. Orthogonal trajectories.
- Unit-V** : Second order Linear differential equations with constant coefficients. Homogeneous linear ordinary differential equations. Transformation of the equation by changing the dependent variable / the independent variable. Method of variation of parameters. Ordinary simultaneous differential equations.

References :

- 1] Ayres F Jr. : Differential equations, Schaum's outline series, McGraw Hill, 1981.
- 2] Ayres F.Jr. : Calculus, Schaum's Outline series, McGRaw Hill, 1981.
- 3] Birkhoff G : Ordinary Differential equations, John Wiley and Sons, and Rota G.C. 1978.
- 4] Coddington : An Introduction to Ordinary Differential Equations, E.A. Prentice Hall of India, 1998.
- 5] Edwards J : Differential Calculus for Beginners, MacMillan and Co.Ltd.,1963.
- 6] Edwards J : Integral Calculus for Beginners, AITBS, Publishers and Distributors, 1994.

- 7] Forsynth A.R. : A Treatise on Differential Equations, (Sixth Edition) MacMillan and Co.1956.
- 8] Greenspan D. : Introduction to Calculus, Harper and Row, 1968.
- 9] Gorakh : Differential Calculus, Pothishala Pvt. Ltd., Allahabad. Prassad
- 10] Gorakh : Integral Calculus, Pothishala Pvt. Ltd., Allahabad. Prassad
- 11] Gabriel K. : Mathematical Analysis, Marcel Dekkar, Inc.New York, 1975.
- 12] Jain P.K. and : An Introduction to Real Analysis, S.Chand & Kaushik S.K. co., New Delhi, 2000.
- 13] Karade T.M. : Lectures On Calculus and Differential Equations, Sonu-Nilu, 5, Bandu S. M. Soni layout, Gayatri Road Parsodi, Nagpur.
- 14] Murray R. : Theory and Problems of Advanced Calculus, Spiegel Schaum's outline series,Schaum Publishing Co, New York.
- 15] Murray D.A. : Introductory course in Differential Equations, Orient Longman (India), 1967.
- 16] W.E.Boyce : Elementary Differential Equations and Boundary Value Problems, John Wiley, 1986. and P.C. Diprima,
- 17] Erwin, : Advanced Engineering Mathematics, John Kreyszig Wiley & Sons, 1999.
- 18] Piaggio HTS : Differential Equations, CBS Publishers & Distributors, Delhi, 1985.
- 19] Siminons G.F. : Differential Equations, Tata McGraw Hill, 1972.
- 20] N.Piskunov : Differential and Integral Calculus, Peace Publishers, Moscow.

PAPER-III

VECTOR ANALYSIS AND GEOMETRY.

- Unit-I** : Scalar and Vector Product of three vectors, product of four vectors, vector differentiation. Gradient, divergence and Curl.
- Unit-II** : Space curve t-n-b vectors fundamental planes, curveture, torsion, Frenet-Srret formula, vector integration. Line integral, Existence and Evaluation. Work done.
- Unit-III**: General equation of second degree. Tracing of Conics. System of Conics. Confocal conics. Polar equation of a conic.
- Unit-IV**: Plane, The Straight line and the plane, Sphere, cone and cylinder.
- Unit-V** : Central Conicoids. Paraboloids. Plane sections of conicoids.

Generating lines. Confocal conicoids. Reduction of second degree equations.

References :

- 1] T.M.Karde, Maya S. Bendre, Lectures on Vector analysis and geometry, Sonu Neelu Publication, Nagpur.
- 2] Murray R. Spiegel, Theory and problems on Advanced Calculus, Schaum Publishing Company, New York.
- 3] Murray R. Spiegel, Vector Analysis, Schaum Publishing Company, New York.
- 4] N.Saran and S.N.Nigam, Introduction to vector Analysis Pothishala Pvt.Ltd.Allahabad.
- 5] Erwin Kreyszig Advanced Engineering Mathematics, John Wiley & sons, 1999.
- 6] Shanti Narayan, A Text Book of Vector Calculus, S.Chand & Co. New Delhi.
- 7] S.L.Loney, The elements of Co-ordinate Geometry Macmillan and Company, London.
- 8] Gorakh Prasad and H.C.Gupta, Text Book on Co-ordinate Geometry, Pothishala Pvt.Ltd.Allahabad.
- 9] R.J.T.Bell, Elementary Treatise on Co-ordinate Geometry of Three Dimensions, Macmillan India Ltd., 1994.
- 10] P.K.Jain and Khalil Ahmad, A Text Book of Analytical Geometry of Two Dimensions, Wiley Eastern Ltd., 1994.
- 11] P.K.Jain and Khalil Ahmad, A Text Book of Analytical Geometry of Three Dimensions, Wiley Eastern Ltd., 1999.
- 12] N.Saran and R.S.Gupta, Analytical Geometry of three dimensions, Pothishala Pvt.Ltd.Allahabad.

8. GEOLOGY

(Effective from the Session 2003-2004)

The examination in Geology at the end of First Year shall comprise of three theory papers and a practical examination as follows :

Theory

Paper I	:	Introduction to Geology - I.
Paper II	:	Introduction to Geology - II
Paper III	:	Introduction to Geology - III.

Practical :

Each theory paper will be of three-hour duration and carry 40 marks. Practical examination will be of Three-hour duration and carry 30

marks. The distribution of marks for practical will be as follows :

A)	a)	Megascopic Identification of Minerals	3 Marks
	b)	Microscopic Minerals	2 Marks
	c)	Megascopic Identification of Rocks	3 Marks
	d)	Microscopic Rock	2 Marks
	e)	Symmetry Elements	3 Marks
	f)	Geological Section Drawing	4 Marks
	g)	Palaeontology Fossil Identification	3 Marks
B]		Sessional	2 Marks
C]		Field Work, Report and Viva-Voce	8 Marks
		Total	30 Marks

The following syllabus is prescribed on the basis of two lecturers per paper i.e. six lectures per week for three papers and six practical periods per batch per week (i.e. two practical of three periods per batch.) Candidate must pass separately in practical and in total of theory papers.

PAPER - I: INTRODUCTION TO GEOLOGY - I.

UNIT-I	:	Geology and its perspectives. Earth in the Solar System. Origin and Age of the earth. Composition and Constituents of Earth's crust, mantle and core, Origin of oceans, continents and mountains.
UNIT-II	:	Earthquake and earthquake belts ; measurement of earthquakes. Volcanoes : types and distribution. Diastrophism - Orogenic and Epirogenic Movements.
UNIT-III	:	Rock weathering. Geological work done by wind, rivers, ground water and glaciers.
UNIT-IV	:	Elementary ideas about crystal structure. Crystal: faces, edges, solid angles, and zone. Crystallographic axes and axial angles. Parameters and indices. Crystal symmetry and classification of crystals into seven systems.
UNIT-V	:	Basic ideas about the methods of mineral exploration, Application of statistics, trigonometry, algebra and calculus to the study of Geology. Use of computer in geological studies.

PAPER II: INTRODUCTION TO GEOLOGY - II.

UNIT-I	:	Minerals: definition, Physical properties and chemical composition of common rock forming, ore minerals and industrial minerals. Silicate structure.
UNIT-II	:	Petrological microscope : its parts and functioning. Optical mineralogy : refractive index, twinkling birefringence, pleochroism, interference colours,

- extinction angle and twinning.
- UNIT-III : Magma: definition, composition, origin, Bowen's reaction series. magmatic differentiation and assimilation. Texture, structure and forms of igneous bodies. Classification of igneous rocks.
- UNIT-IV : Sediments : Origin, transportation, deposition. Consolidation and diagenesis. Sedimentary fabrics and textures. Classification of sedimentary rocks.
- UNIT-V : Metamorphic rocks : agents, texture, structure and classification . Metamorphic facies, facies series and isograds.

PAPER III: INTRODUCTION TO GEOLOGY - III.

- UNIT-I : Study of outcrops : identification of bedding, Dip and Strike , data measurement , effects of topography, outlier and inlier. Unconformity, on lap and off lap. Simple deformational structures: folds, faults and joints.
- UNIT-II : Definition and scope of palaeontology, process of fossilization, preservation potential of organism. Elementary ideas about origin of life, classification of organic world.
- UNIT-III : Systemic classification of organisms - their morphological characters and classification of mollusca, brachiopoda, echinodermata and anthropoda.
- UNIT-IV : Principles of stratigraphy, lithostratigraphic, chronostratigraphic and biostratigraphic units, stratigraphic correlation, Geological time scale.
- UNIT-V : Physical and structural subdivisions of Indian subcontinent and their characteristics. A brief account of the different geological formations of India. Archen Dharwar, Luddapah, Vindhyan and Deccan Trap.

Practical :

1. Study of physical properties of mineral in hand specimen. Quartz, Feldspar, Mica, Hornblende, Olivine, Kyanite, Calcite, Tourmaline, Talc, Gypsum.
2. Study of the optical characters of important minerals like Quartz, Orthoclase, Microcline, Muscovite, Biotite, Garnet, Olivine, and Hornblende, using polarizing microscope.
3. Study of elements of symmetry in the crystals from normal classes of seven crystal systems.
4. Study of megascopic and microscopic characters of important rocks

- like granite, gabbro, trachyte, basalt, Sandstone, shale, Limestone, Schist, Gneiss, Marble.
5. Use of clinometer and Brunton Compass. Laboratory exercises on structural geology problems : Completion of outcrops, drawing and interpretation of cross-sections through elementary representative geological structures.
 6. Study of morphological characters of phyla included in the theory syllabus.

Geological Field Training :

Students will be required to carry out field work for a week in an area of geological interest to study the elementary aspects of field geology. (Study of topographic features, reading topographic maps, use of compass clinometer, marking locations on the toposheets) and submit a report thereon.

Books Recommended For B.Sc. - I : Geology.

1. Text Book of Engineering Geology - Parbin Singh, Katson Publishing, Ludhiana.
2. Text Book of Geology - P.K. Mukerjee - World Press Pub., Calcutta.
3. Text Book of Geology - Santosh Garg - Khanna Publ., Delhi.
4. Dynamic Earth - Skinner Potter - Pub. John, Wiley.
5. Text Book of Physical Geology - G.B. Mahapatra - Pub. C.B.S., New Delhi.
6. Fundamentals of Geology - Vol. I, II, Borges, Gwalanietal - Pub. Himalaya Pub., Bombay.
7. Physical Geology - Datta A.K., Pub. Kalyani Pub.
8. Concepts in Geology - Chakranarya, Kulkarni, Pub. Scientific Publication, Pune.
9. Fundamentals of Mineralogy and Petrology - M.A. Koregave, Pub. Book World Enterprises- Bombay.
10. Fundamentals of Invertebrate Palaeontology - M.A. Koregave, Pub. Book World Enterprises.

LIST OF EQUIPMENTS & MATERIALS FOR B.SC.

(GEOLOGY)

Petrology Practicals :-

1. A set of 200, Rocks specimens for megascopic study (set should include all the types of rocks). As listed in practicals and their varieties.
2. A set of 100 rock slides for Microscopic study (Set should include all slides of all the rocks listed in practicals and their varieties).

3. A set of 50, rocks slides showing typical textures of Ingenous, Sedimentary and metamorphic rocks.

Mineralogy Practicals :

1. A Set of 200, Rock forming Minerals specimen for Magascopic study. (Set should include all the minerals as listed in syllabus and their varieties).

2. A Set of 100 Minerals slides (thin sections) for microscope study. (Set should include all the minerals listed in practical and the scheme in different directions.

3. A set of 25 Oriented Minerals slides to demonstrate axiality, optic sign, pleochrosim shceme Extinction etc.

4. Minerals sets demonstrating Hardness, Cleavage, Lusture, Streak and forms etc.

Ore Minerals.

A set of 100 one Minerals for megascope study. (Set should be made with one Minerals as listed in Practicals an included in Indian Matallic deposit of Theory course).

A Part from this geological material following equipments are essential for megascopic and Microscope study.

1. Petrological slide, projector (For Demonstration of this section) with screen	1.No.
2. Magnifiers 10x or more (Table/Hand model with large view for Magascopic Study)	20 Nos.
3. Hand lens 10 x or 20 x	20Nos.
4. Pen knife	20 Nos.
5. Streak Plates	20 Nos.
6. Perrological ploarizing miscroscope	20 Nos.
7. Minocular microscope with point counter, Camera Lucida and U. Stage fitting.	1 Nos.

CRYSTALLOGRAPHY

1. A set 150 wooden crystallography models belonging Normal class of six major crystal system.

2. A set 25 wooden models showing twinning and the type and laws.

3. Contact Goniometer 5 Nos.

4. Set of transparant, Crystal models demonstrating axes planes and centre of symmetry of different Normal class of major system.

5. A set of atomic structure models demonstrating basic types.

PALAEONTOLOGY

1. A set of 100 fossil as included in the practical syllabus and the phyllum mentioned in theory in course.

2. A set of 20 plant fossils as mentioned in practical course and their varieties.

3. A set of 25 Geomorphological models.

4. Index map of Survey of India.

CERMORPHOLOGY

1. Toposheet of survey of India on 1:50.000 scale covering Entire Vidarbha.

2. Degree sheets of survey of India on 1.25,000 scal covering entire, Vidarbha.

3. Rotarameter 5 Nos.

4. Planimeter 5 Nos.

5. Tracing table (large size) 1 Nos.

PHOTOGEOLGY

1. Lens Steroscope 10 Nos.

2. Mirror Stereoscope 10 Nos.

3. Aerial Photographs (Stereopairs) 10 Nos.

a) A set of 10, demonstrating different types of Lithologies, Structure etc.

b) Aerial photographs and Land sat imageries covering Vidarbha for geological & Geomorphological and ground water studies.

4. A set of about 50 Structural models demonstrating various types of Primary and Secondary geological structure.

STRUCTURAL GEOLOGY

A) Every department should have adequate copies of outcrop maps and geological maps, so as to cover atleast 20 outcrop map and 20 section maps for every academic session, covering different geological situation from simplest to comples. In addition about 20-25 problems are to be taken on dip, strik, thickness, three points problem, borehole problem.

1. Large scale geological map in India.

2. Geological maps of various states or Geological sheet atlas of India.

3. Tectonic map of India.

4. Hydrogeological map in India.

5. Geological map of various geological systems and the type area.

Charts

As for as possible maximum no of charts should be present for demonstration of symmetry elements, crstallographic system. Morphology of various phyllum, structural diagram, geodynamics, gelogical works performed by natural agencies. Mineralogical, pertrological and optical variation in rocks and minerals etc. Minimum 100 charts of basic data should be available.

Field Work.

1. Geological Hammer 1000 gm.	10 Nos.
2. Harver Sack	20 Nos.
3. Field camera (Plntax) with zoomlens and flash guns	1 Nos.
4. Water bottle	2 Nos.
5. Steel tapes 5 Mtr., 10 & 50 Metrs.	2 Each.
6. Clinometer compass	15 Nos.
7. Bruten compass	5 Nos.

In addition of these following additional equipments if kept will help to improve teaching and practical demonstration techniques related to course.

1. Overhead Projector	1 Nos.
2. Epidio Scope	1 Nos.
3. Any geophysical instrument Resistivity/Seismic	1 Nos.
4. Water analysis kit	1 Nos.

(Note: 1) Necessary arrangement should be made available to display these moels so that students can observe them as and when they like, Adequate no of trays, showcases should be made available.

2) As far as possible Geological Musium should be separate.)

9. STATISTICS (Effective from the Session 2003-2004)

The examination in Statistics will comprise of two theory papers and a practical examination. Each theory paper will be of three hours duration and carry 60 marks. The practical examination will be of three hours duration and carry 30 marks. The distribution of marks for practical will be as follows :

Practical	5 marks
Viva voce	5 marks
Practical problems	20 marks

Total	: 30 marks
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The following syllabus is prescribed on the basis of three lectures per week per paper and 6 practical periods per batch per week. Each theory paper has been divided into 5 units. There shall be one question on every unit with internal choice for each. Out of five questions three shall be of the short answer type and two shall be of long answer type. Each short answer type question should contain three to four questions each carrying not more than four marks. Long answer type questions should consist of questions each carrying more than four marks.

The college imparting instructions in Statistics should provide a 12 digit desk model electronic calculator to every student for the practical

work. The calculator should not have any trigonometric, exponential, logarithmic or statistical function.

PAPER-I PROBABILITY AND DISTRIBUTIONS

Unit-I: Important concepts in probability : Definition of probability. Classical and relative frequency approach to probability. Cramer and Kolmogorov's approach to probability. Merits and demerits of these approaches - (only general ideas be given)

Random experiment : Trial, sample point and sample space, definition of event, operations of events, mutually exclusive and exhaustive events. Discrete sample space, properties of probability based on axiomatic approach, conditional probability, independence of events, Baye's theorem and it's applications.

Unit-II: Random variables : Definition of discrete random variables, probability mass function, idea of continuous random variable, probability density function. Numerical problems on probability mass function and probability density function, illustration of random variable and it's properties, expectation of random variable and its properties, moments, variance, covariance. Chebyshev's inequality and its applications.

Unit-III: Probability generating function (if it exists), moment generating function & cumulant generating function, their properties and uses. Bivariate probability distributions (discrete and continuous), marginal and conditional distributions, stochastic independence. Standard univariate distributions and their properties : Discrete Uniform and Bernoulli Binomial distribution.

Unit IV : Discrete distributions : Poisson, Hypergeometric, Geometric Negative binomial distribution.

Unit V : Continuous Univariate distributions : Uniform, Normal, Exponential, Gamma and Beta distribution of both kinds.

References :

1. Bhat B.R. Srivenkatramana T and Rao Madhava K.S. (1997); Statistics : A Beginner's Text Vol.II, New Age international (P) Ltd.
2. Edward P.J., Ford J.S. and Lin (1974) : Probability for Statistical Decision making, Prentice Hall.
3. Goon A.M., Gupta M.K., Das Gupta B (1999) : Fundamentals of Statistics Vol.II : World Press Calcutta.
4. Mood A.M., Graybill F.A. and Boes D.C. (1974) : Introduction to theory of Statistics. McGraw Hill.
5. Brase and Brase : Understandable statistics.
6. S.C.Gupta, V.K.Kapoor : Fundamentals of Mathematical Statistics, Sultan Chand & Sons.
7. J.Medhi : Statistical methods, an introductory text.

8. Hoel P.A. : Introduction to mathematical statistics.
9. Meyer P.L. : Introduction to probability and Statistics.

PAPER-II
DESCRIPTIVE STATISTICS

Unit-I: Types of data : Concepts of statistical population and sample from a population. Qualitative and quantitative data. Nominal and Ordinal data, cross sectional and time series data, discrete and continuous data, frequency and non-frequency data. Different types of scales - nominal, ordinal, ratio and interval.

Collection and scrutiny of data : Primary data- designing a questionnaire and schedule, checking their consistency, secondary data - it's major sources, including some government publications, complete enumerations, controlled experiments, observational studies and sample surveys, scrutiny of data for internal consistency and detection of errors of recording. Ideas of cross validation.

Unit-II: Presentation of data : Construction of tables with one or more factors of classifications. Diagrammatic and graphical representation of data, Frequency distributions, cumulative frequency distributions and their graphical representation, Histogram, frequency polygon and ogive, stem and leaf chart, Box plot.

Unit-III: Analysis of Quantitative data : Univariate data, concept of central tendency. Measures of location and dispersion, absolute and relative dispersion. Skewness and Kurtosis and their measures including those based on quantiles and moments. Sheppard's corrections for moments for grouped data (without derivation).

Unit-IV: Bivariate data : Scatter diagram. Product moment correlation coefficient and it's properties. Coefficient of determination. Correlation ratio. Concept of error in regression. Principle of least squares. Fitting of linear regression and related results. Fitting of curves reducible to Polynomials by transformation, Rank correlation - Spearman's and Kendall's measures.

Unit-V : Multiple regression, multiple correlation, partial correlation in three variable.

Analysis of categorical data : Consistency of categorical data. Independence and association of attributes. Various measures of association for two-way and three-way classified data.

References :

1. Bhat B.R., Srivenkatraman T and Rao Madhava K.S. (1996) : Statistics : A Beginner's text Vol.I, New Age International (P) Ltd.
2. Goon A.M., Gupta M.K., Dasgupta B. (1999) Fundamentals of Statistics

Vol.I, World Press Calcutta.

3. Croxton F.E. Cowden D.J. and Kelin S. (1973) : Applied General Statistics, Prencie Hall of India.
4. Gupta S.C., Kapoor V.K. : Fundamentals of Mathematical Statistics.
5. D.N.Elhance : Fundamentals of Statistics.
6. Spiegel, M.R. (1967) : Theory and Problems of Statistics, Schaum's Publishing Series.
7. Snedecor, G.W. and Cochran W.G. (1967) : Statistical methods, Iowa State University Press.

List of Practicals :

- 1] Evaluation of probabilities using addition and multiplication Theorem.
 - 2] Evaluation of conditional probabilities and Baye's Theorem.
 - 3] Calculation of mean, variance, coefficient of skewness and Kurtosis for Binomial distribution.
 - 4] Calculation of mean, variance, coefficient of skewness and Kurtosis for Poisson distribution.
 - 5] Calculation of mean, variance, coefficient of skewness and Kurtosis for Geometric distribution.
 - 6] Calculation of mean, variance, coefficient of skewness and Kurtosis for Hypergeometric distribution.
 - 7] Fitting of Binomial distribution.
 - 8] Fitting of Poisson distribution.
 - 9] Fitting of normal distribution.
 - 10] Problems on Area property of Normal Distribution.
 - 11] Presentation of data by frequency table.
 - 12] Diagramatic Representation of data.
 - 13] Graphical Representation of data.
 - 14] Calculation of measure of central tendencies : Mean, median, mode, geometric and harmonic mean.
 - 15] Calculation of measures of dispersion.
 - 16] Problems on skewness and Kurtosis.
 - 17] Problems on product moment Correlation.
 - 18] Spearman and Kendall Rank correlation coefficient.
 - 19] Fitting of straight line, second degree parabola by the method of least square.
 - 20] Fitting of exponential curve by the method of least square.
 - 21] Problems on regression of two variable.
 - 22] Problems on Multiple correlation and partial correlation.
 - 23] Testing Association of Attribute by
 - i) Frequency method.
 - ii) Proportion Method.
 - iii) Yule's Coefficient Association.
 - iv) Yule's Coefficient of Colligation.
- [Total 30 practicals]

List of equipments and instruments required for a batch of students in the Under graduate Statistics Laboratory :

1] Twelve digits desk model electronic calculator.	25
2] Biometrika tables Vol.I, Vol.II	05 each
3] Seven figure logarithmic table.	10
4] Statistical tables (compiled)	10
5] Random number tables.	10
6] A mathematical typewriter	01
7] A duplicating machine	01
8] Personal Computer	01
9] Statistical Poster and Chart	01
10] Statistical pastures and charts	01
11] Software Packages, like ststat, stat lab., SPSS/OR other useful packages may be provided in Laboratory for practical purposes.	

10. GEOGRAPHY

The examination in Geography will comprise two theory papers and One Practical. Theory Paper shall be of Three Hours duration and shall carry 60 Marks each. The Practical examination shall be of four hours duration and shall carry 30 Marks.

The following syllabus is prescribed on the basis of 3 lectures per paper per week and two practicals of three periods each.

PAPER-I

CLIMATOLOGY AND OCEANOGRAPHY

SECTION-A Climatology

- Unit-I :** 1. Atmosphere, its extent and composition. Elements of Weather and Climate.
2. Isolation : Factors determining its distribution over the surface of the earth.
- Unit-II :** 1. Process of heating and cooling of the atmosphere Vertical and horizontal distribution of temperature.
2. Atmospheric pressure and winds.
- Unit-III :** 1. Humidity, Forms of condensation, Types of air ascent and associated precipitation, Zonal rainfall patterns.
2. Cyclones and anticyclones and weather associated with them.
- Unit-IV :** 1. Climatic : Classification by koppen and Austin Miller.
2. Major Climatic Types : Af, Aw, Am, Bwh, Bwk, Ca, Cs, Cb, Da, Db, Dc, ET, EF.
- Unit-V :** 1. Distribution of Temperature and Salinity of Oceans.
2. Oceans Deposits.

- Unit-VI :** 1. Movements of oceanic water-waves, tides and currents.
2. Coral Islands and Coral reefs.
- (Note :- There will be one questions on each unit. Each questions will have alternate choice).

PAPER-II

BIOGEOGRAPHY AND SOIL GEOGRAPHY

- Unit-I :** 1. Nature and scope of Biogeography/
2. Environmental factors and their importance in the distribution of plants and animals.
- Unit-II :** 1. Classification of plants.
2. Classification of plants and animals.
- Unit-III :** 1. Major plant communities of Forests.
2. Major plant communities of Grasslands and deserts.
- Unit-IV :** 1. Major faunal area and their significance.
2. Zoo-geographical realms and their fauna.
- Unit-V :** 1. Ocean life and its economic significance.
2. Soils their formation, texture, fertility and structure.
- Unit-VI :** 1. Major soil groups of the world.
2. Soil erosion and conservation.
- (Note : There shall be one question on each unit. Each question will have an alternate choice).

PRACTICAL

- Construction of Scales : Plain, Diagonal, Comparative and Time distance.
- Use of meteorological instruments :
 - Maximum and Minimum thermometers.
 - Dry and Wet Bulb Thermometers.
 - Thermograph
 - Barometer.
 - Barograph
 - Anemometer
- Drawing of maps and diagrams
Isopleth maps to represent distribution of climatic elements Hythergraph.
- Study of L.M.D. weather maps.
- Surveying :
 - Chain
 - Abney level
- Statistical methods in Geography
 - Tabulation-Running data and classified data.
 - Sariation.

Plan of Practical Examination

1. Scale	5 Marks
2. Drawing of Maps & Diagrams	5 Marks
3. Weather maps	5 Marks
4. Surveying methods	5 Marks
5. Stastical Methods	5 Marks
6. Practical record, Viva-Voce including metrological instruments	5 Marks
Total : 30 Marks	

Notes : (1) As per decision of Academic Council, in its meeting held on 16.1.90 maximum number of examinees in Geography practical examination up to B.A./B.Sc. level shall not exceed 40 examinees per day.

(2) The following certificate will be necessarily attached to the Practical Record Note-Book of the Examinee when submitted before the commencement of the Practical Examination on the subject.

CERTIFICATE**Department of Geography**

Name of the College :

This to certify that this practical Record is the bonafied practical work of Shri./Kumari/Shrimati.....

.....

During the Academic Year

Signature of the teacher who taught the examinee.

Dates.

- 1.
- 2.
- 3.

Head of the Department

In the absence of the above certificate marks for Practical Records shall not be awarded to the examinee.

BOOKS RECOMMENDED :**THEORY PAPER-I**

1. G.T. Trewartha : An introduction to Climate Geography, McGraw Hill Series.
2. P.Lake : Physical Geography, Cambridge University Press.
3. M.G. Gross : Oceanography, Charies E. Mirill Books Inc. Colombus, Ohio, 1967.
4. Sharma : Oceanography for Geographers.
5. Strahler : Physical Geography, John Wiley and Sons Inc. New York.
6. Barry R.G. Ghorley R.J. : Atmosphere, Weather and Climate, Methuen, Forme and London.

PAPER-II

1. Newbegin M.L. : Plant and Animal Geography, Methuen, London.
2. Nicholas Polunin : Introduction to Plant Geography, Longmans.
3. Money, D.C. Climate Soils and Vegetation, University Tutorial Press.
4. USDA : Oxford, Calcutta : A Manual on Conservation of Solid and Water.
5. Brain T. Bunting : Geography of Soil, Hyutchinson, London.
6. Jacob, S. Joffe : ABC of Soils, Oxford Books Co.

PRACTICAL

1. Monkhouse and Wilkinson : Maps and Diagrams.
2. Sing & Dutta : Elements of Practical Geography, Students Friends.
3. Sir David Brunt : Weather study : Thomas Nelson and Sons, London.
4. Arthur Guest : Advanced Practical Geography Heinemann Educational Books Ltd.

11. MICROBIOLOGY**(Effective from the Session 2003-2004)**

The examination in Microbiology is comprised of two theory papers and one practical. Each theory paper is divided into five units. There shall be one question from each unit with internal choice. Examinees should attempt all five questions. Theory paper is of three hours duration and shall carry 60 marks each. Each practical examination (each batch of students) will last for atleast two consecutive days with minimum five working hours each day. The syllabus is based on six theory periods and six practical periods per week.

PAPER-I**GENERAL MICROBIOLOGY AND BASIC BIOCHEMISTRY****UNIT-I : A) History of Microbiology**

- a) Discovery of microorganisms - Leeuwenhoek, Robert Hook, Zaccharias Janssen.
- b) Controversy over spontaneous generation. Contributions of Aristotle, Redi, Joblet, Needham, Spallanzani, Schulze and Schwann, Schorder and Von Dusch, Pasteur, John Tyndall.
- c) Fermentation : Pasteur, Kutzing, Bernard, Buchner.
- d) Germ theory of disease : Joseph Lister, Davaine, Hanle, Koch's postulates, River's postulates.
- e) Immunology and Immunization : Jenner, Pasteur, Metchnikoff, Ehrlich, Kitasato.
- f) Pure Culture Concept : Lister, DeBarry, Brefeld, Koch.

B) Scope of Microbiology

- a) Bacteriology, Virology, Mycology, Phycology, Parasitology, Industrial Microbiology, Environmental Microbiology, Medical Microbiology, Geomicrobiology, Molecular Microbiology, Food Microbiology, Dairy Microbiology, Genetic Engineering, Biotechnology.
- b) Distribution of microorganisms in nature and their beneficial and harmful activities.

UNIT-II : Microscopy and Staining :**A) Microscopy :**

- (a) General principles, resolving power, numerical aperture, angular aperture, magnification, working distance, Aberrations.
- (b) Compound Microscope (Bright field microscopy)- Parts, their functions, use of oil immersion objective, ray diagram, magnification, applications and comparative study of :
 - i) Dark field
 - ii) Phase contrast
 - iii) Ultraviolet
 - iv) Fluorescence
 - v) Electron-Transmission & Scanning.

(B) Staining :

- (a) Dyes and stains - Definitions, auxochromes, chromophore, mordent, chromogen, leucostain.

- (b) Classification of dyes and stains.: Outline
- (c) Theories of staining : Physical and Chemical
- (d) Principle and method of following techniques:
 - i) Simple
 - ii) Differential : Gram, Acid fast
 - iii) Negative : Capsule
 - iv) Microchemical : storage granules
 - v) Flagella staining
 - vi) Cytological : Endospore

UNIT-III : Classification of Microorganisms.**A) Bacterial Classification**

- (a) i) Definition of Taxonomy (systematics), Classification, Identification, Nomenclature and Taxonomic ranks.
- ii) Whittaker's Classification : Introduction.
- iii) Burgey's Manual of Systematic Bacteriology : General and comparative account of Gracilicutes, Firmicutes, Tenericutes and Mendosicutes.
- iv) Methods of Classification : Intuitive, Numerical taxonomy, Genetic relatedness.

B) General characters of Mycoplasma, Rickettsia, Actinomycetes, Chlamydia, Cyanobacteria and Archaeobacteria.**C) Out line of classification of Algae, fungi and Protozoa.****UNIT IV : VIRUSES**

- (i) Discovery of viruses : Iwanosky, Stanely, D'Herelle, Jenner, Pasteur.
- (ii) General characteristics of viruses.
- (iii) Structure of viruses.
- (iv) Classification of viruses : LHT system.
- (v) Replication of viruses : Lytic cycle (T4), Lysogeny (Lambda Phage)
- (vi) Cultivation of Viruses : Various methods of cultivation and detection of viral growth, CPE, Inhibition of cell metabolism, haemadsorption, interference, transformation, FAT, haemagglutination.
- (vii) Definition of virioids, Prions and Interferon.

UNIT V : Basic Biochemistry :

- a) Carbohydrates - Classification, Different types of

- glycosidic linkages eg. Maltose, sucrose, raffinose, starch, lactose, hyaluronic acid.
- Lipids Classification, concept of saturated and unsaturated fatty acids, outline of conjugated and derived lipids.
 - Proteins - Classification of amino acids, concepts of peptide bond, elementary concept of protein structure.
 - Nucleic acid - Purines and pyrimidine bases, Nucleotides and nucleosides, Structure of DNA, Structure of RNA, m-RNA, t-RNA & r-RNA.

PAPER-II

MICROBIAL PHYSIOLOGY, COMPUTERS & BIostatISTICS

UNIT I : Morphology and Fine Structure of Bacteria.

- Concept of Prokaryotes and Eukaryotes : Comparison and differences, Typical bacterial cell.
- Morphology - Size, Shape and Arrangements of bacteria.
- Structure and functions of following :
 - Capsule and Slime layer.
 - Cell wall : Chemical Structure of Gm + ve and Gm - ve bacteria, protoplast, spheroplast and L-forms.
 - Cell membrane : Fluid Mosaic Model
 - Mesosomes : Types and Functions.
 - Ribosomes : Prokaryotic and Eukaryotic ribosomes, differences, polyribosomes.
 - Fimbriae : Types.
 - Flagella : Arrangements of flagella, flagellar, spirochaetal and gliding movement, Chemotaxis.
 - Bacterial Chromosome.
 - Plasmids : Definition, classes, general characters,
 - Vacuoles, cytoplasmic inclusions.
 - Spores : Typical bacterial spore, Arrangements of endospore, bacterial sporulation and germination process.

UNIT II: A. MICROBIAL NUTRITION

- Basic Nutritional requirements.
- Types of Media : liquid, solid, semi-solid, synthetic, non-synthetic media, composition and functions of beef, malt, yeast extract, peptone,

agar, gelatin.

- Specific Media: Enriched, Selective, differential, assay, maintenance, enumeration and characterization media.
- Determination of nutritional requirements: Auxanography, Replica plating technique.
- Nutritional Classification:
 - On the basis of carbon source
 - On the basis of energy source.
- Concept of autotrophy.

(B) Pure Culture and Cultural Characteristics:

- Mixed culture, Pure culture, Methods of isolation of pure culture - serial dilution, streak plate, spread plate, pour plate, enrichment culture method, single cell isolation and special isolation.
- Pure Culture Maintenance: Stock culture collection centres, Methods of preservation of cultures.
- Systematic study of pure cultures (outline)

UNIT III: Reproduction and Growth of Bacteria.

- Reproduction: Binary fission in detail, other methods- Budding, fragmentation, sporulation (outline).
- Growth - Definition
- Growth rate and Generation time : Definition and mathematical expression of growth.
- Growth Curve, Diauxic phenomenon.
- Synchronous Culture : Definition, methods (Helmstetter-Cummings technique, Induction technique) and applications.
- Continuous culture: Definition, methods (Chemostat, turbidostat and dialysis technique) and applications.
- Measurement of Growth:
 - Cell number measurement: Breed method, coulter counter method, colony count.
 - Cell mass measurement: Dry weight measurement, nitrogen and turbidity measurement.
 - Cell activity measurement : Biochemical activity.
- Physical conditions required for growth: Temperature, pH, gaseous and Miscellaneous.

UNIT IV : MICROBIAL CONTROL

- (a) Definitions & Terminologies - Sterilization, Antiseptic, Sanitizer, Germicide, Microbiostatic, Antimicrobial agent, Preservative, Pasteurization, Tyndallization, Disinfection.
- (b) Factor influencing antimicrobial activity.
- (c) Mechanism of Cell injury - Damage to cell wall, cytoplasmic membrane and DNA, inhibition of metabolic reactions.
- (d) Physical Control: Temperature, Desiccation, Surface tension, Osmotic pressure, Radiations, Filtration.
- (e) Chemical control : Characteristics of ideal disinfectant, Chemistry and mode of action of Halogens, Heavy metals and its derivatives, Phenol and phenolic compounds, Alcohols, Dyes, Detergents and Gaseous sterilization.
- (f) Chemotherapeutic Agents: Definition, Mode of action of Penicillin, Streptomycin, tetracycline, Norfloxacin and Grasiiofulvin.
- (g) Biological Control: Definition and examples.

UNITV: A) Biostatistics :

- (a) Statistical methods - Measures of central tendency.
- (b) Co-relation and linear regression - coefficient of correlation, linear least squares fit method of regression.
- (c) Test of significance - (chi square) X^2 test, t-test.

B) Introduction to Computers :

- (a) Components of a computer system - hardware - input devices, CPU, out put devices, monitor, software.
- (b) Memory concept :- Computer memory, primary and secondary memory in computers.
- (c) Windows operating systems - Introduction, graphical user interface systems, desk-top menus, launching a programme through start menu.
- (d) MS-Word - creating, saving, opening, editing, closing a document, entering and editing text.
- (e) Using Internet Explorer, MS Power point.

PRACTICALS

1. Demonstration of different equipments and techniques used in Microbiology.
2. Use and Care of Microscope.

3. Preparation of Nutrient Broth, Nutrient agar and PDA.
4. Demonstration of presence of bacteria on skin, teeth, soil, water and air.
5. Staining
(i) Gram (ii) Endospore (iii) Acid fast (iv) Fungi
6. Demonstration of motility.
7. Measurement of size of bacteria.
8. Cultivation and Demonstration of :
(a) Yeast : *S.cerevisiae*, *Candida albicans*.
(b) Molds : *Mucor*, *Rizopus*, *Penicillium*, *Aspergillus*.
9. Demonstration of :
(a) Protozoa : *E.histolytica*, *Paramecium*,
(b) Algae : *Anabena*, *Nostoc*, *Spirogyra*, *Ulothrix*.
(c) Virus : Plaque formation.
10. Isolation of pure culture by
(i) Spread plate (ii) Streak plate (iii) Pour Plate.
11. Enumeration of bacteria in the given sample by
(i) Standard plate count. (ii) Brid method, (iii) Haemocytometer.
12. Effect of salt and sugar concentration, pH and temperature on bacterial growth.
13. Demonstration of replica plate technique.
14. Demonstration of Oligodynamic action.
15. Word Processing
16. Use of MS-Excel
17. Statistical Data Processing
18. Microbiological Study Tour.

Distribution of Marks for Annual Practical Examination.

1. Gram staining.	.....	04
2. Special staining Technique/Motility.	.....	04
3. Measurement of size of microorganisms/ Effect of Environment on microbial growth/ MS-Excel/Statistical Data Processing	.....	04
4. Isolation of pure culture by streak plate/Spread plate/Pour plate/enumeration of bacteria.	.....	06
5. Spotting	.....	05
6. Viva	.....	05
7. Class record	.....	02

Total : 30

LIST OF BOOKS RECOMMENDED FOR PAPER I & II

- 1) General Microbiology : Stainer, Roger et. al.
- 2) General Virology : Luria, S.E.
- 3) Handbook of Genetics : Esser, K.
- 4) Fundamentals Principles of bacteriology : A.J. Salle.
- 5) Microbiology : Pelczar, Chan, Krieg. (TMH)
- 6) Fundamental of Microbiology : Frobisher
- 7) General Microbiology Vol. I & II : Power & Dagainawala. (Himalaya Publication)
- 8) Zinsser Microbiology : W.K. Joklik
- 9) General Microbiology : W.G. Walter
- 10) Elements of Microbiology : M.J. Pelozar & E.C.S. Chan
- 11) Essays in Microbiology : J.N. Norris & M.H. Richmond
- 12) Microbiology (Essentials & Applications) : L. Mckane & J. Kandel
- 13) Basic Microbiology : Volk
- 14) Chemical Microbiology : Rose
- 15) Microbiology (Introduction to Health of Professional) : Paul A. Ketchum.
- 16) Molecular Biology of the gene : J.D. Watson.
- 17) Molecular Genetics : Taylor J.H.
- 18) Gene Expression Vol. I, II III, IV : Lewin
- 19) Elementary Microbiology Vol. I & II : Modi (Akta Prakashan)
- 20) Basic experimental Microbiology : Ronald M., Atlas, & Alfred Miller
E.Brown, Kenneth W. Dobra, Lionas (1986) (Prentice Hall - 316 PP)
- 21) General Microbiology : Robert F.Boyd (1984) times mirror / mosby college, Pub. 22 PP.
- 22) Fundamentals of Biostatistics (Biometry) : Satguru Prasad, Emkay Publications, Delhi.
- 23) Text Book of Microbiology : Dubey & Maheshwari (S.Chand, Publication)
- 24) Introduction to Computer by : Shrivastav (Macmillan)
- 25) Fundamentals of Computer : Rajaraman (PHL)
- 26) Office automotion : Bajaj (Macmillan)
- 27) Computer made simple : Taxilli.

LIST OF BOOKS FOR PRACTICALS

- 1) Microbes in Action : Seely, Wander Mark
Tarporewala, Bombay
- 2) A Manual of Microbiology Methods : A.J. Salle.
- 3) Medical Microbiology Vol. II : R. Cruickshank
- 4) Microbiology Methods : Collins
- 5) Difco manual
- 6) Bacteriological Techniques : F.J.Baker
- 7) Introduction to Microbial Techniques : Gunasekaran
- 8) Biochemical methods : Sadashivam & Manickam
- 9) Laboratory Fundamentals of Microbiology : Alcamo, I.E., Jones and Bartlett Publishers.

**List of Instruments/Equipments With Specification
required for B.Sc. I, II and Final Microbiology Laboratory**

Sr. No.	Name	Make	Specification	Quantity required
1.	Autoclave a. Portable	Yarco/Wiswo or any Std. make	Pressure gauge 0-30 psi size 350X325 mm. Double Walled Non-Electrical	1.
2.	b. Vertical	Wiswo/Yarco	Electrically operated or any std. make coil 2000 Watts. Double walled. mild steel body. S.basket. cord & plug to work on 220 V. pressure control switch chamber size.	1.
3.	Hot-air oven	Yarco/Tempo/ Lab.Hosp. or any make	Double walled. Thermostat, Temp. regulator. Size 45X45X45 cm.	2.
4.	Incubator	Yarco/Tempo/Lab. Hosp. or any std. make	Double walled Insulated Temp. regulator size Temp. upto 60 C with thermostat sensitivity +0.5 C size 45X45X45cm	2.

5. Refrigerator	Godrej/Kelvina- tor/BPL/std. any std. or make	Double/Trippl door with 250/300 Lit. capacity having separate freezer.	1.
6. Serological Water bath	Yarco/Tempo/Lab Hosp or any std.	Double walled -Thermo regulated. Max. Temp. upto 80 C.Size 12X12 X12" with Cover.	1.
7. Magnetic Stirrer with hot plate	Yarco/Tempo/Remi Lab.Hosp./or any std. make	2 Lit. Capacity with 500 Wt. temp. regulated hot plate.	1.
8. Cyclo-Mixer	Remi/Tempo/or any std. make	For one test tube only	1.
9. Centrifuge	Remi R-8c/Yarco or any std make	With replaceable swing out rotorheads one to hold 8-16 tubes of 15 ml capacity Another head to hold 4 tubes of 50-100 ml. capacity.	1.
10. pH Meter	Systronics/Elico J.Mitra/or any std. make	Digital With glass electrade pH scale from 0 to 14. Resistant to temp change.	1.
11. Colorimeter	Erma/Elicol Systronics or any std. make	Digital.Single cell with either glass or quartz cuvetters. Visible range with coloured filters.	1.
12. Distillation Assembly	Remi/Tempo/Lab. Hosp or any std. make	2 Lits./hr. Capacity with metal condensor	1.
13. Single pan Electrical balance	Systronics/K.Roy contac or any std. make	Digital 125 gram capacity. Sensitivity 0.01 gm	1.
14. Mixer	Sumit/Jyoti/or any std make	With 3 Jars and Timer	1.
15. Single pan balance (triple beam)	National/Remi/ or any std. make	III gram Capacity	2.

16. Anaerobic Jar	Dynomicro/or any std. make	Capacity 10 Petri dishes Complete set.	1.
17. Rotary shaker Hozt. Table top	Yarco/Tempo/Remi or any std. make	Flask Capacity 36 flask or 250 ml. Mechanical Variable speed motion size 24X24" platform.	1.
18. Automatic Pipette washer	Kumar/Modern or any std. make	Stainless steel 1 ml, 5 ml,10 ml. Capacities	1.
19. Over head Projector	Metzer/photophone or any std. make	Complete with screen 72X50" Glass screen 16X16".	1.
20. Membrane Filter Assembly	Yarco/Tempo/or any std. make	With Vacuum pump 0.5 h.p. Filter funnel Adaptor, Filtering Flask. memberane filters 0.45 mm and 0.22 mm, for 125 filters compl set	1.
21. Microscope a.Monocular	Olympus/Metzer/ Labo. or any std. make	Straight, with mechanical stage, mirror, objectives 10X, 45X & 100X. Eye piece 5X, 10X & 15X.	20
22. b.Binocular	Olympus/Metzer/ Labo. or any std. make	Inclined with Mechanical Stage, Mirror, Lighting arrangment.objectives 10X, 45X, 100X. Eye piece 5X, 10X and 15X.	5
23. Oil Immersion lens	Olympus/Meopta Labo/or any std. make (preferably Imported.)	Original (Imported) with good spring load.	20
24. Autolet	Ames or any std. make	With laoncet holder. lancet cover end cap.	2

25. Laminar Air-flow (Hozt.) (to be installed in Asceptic room)	Micro filt/or any std make	Complete with U.V. light HEPA filter stainless steel top. Side glass Window pressure 25mm w.g. at rated flow D.O.P. efficiency 99.97% blower 1/4 hp. Size 3'X2', 4'X2'.	1.
26. Ultra-violet Light (to be Fitted in Asceptic Room)	Amtrex/Videocon or std. make	15 Watts/30 Watts of variable length	1.
27. Air-Conditioner (to be Installed in Asceptic Room)	Amtrex/Videocon or any std. make	Window Room A/C at list 1.5 ton capacity special filter for dust free air 4 way air distribution Noiseless standard compressors.	1.
28. Asceptic room	10'X10' Totally enclosed with air-conditioner	Dimension 10'X10' with Air-conditioner and U.V. light	1.
29. B.O.D. Incubator	Toshiba/Kumar/Remi or any std. make.	Chamber size 45"x45"x45x digital Temp range 5 C-60 C sensitivity +0.5. 230 Volts. double walled Aluminium/ stainless steel.	1.
30. Teaching aids Epidiscope	Metzer/Photophone or any std. make	500 W. Imported Halogen illumination both for Diascopic projection with powerful and Noiseless colling system. An astigmatic lenses and Reflecting mirrors.	1.

31. Slide Projector	Metzer/ Photophone	300 W. Imported Projection bulb Noiseless cooling system. Slide carrier for slides 2"x2" and film strip carries with mask for 35 mm A best quality projection lenses B German lenses 85 mm f.2.8 coated lens.	1.
32. Video Cassettes	Indian/ Imported	Practical Microbiology each Applied Microbiology, (Environment, food, Industrial and medical Microbiology)	
33. V.C.R. & T.V. set	National/ Sony/Philips/ Videocon or any std. make	Recording & playing facility T.V. 21" with remote control.	1 each
34. Computer with printer and	Intel pentium or any standard make.	Current configurations legal softwars.	1
35. Internet Modem	Any Std. make	Current Configurations	1

12. BIOCHEMISTRY

(EFFECTIVE FROM THE SESSION 2003-2004)

- 1] The examination in Biochemistry shall comprise of two theory papers and one practical. Each theory paper shall be of three hours duration and shall carry sixty marks each. The practical examination shall be of six hours duration in one day and shall carry 30 marks.

Theory Paper :

Paper-I (Biomolecules and Nutrition)	-	60 Marks
Paper-II (Biophysical and Biochemical Tech.)	-	60 Marks
Practical	-	30 Marks
Total	-	150 Marks

- 2] The distribution of marks in practical shall be as follows.

A] Any five tests for Section-I	-	10 Marks
B] Any one experiment from Sec.-II or III	-	06 Marks
C] Isolation of any one compound from Sec.IV	-	06 Marks

D] Viva-Voce	-	04 Marks
E] Class work and Practical Record	-	04 Marks
		30 Marks
	Total	30 Marks

- 3] The following syllabus is prescribed on the basis of three lectures per paper per week and two practicals of three periods each on consecutive days.
- 4] The B.Sc. students of biochemistry shall pay at least one visit to any biochemical / research institute / biochemical industry.
- 5] The students are expected to perform on the practicals mentioned in the syllabus. However a minimum of 12 experiments (at least one from each section) through out the year is mandatory.

PAPER-I

BIOMOLECULES AND NUTRITION

UNIT-I : CARBOHYDRATES :

Definition, classification, asymmetric carbon, optical isomerism, D and L-isomerism, Empiricism, ring structure of pentoses and hexoses, α , β anomers, mutarotation, Reactions of aldehyde, ketone groups and hydroxyl groups, important derivatives of monosaccharides, disaccharides (structure, occurrence functions) Types of glycosidic bonds, Structure, occurrence and biological importance of polysaccharides like starch, glycogen, cellulose, chitin, pectins, agar. Mucopolysaccharides like heparin, hyaluronic acids, chondroitin sulphates, sialic acids, proteoglycans, bacterial cell wall polysaccharides. Energy value and nutritional importance of carbohydrates.

UNIT-II : LIPIDS :

Definition and classification. Fatty acids : Introduction, classification, Nomenclature, structure and properties of saturated and unsaturated fatty acids. Essential fatty acids, prostaglandins, cis- and trans-isomerism, positional isomerism. Triacyl glycerols : Nomenclature, properties and characterization of fats : Hydrolysis, saponification value, acid value, rancidity of fats, Iodine number, Reichert - Meissel number & reaction of glycerol. Biological significance of fats. Properties and functions of Glycerophospholipids (Lecithins, cephalins, phosphatidyl, choline, phosphatidyl inositol, phosphatidyl serine and plasmalogens) sphingomyelins, glycolipids- cerebrosides, gangliosides. Isoprenoids and steroids (Properties and functions of Ergosterol, Cholesterol, bile acids) Energy value and nutritional importance of Lipids, obesity, Fatty liver.

UNIT-III : PROTEINS :

Introduction, classification based on solubility, shape, composition and functions.

Amino acids : Classification, structure and isomers of standard amino acids, zwitterionic structure, physicochemical properties, titration curve, separation of amino acids. Glycogenic and ketogenic amino acids, Essential amino acids, Non proteinous amino acids (Ornithine, citrulline, β -alanine). Peptides : Structure of peptide bonds, important peptides (structure & functions), identification of N-terminal and C-terminal amino acids, protein sequencing, chemical synthesis of polypeptides.

Protein Structure : Levels of structure, forces stabilizing the tertiary and quaternary structure of proteins, Denaturation and Renaturation of proteins. Salting in and salting out of proteins, structure and biological functions of fibrous proteins (keratins, collagen and elastin), globular proteins (Hemoglobin and myoglobin), Catalytic proteins, Nutritive value of proteins, complete and incomplete proteins and protein calorie malnutrition.

UNIT-IV : VITAMINS, DIETS AND NUCLEIC ACIDS :

A] VITAMINS : Chemistry, sources, daily allowances, nutritional importance and deficiency of water soluble and fat soluble vitamins.

B] Balanced Diet, dietary standards, infant diet, diet during pregnancy and Diet for old persons, RQ, BMR and SDA.

C] Nucleic Acid :- Structure of nitrogenous bases, nucleosides, nucleotides, structure of DNA and RNA, Denaturation and annealing of DNA, Evidence that DNA is the Genetic material, gene, genome, chromosomes.

UNIT-V : HORMONES, PORPHYRINS AND MINERALS :

(A) Hormones : Definition, classification, mode of action and target sites. Chemistry and function of hormones of pituitary, thyroid, parathyroid, adrenal, pancreas, gonads and corpus luteum.

(B) Chemistry of porphyrin nucleus, classification, important metalloporphyrins (haemoglobin, cytochromes and chlorophyll). Detection by spectrophotometry and fluorescence. Bile pigments : Chemistry and Physiological role.

(C) Importance of Minerals like Na, K, Fe, Cu, Mg, Ca, P, An, Co, I, Mn in nutrition.

PAPER-II

BIOPHYSICAL AND BIOCHEMICAL TECHNIQUES

UNIT-I : CONCEPT OF BIOGENETICS :

Principle of thermodynamics and their applications in biochemistry - introduction, thermodynamic systems, Laws of thermodynamics, Concepts of free energy, standard free energy, determination of

ΔG of reaction, relation between equilibrium constant and standard free energy changes, standard free energy change in coupled reactions. Biological oxidation - reduction reactions - introduction, redox potentials, relation between standard redox potentials and free energy change (derivation and numericals included).

High energy phosphate compounds - introduction, phosphate group transfers, free energy of hydrolysis of ATP and sugar phosphates alongwith reasons for high ΔG .

UNIT-II :

(A) ACIDS, BASES AND BUFFERS:

Concept of water as biological solvent, weak acids and bases, pH, buffers, Handerson-Hasselbalch equation, Physiological buffers, Principles of glass and reference electrodes, measurement of pH by indicators (liquid and pH papers) and pH meter.

(B) Biomembranes :

Structure and characteristics of biological membranes, active and passive transport, Donnan membranes equilibrium, Dialysis and Osmosis.

(C) Hydrodynamic methods :

Sedimentation velocity, preparative and analytical ultra centrifugation, determination of molecular weight by hydrodynamic methods (derivations excluded and numericals included.)

UNIT-III : CHROMATOGRAPHY:

General Principles and Applications of -

- 1) Adsorption chromatography.
- 2) Ion-exchange chromatography.
- 3) Thin layer chromatography.
- 4) Molecular sieve.
- 5) Hydrophobic Chromatography.
- 6) Gas-liquid chromatography.
- 7) HPLC
- 8) Affinity chromatography.
- 9) Paper chromatography.

UNIT-IV : (A) ELECTROPHORESIS:

Basic Principles of agarose & paper electrophoresis, PAGE, SDS-PAGE, 2-D electrophoresis and its importance, isoelectric focusing, western, southern and northern blotting techniques.

(B) IMMUNOLOGICAL TECHNIQUES:

Immunodiffusions, Immunoelectrophoresis, RIA, ELISA, Immuno fluorescence.

UNIT-V : (A) SPECTROSCOPIC TECHNIQUES :

Beer's Lambert's law, Light absorption and its transmittance, determination and application of extinction coefficient principles and application of visible and uv spectroscopic techniques. Principles and application of NMR, ESR, Mass spectroscopy, Fluorometry and flame photometry.

(B) OTHER ANALYTICAL TECHNIQUES :

Isotopic tracer techniques, isotopes commonly used in biochemical techniques - ^{32}P , ^{35}S , ^{14}C and ^3H , Autoradiography, Biological Hazards of radiation, PCR.

PRACTICAL

Section-I - Qualitative Tests and Biochemical Preparations.

- (a) Qualitative tests for carbohydrate.
- (b) Qualitative tests for Proteins, Lipids, and amino acids.
- (c) Preparation of buffer of different pH.
- (d) Measurement of pH of given sample by Universal indicator solution, pH strip and pH meter.

Section-II - Titrimetry

- (a) Determination of acid and value of fat.
- (b) Determination of Saponification number of oil.
- (c) Determination of iodine number of fat.
- (d) Estimation of Glycine by Formal titration.
- (e) Estimation of ascorbic acid by Dye method.

Section-III - Colorimetry

- (a) Verification of Beer's Lambert's law.
- (b) Estimation of Protein by Biuret method.
- (c) Estimation of Carbohydrate by Anthrone method.
- (d) Estimation of RNA by Orcinol reaction.

Section-IV - Isolation of biomolecules from natural sources.

- (a) Starch from Potato / sweet potato.
- (b) Casein from milk.
- (c) Glycogen from liver.
- (d) Total lipid from egg yolk by Folch method.
- (e) Proteins from biological sample by salt precipitation (salting out)

Section-V - Demonstration of Analytical Techniques.

- (a) Amino acids separation by paper chromatography.
- (b) Separation of sugars by paper / thin layer chromatography.
- (c) Flame photometry for estimation of Na and K.
- (d) Separation of Serum proteins by paper electrophoresis.

BOOKS RECOMMENDED:

- 1] Lehinger's Principles of Biochemistry (2000) by- Nelson, Cox, M.M. Macmillan, New York.
- 2] Fundamentals of Biochemistry (1999) by Donald Voet, Judith Voet, Charlotte Pratt, John Wiley & Sons, N.Y.
- 3] Biochemistry 3rd edition (1994) by Lubert Stryer WH Freeman and Co. San Francisco.
- 4] Outline of biochemistry (1987), Conn, Stumpf, Bruencing, Doi, John Wiley & Sons, N.Y.
- 5] Text Book of Biochemistry by Dr.O.P.Agrawal.
- 6] Fundamentals of Biochemistry by J.L.Jain.
- 7] Essentials of Biochemistry by Dr.M.C.Pant.
- 8] Principles of Biochemistry Lehinger.
- 9] Text book of Biochemistry by West and Todd.
- 10] Practical manual in Biochemistry by Jairaman.
- 11] Essentials of Food and Nutrition, Volume I & II by Swaminathan.
- 12] Advanced Text Book of Food and Nutrition Volume-I & II by Swaminathan.
- 13] Text book of Biochemistry by Sucheta Dandekar.
- 14] Text book of Biochemistry by U.Sattyanarayan.
- 15] Physical Biochemistry (2nd Ed. 1985) by Vantolde K.E., Prentice Hall, INC, New Delhi.
- 16] Biophysical chemistry by Upadhyay, Upadhyay and Nath.
- 17] Physical Biochemistry (II ed. 1983) by D.Friefelder, WH Freeman & Co., USA.
- 18] Chromatography : A Laboratory handbook of chromatography and Electrophoretic Methods (IIIrd 1975) BY Erich Haffman, Van Nostrand Reinhold, NY.

List of Instruments/Equipments/Glass-ware with sepcification required for B.Sc.Ist yr. Second yr. Final (Biochemistry)

Lab. for a batch.

INSTRUMENTS/EQUIPMENTS

SR. NO.	NAME	MAKE	SPECIFICATION REQUIRED.	QUANTITY
1.	Photoelectric Colrimeter	Erma Japan J.Mitra Elico, Specol cistronic Aimil instrment- tion or any one.	Single Cell with either glass or quartz Cuvettel Vissible range with coloured filters.	1
2.	pH Meter	Elico Sistronic J.Mitra	With glass elect- trode pH Scale from 0 to 14 resistant to temp	1

3.	Table Centrifuge	"Remi Model R-8C"	Change. with replaceable Swing out rotor heads. One to hold 8-16 tuber of 15ml capacity Another head to hold tuber of 50-100 capacity.	1 4
4.	Incubator	Tempo. Lab. Hosp. Yarco.	Double walled Insulated with double doors. (Inner glass door) Tempo. upto 600 C with termostat. Sensitivity + 0.50 C. Size; 455 x 605x455mm.	1
5.	Hot-air Ovan	yarco Tempo. lab. Hosp	Double walled Thermostat Tempreture regulator. Size 455x605x455mm.	1
6.	Refrigerator	"Voltas" "Godrej" Allwyn Kelvinator or any make	Double door with 300 Lit. capacity having seperate freezer.	1
7.	Serological water both	"Tempo" "Lab-Hosp" Yarco or any make	Double walled Thermoregulated Mix. Temp. up to 800 C. Size 12 x 15 x 12 with cover.	1
8.	Magnetic Stirrer with Hot plate	"Tempo" Remi" Lab Hop Yarco or any make.	2 Lit. Capacity with 500 Wt. temp. regulated hot plate.	1
9.	Metal Water Distillation plant	"Remi" "Temp" Lab. Hosp.	2 Lit./Hr capacity with metal condensor	1
10.	Thin Layer Chromatography Assembly		Chamberor Glass Tank Spreader Glass Plates Stage for glass Plates.	1
11.	Hot Plate	"Tempo" "Remi" "Lab. Hosp."	Round 7 Diameter with 3 way control or any make. switch. 1000 watts.	2

12.	Mixer	"Remi" "Sumit" or any make	with 3 jars and timer.	1
13.	Single Pan Balance (Tripple beam)	National Scientific Works VARANASI	100 gm. capacity	2
14.	One Pan Electric Balance	Umex Instraments works. VARANASI	100 gm. Capacity Accuracy upto 4th decimal of gm.	1
15.	Cyclo-Mixer	"Vortex" "Remi"	For one test tube only.	1
16.	Laboratory Microscope	"Olympus" or any make.	Monacular Medical microscopic Sliding Stage.	4
17.	Fingure pricking needle	"Auto Let" Japan.	With Disposable Needler.	2
18.	Haemometer Sahil's	GDR make or Tap	With Comparater Glass, Tube and Hb pipet	2
19.	Neubauer's Counting Chamber.	–	With Bright rullings.	4
20.	RBC Pipettes	GDR or England make or any make.	–	25 Nags,
21.	WBC Pipettes	do	–	25 Nags.
22.	Lab-cell Counter	any make	–	5 Nags.

Glass-Ware :-

Sr. No.	Name	Make	Specification	Quantity Requirement
1.	Test Tubes	Borosil/Corning/Vensil	20 ml. capacity	1000 Nags.
2.	Centrifuge Tubes	Borosil/corning/Vensil	15ml capacity	100 Nags.
3.	Folin-Wu Tubes	Coming/Borosil/Vensil	25 ml. capacity With bulb.	50 Nos.
4.	Nessler's Tubes	Corning/Sorosil/Vensil with	25 ml. capacity with 12.5 ml. marks.	50 Nos.
5.	Boiling Tubes (Hard glass)	Corning/Borosil/Vensil	50 ml capacity	60 Nos.

6.	K.T. Tubes	Borosil/ Corning Vensil	5 ml capacity	20 Nos.
7.	Buretters	Emaky or any make.	50 ml capacity with stop cock.	20 Nos.
8.	Micro-buretters	Borosil/ Emkay	10ml	10 Nos.
9.	Pipettes	Corning/ Borosil/ Vensil	10ml capacity with graduation. 5ml capacity with graduation Zero at tip 2ml capacity with graduation zero at tip. 1ml capacity (graduated) 0.2ml capacity (graduated) 0.1 ml capacity with graduation zero at tip	20 Nos. 20 Nos. 20 Nos.
10.	Measuring Cylinders	Corning/ Borosil/Vensil	1000ml graduated 500ml graduated 100ml capacity with graduations -50 ml capacity graduation -10 ml capacity graduation	1 No. 1No. 5 Nos. 3 Nos. 3 Nos.
11.	Standard Volumetric Flasks	Corning/ Borosil/ Vensil	1 Lit. capacity 500ml capacity 250 ml capacity 100 ml capacity	3 Nos. 5 Nos. 12 Nos. 20 Nos.
12.	Beakers	Corning Borosil/ Vensil	1 Lit capacity 500 ml capacity 250 ml capacity 100 ml capacity 50 ml capacity	5Nos. 30 Nos. 30 Nos. 50 Nos. 50 Nos.
13.	Flasks	Borosil Vensil	250 ml capacity 100 ml capacity 50 ml capacity	30 Nos. 30 Nos. 30 Nos.
14.	Reagent	Emkay	2 Lit capacity 1Lit. capacity	5 Nos. 5 Nos.

			500 ml capacity	100 Nos.
			250 ml capacity	100 Nos.
15.	Dropping Bottle	Emkay	100 ml capacity	10 Nos.
16.	Flat Bottom Round Flask	Emkay	500 ml capacity	20 Nos.
17.	Funnles	Emkay	2.5" diameter	20 Nos.
			3" diameter	20 Nos.
			6" diameter	3 Nos.
18.	Glass Tubing		1/2 mm.	1kg.
19.	Glass Rods		1/2 mm	1 kg.

Miscellenious :

Sr. No.	Name	Make	Specification	Quantity required
1.	Propipettes	Any make	Able to hold any pipettes from 0.1 ml to 10ml capacity Rubber or Plastic	5 Nos.
2.	Test tube stands	Tarson	To hold 12 Tubes	20 Nos.
3.	Burette Stands	---	Metal rod and Stand base with tarson clamp	20 Nos.
4.	Rubber Cock		To fit in conical flasks of all capacity	20 Each
5.	Porcelain Glazed tiles		6x6"	20 Nos.
6.	Mortar and Pestal		6" diameter	1 No.

13. Computer Science (Implemented from the session 2004-2005)

The Examination in Computer Science will comprise of two theory papers and a practical examination. Each theory paper will be of three hours duration and carry 60 marks. The practical Examination will be of 6 hours duration and carry 30 marks.

The distribution of marks in practical examination is given as :-

Program writting / execution (on group A & B)	20 marks
Practical / Record	04 marks

Viva-voce	06 marks

Total :	30 Marks

Each unit of theory paper will carry two questions with internal options to solve any one question.

The syllabus is based on 6 theory periods and six practical periods per week.

Candidates are required to pass seperately in theory and practical.

In case of programming langugae standard ANSI version of languages is to be followed.

Paper-I Information Technology

Unit-I : **Introduction to Computers** : Characteristics, classification of computers, block diagram of computer, memory : Types of memory, RAM, ROM, PROM, EPROM, EEPROM, I/O devices : Keyboard, mouse, floppy disk, monitor, compact disk.

Printers : Impact, Non-impact, dot matrix, inkjet, laser; Interpreter, compiler, assembler.

Unit-II : **Introduction to Number System** : Decimal, binary, octal, hexadecimal, codes : ASCII, EBCDIC.

Introduction to DOS : Booting process, directory structure, FAT.

Internal DOS commands : REN, CD, MD, RD, DIR, DEL, COPY, TYPE, DATE, TIME, COPY CON, PROMPT.

External Commands : FORMAT, XCOPY, CHKDSK, PATH, ATTRIB, importance of AUTOEXEC.BAT and CONFIG.SYS.

Unit-III : **Windows** : Introduction, features, Desktop : Background, screensaver, customizing desktop, creating, moving, deleting, Icons.

Windows Explorer : Copying, renaming, moving, deleting operations on files and folders.

My Computer, My Documents, Control Panel : Mouse, printer, date and time.

Unit-IV : **MS-Word** : Introduction to word, features, page setup, views, text formatting, autocorrect, spellcheck, grammer, table, tabs, indentation, mail merge, print perview, printing of document, hyperlink.

Unit-V : **MS-EXCEL** : Introduction, features, creating and formatting worksheet, inserting data, entering mathematical formulas and functions, autofill, goalseek

Graphs : Types of charts, creating, moving charts, (column, bar, line & pie)

Unit-VI : Introduction to Internet : Types of internet connection : Direct, dial-up, protocol : TCP/IP, FTP, HTTP. Domain name, Electronic mail addresses, world wide web, search engines, browser : Internet Explorer.

Books Recommended for Paper-I :

- 1) Computer fundamentals : B.Ram, Nas Age Publication
- 2) A first course in Computer : Sanjay Saxena
- 3) PC Software : Taxali R.K.
- 4) Fundamentals of Computer : V.Rajaraman, PHI Publication.
- 5) Information Technology : Alexie and Mathews, Vijay Nikole Publication.
- 6) IT Tools and Applications : Alexie and Mathews, Vijay Nikole Publication.

**Paper-II
C Programming**

Unit-I : Programming Concept : Algorithm, flowcharting, programming languages, generation of programming languages.

Programming process : Program design, coding, compilation & Execution, testing & debugging, documentation.

Structured programming, its features and approaches.

Unit-II : Elements of C : Introduction to C, History, features, structure of C program, header file, Character set, keywords & identifiers, constants, variables, basic data types, symbolic constants, typedef..

Operators & Expressions : Arithmetic, Relational, logical, assignment, increment & decrement, Precedence of operators

Unit-III : I/O Operations :

Formatted I/O : printf(), scanf()

Unformatted I/O : getch(), getche(), getchar(), putchar(), putche(), putchar(), gets(), puts().

Control Structure : if, if-else, nested if, conditional operator, switch, goto, for, while, do-while, nesting of loops, break, continue.

Unit-IV : Functions : Definition, prototype, local & global variables, function parameters, function calling, function return, return values and their types, function recursion.

Arrays : Declaration & initialization of one and two dimensional arrays, function with array.

Unit-V : Strings Handling :- Declaring and initialising string variable, operations on strings : string copy, comparison, concatenation.

Pointers : Declaration and initialization, pointer arithmetic, pointer comparison; pointer and arrays.

Unit-VI : Structure : Defining and declaration, initialization, array of structure, nested structure. Union.
File Handling : Definition and opening a file, closing a file, I/O operations on file : fgetc(), fputc(), fgets(), fputs(), fscanf(), fprintf(), fread(), fwrite().

Books Recommended for Paper-II :

- 1) Programming in C : E.Balguruswamy, TMH Publication.
- 2) Programming with C : Venugopal K.R., TMH Publication
- 3) Programming in ANSIC : Ramkumar and Rakesh Agrawal, TMH Publication.
- 4) Programming with C : Byron Gottfried, Schaum Series Publication.

Practicals :

Group A : Minimum 16 practicals based on DOS, WINDOWS, Internet and MS OFFICE covering all aspect of syllabus.

AND

Group B : Minimum 16 practicals based on "C" languages covering all aspects of syllabus.

Study Tour : Study tour may be arranged to computer Industry or software development organisation or software technology park or IT park.

List of Equipments :- (Minimum requirement) For Computer Science for B.Sc. Part-I, II, III.

I) Hardware :-

- a) Computer Terminals : 10 Nos.
Desirable configuration : Computer with latest configuration.
- b) Printer (DMP) - 2 Nos.
Desirable configuration :- 24 pin- 132 / 80 columns.
- c) Inkjet Printer - 1 No.

II) Accessories :-

- 1) Floppy boxes, 1.44 MB or 1.2 MB - 2 Boxes.
- 2) Printer ribbon (Cartridge)
- 3) Printer Stationary - 5000 sheet.
- 4) Stabilizer / UPS
- 5) Internet facility.

III) Softwares legal version based on syllabus.

IV) Other accessories be available based on syllabus.

14. ENVIRONMENTAL SCIENCE

(Revised from the Session 2006-2007)

The syllabus is based on six theory periods and six practical periods per week. The examination shall consist of three theory papers and one practical. Each paper shall be of three hours duration and carry forty marks. Practical shall be of four hours duration and carry 30 marks.

Paper-I**Concepts of Environment**

- Unit-I :** Basic Concept of Environmental Science - Definition, scope, principles of Environmental Science. Classification of total environment.
Atmosphere - Definition, composition and structure.
Biosphere - Definition, boundaries and evolution of life.
Lithosphere - Definition, structure of earth, formulation and types of rocks.
Hydrosphere - Definition, hydrological cycle, physical, chemical characters, global water balance.
- Unit-II:** Natural Resources : Classification (renewable and non-renewable).
Types - Water, Forest, Minerals, Marine resources.
Natural Hazardous - Earthquake, Volcanoes, Cyclones.
- Unit-III:** Climatology : Environmental Meteorology :- Definition of climate, weather.
Metrological Fundamentals :- Radiation (solar), Temperature - Lapse rate, Wind - types (planetary and local) monsoon, wind roses, turbulence temperature inversion.
Humidity and its types.
- Unit-IV:** a) Vapour pressure, saturated vapour pressure, Clouds - Definition and types, Precipitation - Types and forms, El Niño Phenomenon.
b) Meteorological Instruments : Barometer, thermometer, anemometer, luxmeter, psychrometer, rain gauge, hygrometer.
- Unit-V :** Introduction to marine environment - Continental shelf and slope. Physico-chemical factors of marine environment - Light, temperature, Gases, Salinity.
Oceanic Movements - Types & Origin, Tides, Waves, currents.

Paper-II**Ecology and Environment**

- Unit-I :** Introduction to Ecology :- Definition, principles and scope of ecology. Ecological factor - Climatic, edaphic, Biotic and Topographic.
- Unit-II :** Community Ecology :- Definition, characteristics of community - species diversity, growth form, dominance succession, trophic structure, density, frequency, abundance, ecological niche, ecotone.
- Unit-III :** Community Ecology :- Characters used in community structure (analytical and synthesis) methods of community study - Floristics, physiognomic and phytosociology.

- Unit-IV :** Population ecology - Definition, characteristics - Natality, mortality, age distribution, growth curve, dispersal and biotic potential. Interspecific relationship - Neutalism, commensalism, parasitism, predation and competition.
- Unit-V :** Soil - Definition, formation of soil, soil profile, Physico-chemical properties of soil.
Humus - Formation and types. Role of soil organisms in soil fertility. Soil erosion and conservation.

Paper-III**Environmental Ecosystem**

- Unit-I :** Introduction to Ecosystem - Definition, components of Ecosystem, structure of ecosystem, food chain, food web, ecological pyramids, and energy flow model in ecosystem. Ecological indicators.
- Unit-II :** Ecosystem - Types, aquatic ecosystem - oceanic and pond ecosystem.
Terrestrial Ecosystem - Forest, cropland, grassland, desert ecosystem.
- Unit-III:** a) Productivity of Ecosystem and its measurement with reference to chlorophyll, O₂, CO₂, and radioactive method.
b) Ecological Succession :- Definition, types and causes.
- Unit-IV :** Biogeochemical cycles - Definition and types.
Gaseous cycle - Carbon, Nitrogen and Oxygen.
Sedimentary - Phosphorous and Sulphur.
- Unit-V :** Economic Importance of following groups :
Protozoa, Arthropoda, Pisces, Bacteria, Fungi, Algae.

Practical Course :- Environmental Science :-**1) Experiments on water analysis.**

- Measurement of pH.
- Determination of total hardness
- Conductivity measurement.
- Determination of dissolved oxygen.
- Determination of total alkalinity.
- Determination of turbidity.

2) Experiments on Soil Analysis.

- To study the texture of soil by Sieve method.
- Determination of Soil temperature by soil thermometer.
- Determination of Soil moisture.
- Determination of alkalinity of soil.
- Determination of organic matter in soil.
- Determination of Electrical conductivity.
- Determination of Calcium Carbonate.

h) To determine the colour of the soil sample.

3) Megascopic study of Important rocks and minerals.

4) Experiments on Ecology.

- Measurement of light penetration in aquatic ecosystem.
- To study the community characters- Density, frequency, abundance by quadrat or line transect method.
- To study the Biological spectrum of Community by Physiognomic method.
- Measurement of Primary productivity in aquatic ecosystem by light and dark bottle method.
- To study the biotic and abiotic components of pond ecosystem and forest ecosystem.

5) Experiments on Climatology :

- Determination of relative humidity by Psychrometer.
- Determination of atmospheric pressure by barometer.
- Measurement of light intensity by luxmeter.
- Measurement of wind speed by anemometer.

6) Experiments on bacteriology.

- Types of bacteria - Gram staining
- Enumeration of bacteria from air, water and soil.

Spotting :

1. Demonstration and Comments on -

- Protozoa - Amoeba, Paramecium
- Algae - Nostoc, Anabena, Volvox, Chlorella.
- Fungi - Morchella, Agaricus, Penicillium, Saccharomyces, (Yeast), Mucor.

2. Observation and Comments on -

- Honey bee (Apis)
- Prawn

3. Observation and Comments on -

- Hygrometer
- Barometer
- Lux meter
- Anemometer
- Rain gauge

Note : Visit to -

- Meteorological Station - Nagpur, Pune.
- National Institute of Oceanography (NIO) - Goa
- Ecosystem - Forest / Pond

Distribution of Practical Marks : Duration - 4 Hours

Q.1	Any one experiment from water	- 05 marks
Q.2	Any one experiment from soil	- 04 marks
Q.3	Any one experiment from Community Ecology	- 03 marks
Q.4	Preparation Slide of bacteria or ‘ Isolation of bacteria from given water sample	- 03 marks
Q.5	Any one experiment from Climatology	- 03 marks
Q.6	Spotting (Any four)	- 04 marks
Q.7	Class record and field diary	- 05 marks
Q.8	Viva-Voce	- 03 marks

	Total	- 30 marks

Books for reference :

- Physical Geography - Savendra Singh.
- Environmental Geology - K.S.Valdiya
- Environmental Meteorology - B.Padmanabha Murty
- Environment - Problems and Solution - D.K.Asthana
- Environmental Chemistry - S.K.Banerjee
- Environmental Chemistry - Moore
- Fundamentals of Ecology - E.P.Odum
- Principles of Environmental Biology - P.K.G Nair, Himalaya Publication House.
- Ecology and Environment - P.D.Sharma, Rastogi Publication, Meerut.
- Plant Ecology and Soil Science - R.S.Shukla, P.S.Chandel, S.Chand and Co.
- Fundamentals of Ecology - M.C.Das, Tata McGraw Hill.
- Water and Hydrology - Peeter B.Black
- Text Book of Environmental Chemistry, S.S.Dara, S.Chand and Co.
- A Text Book of Marine Ecology - N.Balkrushnan Nair and D.M.Thanpi
- Animal Ecology - Kenleigh
- Fresh water Animals of India - C.P.Tonapi.
- Biology of Marine Animals - Nicol J.A.C.
- Communities and Ecosystem - Witalkar.
- Text Book of Algae - Kumar and Singh
- Text Book of Fungi - Vasistha B.R.
- Plant Pathology - Ramaswamy S.V.
- General Microbiology - Powar and Dagainawala
- Fundamentals and Principles of Bacteriology - A.J.Salle
- Bacteriological Techniques - F.J.Baker
- A Manual of Microbiological Method - A.J.Salle
- Soil and Noise Pollution - B.K.Sharma
- Practical Methods in Ecology - R.K.Trivedi, P.K.Goel, Enviro

- Publication.
- 28) Practical Botany Volume-I & II - Bendre and Kumar
- 29) Physico Chemical Examination of Water Sewage and Industrial Effluent - S.Manivasakam.
- 30) Environmental Chemistry - O.D.Tyagi, M.Mehera, Amol Publication.
- 31) Chemical Methods for Environmental Analysis, Water and Sediments - R.Ramesh, M.Anbhu, MacMillan India Ltd.
- 32) Environment, Forest, Ecology and Man - R.K.Dixit, Rastogi Publication.
- 33) Green Readers - C.B.S.E. Publication, New Delhi.
- 34) Environmental Management - Centre for Environmental Education, Ahmadabad.

List of Instruments/Equipments with specification required for B.Sc.I,II and Final Environmental Biology laboratory.

Sr No.	Name of the instrument	Make	Quantity required
1.	pH meter	Systronix	2
2.	Conductivity bridge	systronix	1
3.	Burettes (25 ml)	Borosil	10
4.	Graduated Pipettes, 1 ml,2ml,5ml	Borocil	10 each
5.	Water Sampler	Any std.make	One
6.	Soil Sampler	—”—	One
7.	Stage and Ocular micrometer	Emma	Two sets
8.	U-manometer	Any std.make	One
9.	Rotameter	—’—	One
10.	Paper Chromatography	Chamber	One
11.	Oven	Tempo	Two
12.	Deep-Freezer	Mac/Yorce	One
13.	BOD incubator	—”—	One
14.	Autoclave (vertical)	—”—	One
15.	Hot air blower	Phillips	Two
16.	Incubator	Tempo	One
17.	Serological water bath	Tempo	One
18.	Rotary Microtome	Weswox	One
19.	Magnetic stirrer	Remi	One
20.	Centrifuge	Remi	One
21.	Colorimeter	Systronix	One
22.	Glass Distillation assembly	Tempo	One
23.	Chemical balance	K Roy	One

24.	Single pan	National	
25.	Light Microscopes	Olympus	Twenty
26.	Dissecting microscope	Olympus	Twenty
27.	Oil immersion lens	Olympus	Five
28.	Laminer flow	Kirloskar	One
29.	Slide projector	Kinderman	One
30.	Portable water analysis kit	Naina	One
31.	Over head projector	Photophone	One
32.	TLC Chamber with applicator and accessories	Any std.make	Five sets
33.	Kjeldah Distillation Apparatus	Asgi	One
34.	Hygrometer		Two
35.	Inoculating chamber		Two
36.	Soxlet apparatus		One
37.	Photometer		One
38.	Haemocytometer	(Nenbarir’s chamber)	Ten

15. INDUSTRIAL CHEMISTRY/INDUSTRIAL CHEMISTRY (VOCATIONAL)
(Effective from the session 2002-2003)

There shall be the following papers and practicals for B.Sc.I Examination.

There shall be three compulsory papers in theory each of 3 hrs. as stated below and practical examination duration shall be of 6-8 hrs. Every examinee shall offer the following three papers of 40 marks each and practical examination of 30 marks.

Paper-I

(Energy and Material Balance)

- Unit I: (a) **Dimensions and units** : Fundamental and derived quantities, Interconversion of units.
- (b) Mole, atomic weight, molecular weight, equivalent weight composition of i) solid mixture, ii)liquids and gases-mixture Problems based on above.
- Unit II:(a) Material Balance without chemical reactions with flow sheet diagram. Distillation, Crystallization, evaporation and extraction. problems.
- (b) Material Balance with chemical reactions. Conversion, yield, selectivity, stoichiometric equation, limiting and excess reactants. Simple problems. Introduction to recycling operations without problems.

- Unit III: **Energy Balance.**
Heat capacity, C_p , C_v , mean, molar heat capacity. Heat of reaction, formation, combustion, neutralization, heat of solution, Hess's law of constant heat summation. Problems based on calculation of heat of a reaction.
Adiabatic reactions, heat of vaporization, fusion and sublimation. Simple problems
- Unit IV: **Fuels** : Classification, Units of heat and calorific value.
(a) **Liquid Fuel** : Petroleum : Origin & classification fractional distillation of crude oil, natural gases and uses cracking.
(b) **Solid Fuel** : Coal : Types of Coal, Properties of Coal, Coal analysis, destructive distillation of coal, coal tar distillation, uses of coal tar products. coal gas, water gas.
- Unit V: **Energy** : General idea about conventional energy sources, Advantages & disadvantages. Non conventional energy sources : Solar energy, Space-heating & water-heating by solar energy. Production of Electricity using solar energy. Solar trough collectors, solar energy for driving vehicles. Power from indirect solar energy. Bio-mass energy, Ocean Thermal Energy, conversion (OTEC), Other Renewable Energy Sources : Tidal Power, wind energy.

LIST OF BOOKS FOR PAPER-I

1. Stoichiometry - B.I Bhatt and S.W. Vora.
(Tata Mc-Gram Hill, Publishing Company Ltd., New Delhi.)
2. Introduction to Stoichiometry by Gavhane.
3. Industrial Chemistry by B.K.Sharma.
4. A Text Book of Engineering Chemistry by S.S.Dara.
(S.Chand & Company Ltd. Ram Nagar, New Delhi.)
5. Conventional & Non-Conventional energy sources by R.C.Rai.
6. Coal Conversion : E.J.Haffman. (The Energon Co. Larani Wyoming) U.S.A.
7. Introduction to Petroleum Chemicals : H.Steriner (Pergamon Press.)
8. Principles of Physical Chemistry : Puri and Sharma.
9. Text Book of Physical Chemistry : P.L.Sony.

PAPER-II

(Unit Operations)

- Unit I: a) **Distillation** : Introduction, Flash distillation, differential distillation, steam distillation, vacuum distillation and azeotropic distillation. Continuous distillation with

- rectification, combination of rectification and stripping, Batch and continuous distillation, plate columns and packed columns. Overall material balances, operating lines analysis of fractionating columns by Mc Cabe Thiele method and its graphical construction.
- b) **Evaporation** : Introduction, single and multiple effect operation, short tube and long tube evaporator, forced circulation evaporators, falling film evaporators, climbing film (upward flow) evaporator, wiped (agitated) film evaporators. Evaporators capacity, boiling point elevation.
- Unit II: a) **Extraction** : Introduction, selection of solvents, single stage extraction, multistage extraction, spray column, packed column, settlers, mixer settler, rotating disc column and centrifugal extractor.
b) **Leaching** : Introduction, single stage leaching, percolation tanks, countercurrent multiple contact, continuous countercurrent decantation.
- Unit III a) **Size reduction** : Criteria for comminution, energy and power requirements in comminution. Rittenger's law, Bond's law, classification of size reduction equipment, jaw crusher, ball mill.
b) **Mechanical Separation** : Screening, types of screens, ideal and actual screens, capacity and effectiveness of screens. Filtration, continuous pressure filtration and continuous vacuum filtration, filter media, filter cake, principles of cake filtration, pressure drop through filter cake, rotary drum filter.
- Unit IV: a) **Mixing** : Introduction, Mixing of liquid- liquid, solid-solid and liquid-solid system.
b) **Agitation** : Introduction, Types of agitators: Paddles type, & Turbine type, Types of agitation equipments : Rotating Impellers, circulation pump system, reciprocating paddles, revolving tanks or pans, air lifts and collide mill. Effectiveness of agitation and scaling up of equipment, power consumption of agitator.
- Unit V: a) **Crystallization** : Introduction, solubility, supersaturation, nucleation, crystal growth, tank crystallizer, agitated crystallizer, evaporator crystallizer, draft tube crystallizer.
b) **Drying** : Introduction, Free moisture, bound moisture, tray dryer, flask dryer, fluid bed dryer, drum dryer, spray dryer. Rate of drying, heat transfer in dryers, mechanism of drying

of solids, drying of porous solids, flow of water by capillary, hygroscopic porous solids.

LIST OF BOOKS FOR PAPER-II

1. Process Equipment design - M.V. Joshi.
2. Unit Operation of Chemical Engineering - Mc Cabe- Smith.
3. Unit Operation - Gavane, Nerali Prakashan.
4. Micro transfer Operation - R.E.Treybal.
5. Unit Operation - George Granger Brown, CBS Publications.

Paper-III

(Heat Transfer and Fluid Mechanics)

- Unit I: **Surface Chemistry** : Adsorption, Mechanism of Adsorption, Types of Adsorption and adsorbents, Adsorption Isotherm, Langmuir, Freundlich & BET isotherms. Factors affecting adsorption, Applications of Adsorption. Sols and their preparation coagulation, types of coagulants and their applications, Emulsion, Gels, Micelles, Surfactants.
- Unit II: **Catalysis** : Introduction, Types of catalysis, Homogeneous catalysis, heterogeneous catalysis, mechanism, catalyst properties, catalyst deactivation. Autocatalysis, Negative catalysis, activation energy, Enzyme catalysed reactions.
- Unit III: **Heat Transfer**.
- a) **Fundamentals of Heat Transfer** : Modes of heat transfer, Fourier's law, Newton's law, Stefan Boltzmann's Law. Concept of heat conduction, general heat conduction equation, thermal diffusibility, Nature of heat convection, forced & free convection. Heat transfer by change of phase, Phenomenon of pool boiling, Phenomenon of Filmwise and dropwise condensation.
- b) **Thermal radiation** : Nature of thermal radiation, definition of Absorption, transmission, reflection, Heat exchanger. Types of heat exchangers.
- Unit IV: **Fluid Mechanics** :
- Types of fluid flow, Basic equations of fluid flow : equation of continuity, Bernoulli's equations, newtonian and non newtonian fluids, Pipe joints and fittings, Valves and pumps, reciprocating & centrifugal pumps. Venturimeter, Orificemeter, Pitot-tube, rotameter, manometer.
- Unit V: a) **Water Specification for Industrial use** :
- Types of Impurities present in water and their effects. Dissolved mineral matter, Hardness, Alkalinity, Total

dissolved solid. Methods of treatment of water for Industrial purposes, deionisation of Boiler feed water.

- b) **Boilers** : Their types, functioning with reference to Lancashire and Cornish boilers. Boiler troubles : Carry over methods for preventing priming and foaming, scale formation, its disadvantages, prevention of scale formation by external and internal treatment (carbonate and phosphate conditioning)
- c) **Steam** : Generation, properties and purity.

LIST OF BOOKS FOR PAPER-III

1. Catalysis : Heterogeneous & Homogenous; Delmon & Janner.
2. Catalysis Science and technology; Anderson J.
3. Surface Chemistry J.J. Bickermann, Academic Press.
4. Physical Chemistry of Surface, A.W.Adamson.
5. Heat transfer - Gupta & Prakash.
6. Unit Operation - Mc.Cabe & Smith, McGraw Hill.
7. Unit Operation - Gavane
8. Engineering Chemistry - S.S.Dara.

LIST OF PRACTICAL EXERCISES

1. Numerical problems on Units & conversion.
2. Problems on - Mass relation.
3. a) Preparation of standard solutions of any one of the following : Oxalic acid, copper sulphate, Potassium Dichromate.
b) Standardization of any one of the following solutions. Potassium Permanganate, Sodium Hydroxide, Sodium thiosulphate (any one)
4. Determination of amount of oil in given oil seed.
5. Determination of moisture and ash content in a given coal sample.
6. Determination of flash point of given fuel.
7. Comparison of the calorific value of two solvents.
8. Determination of molecular weight of given sample by Rast's/Landsberger Method.
9. Separation of two component mixture of miscible liquid by simple distillation.
10. Separation of three component mixture by fractional distillation.
11. Crystallization of benzoic acid using water as solvent.
12. Crystallization of organic compound by using mixture of water & alcohol.
13. Decolourization of raw sugar by charcoal.
14. Determination of total acid content in lemon Juice.

15. Preparation of Raninickel.
16. Preparation of charcoal.
17. Determination of Ca^{2+} and Mg^{2+} contents in Dolomite.
18. Determination of Hardness of boiler feed water.
19. Coagulation of suspended solid particles in a given water sample by using alum.
20. Determination of moisture content in seed by Karl Fischer method.
21. Measurement of pressure difference between two point within pipeline, using Manometer.
22. Measurement of Flow rate at a particular point by venturimeter.
23. Measurement of Flow rate at a particular point by orificemeter.

- Note:**
1. Student must perform at least 15 experiment from above list.
 2. Exercise No. 1 & 2 are compulsory.
 3. Out of two experiments to be given in the Practical examination, one should be major.

Distribution of Marks for Practical Examination.

1. Exercise No. 1 (Numericals)	.....	04
2. Exercise No. 2 (Practical Expt.)	.....	12
3. Exercise No. 3 (Practical Expt.)	.....	08
4. Viva-Voce	.....	03
5. Record	.....	03

Total : 30

16. PETROCHEMICAL SCIENCE

The syllabus is based on six theory periods and six practical periods per week.

The examination in Petrochemical Science will comprise of two theory papers and a practical. Each theory paper shall be of three hours duration and carry 60 Marks. The practical shall be of six hours duration and shall carry 30 marks. The distribution of practical marks shall be as follows :

1. Record	5 Marks
2. Viva-Voce	10 Marks
3. Exercise	15 Marks
Total : 30 Marks	

PAPER - I

Petrochemical Science - I

- Unit I Different fuels : conventional and non-conventional, their relative merits & demerits. Importance of Petroleum as a fuel and as a source of Petrochemical; Over all review of petroleum and gas industry at National & International level.
- Unit II Theories of origin of coal, natural gas and petroleum e.g. Inorganic, Organic & Bio-organic; Recovery of petroleum from earth crust with reference to prospecting with geological, geophysical, geochemical & physico-chemical methods; Drilling with cable-tool, rotary and turbo, drilling on and off-shore; Composition and function of drilling fluids
- Unit III Type of Hydrocarbons and Non Hydrocarbons present, Role of hetero atoms containing compounds and necessity for their removal; Elemental and ultimate composition of oil & gas; Classification of crude based on A.P.I. gravity, characterization factor, Co-relation index, n- m- d method.
- Unit IV Field operations - Desalting, Dehydration, and Deemulsification with different methods. Necessity of the fractionation of the crude, Fractions from atmospheric distillation and vacuum distillation, the range of carbon number, boiling point and molecular weight; Details of composition of various fractions.
- Unit V Important properties of Petroleum and Petroleum fractions such as A.P.I. gravity, viscosity, carbon residue, smoke point, vapour pressure, flash point, pour point, etc.

PAPER-II

Petrochemical Science - II

- Unit I Important feed stock for petrochemicals manufacture.
1. gases comprising Associated gas, Lean gas, Refinery off gas, Natural gas, L.P.G., Condensate gases.
 2. Light liquid fractions, Natural gas liquids, Naphthas, Wild gasoline, Kerosene, Reformates.
 3. Heavy Liquids.
Most common impurities present in gases and their removal.
- Unit II Steam Reforming : Verious Chemical Reactions and thermodynamic aspects, reactivity of Hydrocarbons Manufacture of Methanol, its uses and derivatives of it.
- Unit III Formaldehyde, acetic acid, methylamines and methyl chlorides : their manufacture, properties and uses.

Unit IV Production of Synthesis gas, Lurgi Process, Oxo-Synthesis & Chemicals based on carbon monoxide.

Unit V Synthesis gas by partial oxidation of petroleum fraction, process description, process conditions, catalyst used, advantages of partial oxidation.

End uses of synthesis gas.

(Note : The subject should be taught giving elaborated consideration to thermodynamics, kinetics, mechanism, catalyst involved, process conditions, type of reactors and separation and purification of the product.)

LIST OF EXPERIMENTS

- Density and API gravity.
- Pour point
- Acid value of Petroleum Sample
- Aniline point and Diesel Index
- Viscosity by U-tube viscometer.
- Eutectic temperature for Phenol water system.
- Drop point and melting point of wax.
- Congelling point of wax.
- Saponification value of petroleum sample.
- Flash point of petroleum sample by various methods.
- Smoke point of petroleum sample.
- Determination of Refractive index of Hydrocarbon sample.

Books recommended. : (For B.Sc. I)

General Textbooks

- Basic Organic Chemistry, Part 5, Industrial Products, J.M.Tedder, A.Nechvatal and A.H.Jubb, John Wiley, London (1975).
- Industrial Organic Chemistry, K.Weissermel and H.J.Arpe, Verlag. Chemie, New York (1978).
- Chemicals from Petroleum, A.L.Waddams, 4th edn., Murray, London (1978).
- An Introduction to Industrial Organic Chemistry, P.Wiseman, 2nd edn., Applied Science, London (1979).
- Organic Chemicals in Perspective, Vols.1 and 2, H.A.Witteoff and B.G.Reuben, John Wiley, New York (1980).
- Catalysis and Chemical Processes, R.Pearce and W.R.Patterson, Leonard Hill, Glasgow (1981).
- From Hydrocarbons to Petrochemicals, L.F.Hatch and M.Matar, Gulf Publishing, Houston (1981).
- Text Book on Petrochemicals, Dr.B.K.Roy.
- Modern Petroleum Refinery processes by B.K.Roy.

10. Modern Petroleum Technology, G.D.Hobson, 5th edn., John Wiley, Chichester (1984).

11. Chemicals from Synthesis Gas, R.A.Sheldon, B.Reidel Publishing Company, Dordrecht (1983). [Includes a good discussion of the Oxo process.]

LIST OF APPRATUS AND EQUIPMENTS REQUIRED FOR A BATCH OF TWENTY STUDENTS FOR B.SC.I,II & FINAL FOR PETROCHEMICAL SCIENCE.

1.	Burette	20 Nos.
2.	Pipette 10 ml, 25 ml	20 Nos. each
3.	Mohr Pipette 2 ml, 5 ml,	10 Nos. each
4.	Conical Flasks with stoppers	50 Nos.
5.	Standard volumetric flasks.	20 Nos.
6.	Density bottle	20 Nos.
7.	Balance (Electronics / Digital)	02 Nos.
8.	Aniline point apparatus	01 No.
9.	U-tube viscometers of different capillary size	02 sets
10.	Thermometer (0 to 110 0c IP Grade)	10 No.
11.	Thermometer (0 to 360 0c IP Grade)	06 Nos.
12.	Test tube (20 ml and 50 ml with rubber cork	50 Nos.
13.	Smoke point apparatus (IP Grade)	01 No.
14.	Abel Flash point Apparatus (IP Grade)	01 No.
15.	Pensky Martens Flash point Apparatus	01 No.
16.	Cleveland Open cup Flash point Apparatus	01 No.
17.	Poroceline Disc	10 Nos.
18.	Constant Temperature Bath	02 Nos.
19.	Hot plate	01 No.
20.	Air condensor	20 No.
21.	Glass tubing 6mm, 10mm	20 Ft. Each
22.	Glass rod 4mm, 8mm	20 Ft. Each
23.	Stop Watches	04 No.
24.	LPG Cylinder with regulator	01 No.
25.	Refractometer	01 No.
26.	Refrigerator	01 No.
27.	Water Distillation Plant	01 No.
28.	Beaker 250 ml	20 No.
29.	Beaker 50 ml, 100 ml, 500 ml, 1000 ml	7 No. each
30.	Hot air oven	1 No.
31.	Heating Furnace	1 No.
32.	Karl Fisher Autotitrator	1 No.
33.	Dean and Stark apparatus	1 No.
34.	Flame Photometer	1 No.
35.	Colorimeter	1 No.

36.	Bomb Calorimeter	1 No.
37.	Spectrophotometer	1 No.
38.	Oxygen Cylinder with pressure regulating valve	1 No
40.	Vacuum pump	1 No.
41.	Air source	1 No.
42.	Air flowmeter	1 No.
43.	Desiccators	6 Nos.
44.	Water Suction	4 Nos.
45.	Filtration Flask with buckner funnels	
	100ml	6 Nos.
	250ml	6 Nos.
	500ml	3 Nos.
46.	Heating Mantle	6 Nos.
47.	ASTM Distillation Apparatus	1 No.
48.	Viscometer and Constant temperature bath	1 set of viscometer
49.	Apparatus for oil determination in given sample As per IP norm	1 No.
50.	Dean and stark method	1 No.
51.	Reid vapour pressure apparatus with const. temp. bath	1 No.
52.	Ductility measuring meter	1 No.
53.	Penetrometer	
54.	Copper corrosion test apparatus	1 No.
55.	Cooling curve apparatus	1 No.
56.	Crankcase oil dilution apparatus	1 No.
57.	Thermometer as per IP norm for above apparatus and methods	2 Each
58.	Redwood viscometer No.I & No.II	1 No.each

(Note : All equipment and apparatus should be of IP standard.)

17. PHYSICS

There shall be Three theory paper and One practical for B.Sc. Part-I (Physics). It is expected that student should deliver seminar on the topics related to theory / practical. For development of all topics in physics, systems international (S.I.) should be followed. Final formula may be stated using C.G.S. Gaussian system. As far as possible symbols and nomenclature should be recommended by SUN commission.

Theory papers	Marks	Duration.
Paper-I: Mechanics & Properties of Matter	40	3 Hrs.
Paper-II: Kinetic theory, thermodynamics	40	3 Hrs.
Paper-III: Optics & LASER	40	3 Hrs.

Practicals

1. Laboratory practicals (Minimum two experiments)	30	6 Hrs.
Record book	6 marks	
Viva voce	6 marks	
First expt.	9 marks	
Second expt.	9 marks	
2. Completion Certificate: is must for practical record book.		

PAPER-I

(MECHANICS & PROPERTIES OF MATTER).

UNIT-I: Laws of motion; motion in a uniform field; Components of Velocity & acceleration in Co-ordinate systems (inertial & non-inertial frames) Uniformly rotating frame, Centripetal acceleration, fictitious force; Coriolis force and its applications. Motion under central force; Kepler's laws.

UNIT-II: Newton's law of gravitation; Gravitational field, Potential; Potential & Energy; Gravitational Potential due to Spherical Shell; Gauss & Poission equations, gravitational self energy. System of particles, Centre of mass, equation of motion, conservation of linear & angular momentum, Conservation of energy; Single Stage & multistage rockets, elastic & inelastic collisions.

UNIT-III: Rigid body motion; rotational motion; moment of inertia; Radius of Gyration; Theorem of Perpendicular & Parallel axes; M.I. of disc, sphere & bar about different axes.

UNIT-IV: Elasticity; Small deformations; Hooke's Law, Elastic constants for isotropic solids; twisting couple, torsion of cylinder; bending beam and moments; Cantilever; beams supported at both the ends.

UNIT-V: Kinematics of moving fluids; equation of continuity; Euler's equation.

Viscous fluids; Streamline and turbulent flow; Reynold's numbers; Poiseuille's equation; Capillary tube flow; Bernaulli's theorem; Stokes' law.

Surface tension and surface energy; molecular interpretation of surface tension; pressure on a curved liquid surface, Wetting.

BOOKS:-

- Berkeley Physics Course Vol.1, Mechanics, Eno Purcell Ed. (McGraw Hill).
- The Feymann lectures in Physics - Vol.1 R.P.Feymann, R.B.Lighton & M. Sands.
- Mechanics and Properties of matter - D.S.Mathur.

- 4) Text Book of First Year Physics - M.K.Bagde & S.P.Singh -S. Chand & Co.
- 5) Fundamental of Physics - Halliday & Resnik (6th Edi.)
- 6) Physics - Richard Weinder.
- 7) International Students, edition in Physics -Young and Freedman.

PAPER II

(KINETIC THEORY AND THERMODYNAMICS)

UNIT I: Ideal Gas - Kinetic theory of Gases (Assumption, equation without derivation), deduction of Boyle's law, interpretation of temp.; Estimation of R M S speed of molecule; Estimate of Avagadro's number; degrees of freedom; equipartition of energy; specific heat of monoatomic gas; extension to di & tri-atomic gases.

Real Gas- Vander Waals Gas, equation of state, Comparison with experimental P-V curves, The critical constants; nature of Vander-Waals forces.

UNIT II: Liquefaction of Gases - Joule-Thomson effect, Joule's coefficient, Boyle and inversion temperature; Principle of regenerative cooling and Cascade Cooling, Liquefaction of hydrogen and helium.

Transport Phenomena in gases: Molecular Collision, mean freepath, Brownian motion and collision cross section. Transport of mass, momentum and energy and interrelationship; dependance on temperature and pressure.

UNIT III: The laws of thermodynamics - The Zeroth law, P-V indicator diagrams, work done by and on the system; First law of thermodynamics, internal energy as a state function and other applications; Reversible and irreversible changes; Carnot Cycle and its efficiency for perfect gases, The Second law of thermodynamics; different versions of second law, Carnot theorem; Entropy, S-T diagram; Principle of increase of Entropy; The thermodynamic scale of temperature; its identity with the perfect gas scale. Impossibility of attaining the absolute zero; third law of thermodynamics.

UNIT IV: Thermodynamic relationships- Thermodynamic Variables, Extensive and intensive, Maxwell's general relationship; application to Joule-Thomson cooling and adiabatic cooling in a general system. Clausius-clapeyron heat equation, thermodynamic Potentials and equilibrium of thermodynamical systems, relation with thermodynamical variables.

UNIT V: Blackbody radiation - Pure temperature dependance; Stefan-Boltzmann law; Pressure of radiation; Spectral distribution of Black Body radiation; Wein's displacement law, Rayleigh-Jean's

law, the ultraviolet Catastrophy; Planck quantum postulates, Planck's law; complete fit with experiment.

BOOKS:

- 1) Sears and Salinger - thermodynamics, Kinetic theory and Statistical Physics. (Narosa Pub. House).
- 2) Heat and thermodynamics - D.S.Mathur.
- 3) First Year Physics - M.K.Bagde and S.P.Singh.
- 4) Text Book of heat - J.B.Rajam.
- 5) Heat & Thermodynamics – Rajam & Arora
- 6) Heat - Rajkumar & Sharma.
- 7) Programming with FORTRAN – by Dr.B.H.Pawar

PAPER III (OPTICS AND LASER)

UNIT I: Fermat's Principle : Principle of extremum path, Refraction at concave and convex surfaces.

General theory of image formation : Refraction through lenses, Power of lenses, Cardinal points of an optical system, general relationships, thick lens and lens combinations. Aberration in images: Monochromatic aberrations, spherical, Coma, Astigmatism, Curvature field, Distortion and their reduction. Chromatic aberrations, achromatic combination of lenses in contact and separated lenses.

UNIT II: Interference of light: The Principle of superposition, two-slit interference, coherence requirement for the sources, Optical path retardations, lateral shift of fringes, Localized fringes, thin films by reflected and transmitted light, Necessity of broad source, Wedge shape thin film, Newton's rings. Wavelength of light and Refractive index of liquid by Newton's ring. Coloured rings.

Haidinger fringes : Fringes of equal inclination, Michelson's Interferometer, its application for precision determination of wavelength and wavelength difference.

UNIT III: Fresnel diffraction : Fresnel half period zones, rectilinear propagation, Zone plate, Diffraction at straight edge. Fraunhofer diffraction, Diffraction due to single slit, Diffraction due to double slit, the intensity distribution.

Resolution of images : Rayleigh's criterion, Resolving power of telescope and microscope.

UNIT IV: Diffraction gratings: Diffraction at N Parallel slits, intensity distribution, Plane diffraction grating, Determination of Wavelength of light by grating, Resolving power of grating.

Polarisation of light : Concept of polarisation, Brewster's law Double refraction, Nicol Prism, Production and theory of circularly and elliptically polarised light. Phase retardation plates.

UNITV: Laser System: Purity of spectral line, coherence length and coherence time, spatial coherence of a source. Einstein's A and B coefficients, spontaneous and induced emissions, conditions for laser action, population inversion. Application of lasers: Pulsed lasers and tunable lasers, spatial coherence and directionality, estimates of beam intensity, temporal coherence and spectral energy density. He-Ne laser, Ruby laser, YAG laser, Three level and Four level lasers.

Text and Reference Books :-

1. E.Hecht, Optics (Pearson Education Aisa).
2. B.K.Mathur, Principles of optics.
3. B.K.Mathur, Geometrical and Physical optics.
4. R.S.Sirohi, A course of experiments with He-Ne laser. (Wiley Eastern Ltd.)
5. A.K.Ghatak, Physical Optics.
6. D.P.Khandelwal, Optics and Atomic Physics, (Himalaya Pub.House, Bombay, 1988).
7. K.D.Moltev, Optics (Oxford University Press).
8. Jenkins and White, Fundamental of Optics (McGraw - Hill).
9. B.B.Land - Lasers and Non-linear optics. (Wiley Eastern 1985).
10. Smith and thomson, Optics (John Wiley and sons).
11. Shimoda - Laser Physics.
12. Text book of First Year Physics- M.K.Bagade and S.P.Singh.

Practical :

(Every student will have to perform at least 20 experiments from the following list. At the time of examination, each student will have to perform 2 (two) experiments.)

1. Study of laws of Parallel and perpendiculars axes for moment of inertia.
2. Study of conservation of momentum in two-dimensional oscillations.
3. Determination of coefficient of restitution for inelastic collision.
4. Moment of inertia of fly wheel.
5. Study of compound pendulum.
6. To determine moment of inertia of a body using bifilar suspension.
7. Modulus of rigidity by Torsional Pendulum.
8. Acceleration due to gravity by Kater's pendulum.
9. Study of Oscillations of mass under different combinations of springs.
10. Young's modulus by cantilever.
11. Young's Modulus by bending of beam.

12. Modulus of rigidity by statical method.
13. Young's modulus by Vibration Method.
14. Modulus of rigidity by Maxwell's needle.
15. Coefficient of Viscosity by Poiseulle's method.
16. Determination of surface tension of a liquid by double capillary method.
17. Surface tension by Quinke's method.
18. Determination of Surface tension by Jager's method.
19. Heating efficiency of electrical Kettle with varying voltages.
20. Determination of "J" by Callendar and Barne's method.
21. Cp/Cv by Clement and Desorme's method.
22. Determination of Planck's constant by Wein's displacement law.
23. Thermal conductivity of an insulator by Lee's disc method.
24. Determination of wavelength of light by biprism.
25. Wavelength of light by Newton's rings .
26. Study of F-P etalon fringes.
27. Wavelength of light by Grating.
28. R.P. of Telescope.
29. Verification of Brewster's law.
30. R.I. of double image prism.
31. Wavelength of light by cylindrical obstacle.
32. Determination of Stefan's constant.
33. Concentration of Sugar solution by half shade polarimeter.
34. To determine electrical component of polarized light using Babinet's Compensator.
35. Wavelength of laser light.
36. Wavelength of light by Michelson's Interferometer.
37. Velocity of waves over a liquid surface by a method of ripples.
38. To find the sum of sine and cosine series using Fortran Program.
39. To prepare mark list using Fortran Program.
40. To solve simultaneous equation by elimination method.
41. Inverse of matrix using Fortron Program.

Minimum requirement of apparatus for B.Sc. (PHYSICS) Calsses for a batch.

Sr. No.	Name of apparatus/Unit	Mainimum requirement
1.	Optical bench	1
2.	Research optical bench	1
3.	Convex lenses	4
4.	Biprism	1
5.	Prism	6

6.	Double image prism	2
7.	Sodium Lamps Complete	2
8.	Newton's ring apparatus	1
9.	diffraction grating	2
10.	Spectrometer	4
11.	Adjustable slits	4
12.	Microscope (Travelling) vertical Horizontal	4
13.	Telescope	4
14.	Potentiometer	2
15.	Resistance box --	
	1 - 500	3
	1 - 5000	3
	1 - 10,000	2
	Fractional	2
16.	Two way plug keys	5
17.	Rheostats	6
18.	Galvanometers	3
19.	Battery eliminator (Variable)	7
20.	Ammeter	4
21.	Voltmeter	4
22.	Multimeter	8
23.	Leclanche's cell	3
24.	Plug key	10
25.	Tap key	6
26.	Carry Foster's bridge	3
27.	Thermocouple	1
28.	Hot water bath	2
29.	Ballistic galvanometer	2
30.	Transformer	4
31.	Mercury Lamps	1
32.	Standard resistance - 1	2
33.	Charge - discharge dy for absolute capacity	1
34.	Inductances .	
	01 H	2
	5 H	2
35.	Oscillator (A. F.)	5
36.	Oscillator (R. F.)	2
37.	Connecting wire	1 kg.
38.	V.T.V.M.	5
39.	C.R.O.	1
40.	Dimerstate	1

41.	Fixed condenser	4
42.	Babinet compensator	
43.	Polarimeter	
44.	Bar pendulum	1
45.	Stop watches	6
46.	Meter Scale	6
47.	G clamps	4
48.	Knife edges	4
49.	Metal bars	3
50.	Vernier callipers	3
51.	Maxwell's needle for 'n' apparatus	1
52.	Ring disc (Dynamics) apparatus	1
53.	Poisullie's flow apparatus complete	1
54.	Thermometers 0 - 1100	5
55.	Steam traps (glass)	4
56.	Stands	5
57.	Weight boxes	6
58.	Helmholtz resonator	1
59.	Tunning forks set	1
60.	Frequency of A.C. mains apparatus	1
61.	Measuring cylinders 200 ml.	2
62.	Thomon's tube for e/m	1
63.	Milikan's apparatus	1
64.	X- ray diffraction pattern b c c powder	1
65.	Study board of power supply	1
66.	Study board of wein's bridge oscillator	1
67.	G.M. counter experiment set	1
68.	Study board of half adder/ full adder	1
69.	Study board of logic gates	1
70.	Study board of "Characteristics of Phototransistor"	1
71.	Study board of NOR gates and switching characteristics	1
72.	Study board of NAND gate and switching characteristics	1
73.	Study board of Sequential logic FF	1

74.	Study board of Sequential logic RS FF	1
75.	Study board of Sequential logic C RSFF	1
76.	Study board of Sequential logic J K FF	1
77.	Study board of Op-Amp as differentiator	1
78.	Study board of Op-Amp as an integrator	1
79.	Study board of Op-Amp as an inverting amplifiers	1
80.	Study board Op-Amp as an Non-inverting amplifiers.	1
81.	Study of monostable multivibrator	1
82.	Study of bistable multivibrator	1
83.	Study of Astable multivibrator	1
84.	Study of MOPA	1
85.	Study of VHF oscillator	1
86.	Study of diode detector	1
87.	Study of amplitude modulator	1
88.	Study of TRF receiver	1
89.	Study of super heterodyne receiver	1
90.	Digital power supply (Dual type) +15 to-15	1
91.	P-N-diode	2
92.	Apparatus of I-H curve	1
93.	Study board for diode as rectifier	1
94.	Study board for Thevenin's theorem	1
95.	Study board for Millman's theorem	1
96.	Study of Activation energy of thermister	1
97.	Study board Owen's bridge	1
98.	Study board for maximum power transfer theorem	1
99.	'Y' by bending apparatus	1
100.	Thermal conductivity of rubber tube apparatus	1
101.	'n' by statistical method apparatus	1
102.	Keller's Pendulum	1
103.	Zener Diode expt.set	1
104.	Set for study of Star Delta Transformation	1
105.	Study of Multirange Voltmeter	1
106.	Study of Multirange ammeter	1
107.	Study of Series and Shunt Ohmmeter	1

108.	Screw Gauge	3
109.	Study of Phase Shift Oscillator	1
110.	Study of Crystal Controlled Oscillator.	1
111.	Planck's Constant Apparatus	1
112.	'e/n' by Thomson's Apparatus	1
113.	Four Probe Apparatus.	1
114.	Crystal Models to Study Point Symmetry	1

18. CHEMISTRY**(Effective from the session 2003-2004)**

There shall be following papers and practicals for B.Sc.Part-I examination.

There shall be three compulsory papers in theory as stated below and practical examination extending for 6 hours. Every examinee shall offer the following three papers of 40 marks each and practical examination of 30 marks.

1)	Paper-I	:	Inorganic Chemistry	40 Marks
2)	Paper-II	:	Organic Chemistry	40 Marks
3)	Paper-III	:	Physical Chemistry	40 Marks
	Practical	:		30 Marks
			Total	: 150 Marks

The practical examination will be in the above three Branches of Chemistry. The Distribution of marks shall be as follows.

a)	Inorganic Chemistry (Exercise)	08 Marks
b)	Organic Chemistry (Exercise)	08 Marks
c)	Physical Chemistry (Exercise)	08 Marks
d)	Record	03 Marks
e)	Viva	03 Marks
	Total	: 30 Marks

N.B. : Experiments may be performed by microscale techniques.

CHEMISTRY PAPER-I**(INORGANIC CHEMISTRY)***Total Lectures : 60**Marks : 40 .*

Note : Figures to the right hand side indicates number of Lectures.

UNIT I**A] Atomic Structure :****[6]**

Idea of de Broglie, matter waves, de Broglie equation, Heisenberg's

uncertainty principle, atomic orbitals, Schrodinger's wave equation (no derivation), significance of ψ and ψ^2 , Quantum numbers, shapes of s, p and d orbitals. Aufbau and Pauli exclusion principles. Hund's multiplicity rule. Electronic configurations of the multielectron atoms (up to atomic number=71). Effective nuclear charge, calculation of screening constant by Slater's rules.

B] Periodic Properties : [6]

Atomic and ionic radii (definitions of covalent, metallic, Vander Waal's and ionic radii), electron affinity, electronegativity, ionization energy definition, factors affecting and trends in periodic table (down a group and across a period). Methods of determination and evaluation of electro-negativity (electronegativity scales namely - Pauling scale and Mulliken scale). Applications in predicting and explaining chemical behaviour (effect of I.E. and E.N. on properties viz. metallic and non-metallic character, reactivity, oxidizing and reducing properties, acidic and basic nature of elements). Electronegativity and nature of bond (partial ionic character in covalent bond).

UNIT II

A] Ionic Bonding : [8]

Ionic bond formation, different types of cations. Ionic structures, radius ratio effect and co-ordination number, limitations of radius ratio rule. Factors favouring ionic bond formation (viz. low I.E., high E.A., high L.E.), Lattice energy. Born-Landé equation (no derivation), Born-Haber's cycle. Solvation, solvation energy and solubility of ionic solids. Factors affecting solvation energy. Polarization-Polarizing power and polarizability. Fajan's rules and their applications.

B] Metallic Bonding : [2]

Free electron and valence bond theory and explanation of properties of metals like high M.P., B.P., conductivity, malleability, ductility and lustre on the basis of free electron theory.

C] Weak Interactions (Vander Waal's forces) : [2]

Ion-dipole, dipole - dipole, dipole - induced dipole and induced dipole - induced dipole interactions.

UNIT III

A] S-Block Elements (groups I and II i.e. groups IA and IIA): [6]

Comparative study of IA and IIA (groups 1 and 2) group elements with reference to electronic configuration, ionization energy, oxidation states, reducing property, reactivity and flame colouration. Diagonal relationship between Li and Mg.

B] p-Block Elements (Groups 13 & 14 i.e. gps. IIIA & IVA) : [6]

Comparative study of IIIA and IVA (i.e. 13 & 14) group elements with reference to electronic configuration, ionization energy and oxidation states (inert pair effect). Diagonal relationships between Be and Al and Preparation, properties, structure and uses of Hydrides of boron-diborane borazines, carbides, fullerenes.

UNIT IV

A] P - Block Elements (groups 15, 16 & 17 i.e. groups VA, VIA & VIIA): [8]

Comparative study of VA, VIA, VIIA (i.e. 15, 16 and 17 groups) elements with reference to electronic configuration, ionization energy and oxidation states. Oxidizing properties of halogens. Basic properties of halogens. Abnormal behaviour of nitrogen. Preparation, properties and structures of interhalogen compounds. Introduction to tetrasulphur tetramide (S_4N_4). Introduction to fluorocarbons.

B] Noble Gases : [4]

Chemistry of Xenon - preparation, structure and bonding in xenon fluorides, oxyfluorides and oxides.

UNIT V

A] Acids and Bases : [5]

Lux flood concept and solvent system of acids and bases. Classification of acids and bases as hard and soft. Pearson's HSAB principle and its applications. Theoretical basis of hardness and softness. Electronegativity and hardness and softness.

B] Non-Aqueous Solvents : [7]

Physical properties of solvents (namely m.p., b.p., dielectric constant, dipole moment, solubility behaviour). Requirements of a good solvent, water as universal solvent, types of solvents. Reactions in non-aqueous solvents with reference to liquid ammonia and liquid sulfur dioxide. (The reactions to be discussed are acid-base, redox, precipitation, solvolysis and complex formation. In each case at least 2 examples to be discussed).

Paper-II

(ORGANIC CHEMISTRY)

Total Lectures : 60

Marks : 40 .

UNIT I ALIPHATIC HYDROCARBONS

A] Alkanes : [4]

Introduction, Isomerism, Source, Physical properties and chemical reactivity, Reactions : Halogenation, Nitration, Sulphonation, Oxidation, Pyrolysis and Aromatisation, Mechanism of halogenation.

- B] Alkenes :** [4]
Introduction, Source, Physical properties and Chemical reactions. Hydrogenation, Halogenation, Hydrohalogenation, Hydroxylation, Epoxidation, Ozonolysis, Polymerization, Relation between heat of hydrogenation and stability of alkenes. Mechanism of electrophilic ionic addition and free radical addition (Markownikoff's Rule and Peroxide effect).
- C] Alkadienes :** [2]
Introduction to conjugated, isolated and cumulated dienes, Synthesis and properties of 1,3-Butadienes; 1,2 and 1,4-Additions, Diel's Alder Reaction.
- D] Alkynes :** [2]
Introduction, Synthesis and Properties of Acetylene, Reaction : Addition of hydrogen, halogen, HX, water, oxidation, substitution and polymerization.

UNIT II AROMATIC HYDROCARBONS AND AROMATICITY

- A]** Source, Nomenclature, isomerism of aromatic compounds. [1]
- B]** Structure of benzene, stability, orbital picture of benzene. Aromaticity and Huckel's Rule. [3]
- C]** Mechanism of electrophilic aromatic substitution. Nitration, nuclear and side chain halogenation, Birch reduction, Friedal Craft alkylation and arylation. [4]
- D] Orientation :** [4]
Effect of substituent groups, Activating and Deactivating Groups, Directing influence of the following groups in the light of modern electronic theory (-OH, Cl, NO₂, COOH and CH₃ groups).

UNIT III STEREOCHEMISTRY

- A]** Introduction to different types of isomerism. Confirmation, configuration and geometrical isomerisms. [1]
- B]** Optical isomerism : Elements of symmetry, Chirality, assymetric carbon atom, enantiomers, diastereoisomers, relative and absolute configuration. Fischer projection formula. R-S-nomenclature, inversion retention, racemization and resolution of racemic mixture. [4]
- C] Geometric Isomerism :** [3]
Cis-trans-nomenclature. E-Z-nomenclature, methods of structure determination.
- D]** Bayer's strain theory and its limitation, stability of cycloalkanes. Conformations and conformational isomers of ethane, n-butane and cyclohexane their energy level diagrams. Newman, Sawhorse, Fisher

and Flying Wedge projection formulae. [4]

UNIT IV HALOGEN DERIVATIVES

- A] Alkyl Halides :** [4]
Introduction, preparation and properties of ethyl bromide. Mechanism of SN₁, SN₂ and E₁, E₂ reactions, Elimination versus Substitution.
- B] Alkenyl Halides :** [4]
Synthesis and reactions of vinyl, allyl and benzyl chlorides, comparison of reactivity of vinyl and allyl chloride.
- C] Aryl Halides :** [4]
Synthesis and reactions of chlorobenzene, mechanism of nucleophilic (benzyne) substitution reaction. Comparison of reactivity of chlorobenzene and benzene chloride.

UNIT V ALCOHOLS, PHENOLS AND ETHERS

- A] Alcohols :** [3]
Synthesis and reactions of benzyl alcohols 1,2-glycol and glycerol, Mechanism of pinacol and pinacolone rearrangement.
- B] Phenols :** [3]
Introduction, Synthesis and physical properties, acidic character, Reactions: Kolbe's reaction, Reimer Tiemann reaction, Hauben-Hoesch reaction, Mechanism of Fries and Claisen rearrangement. Phenol-Formaldehyde reaction.
- C] Ethers :** [3]
Introduction, Synthesis and reactions of diethyl ether relative reactivities of alcohols and ethers.
- D] Epoxides :** [3]
Synthesis of ethylene oxide and styrene oxide - one method. Ring opening of styrene epoxide catalysed by acid and alkali.

PAPER-III**(PHYSICAL CHEMISTRY)**

Total Lectures : 60

Marks : 40

UNIT I GASEOUS STATE

[12]

RMS velocity, average velocity, most probable velocity and their relationship. Maxwell-Boltzmann distribution law of molecular velocities (only qualitative treatments), and calculation of mean free path, collision diameter and collision number. Ideal and real gases, deviation from ideal gas behaviour, Vander Waal's equation of states,

explanation of deviation from gas laws, critical phenomenon and critical constants and its calculation, reduced equation of states, law of corresponding states, numerical problems.

UNIT II LIQUID STATE [12]

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. Experimental methods for determination of surface tension by stalagnometer method (drop number method), viscosity by Ostwald's viscometer method and refractive index by Abbe's refractometer method. Effect of temperature on surface tension viscosity and refractive index. Applications of surface tension, viscosity and refractive index. Numerical problems.

UNIT III SOLID STATE [12]

Classification of solids, classification of crystals on the basis of forces between constituent units (viz., molecular crystals, covalent crystals, metallic crystals and ionic crystals). Laws of crystallography. Concept of space lattice, Unit cell. Weiss and Miller indices, Bravais lattices, Symmetry elements in crystal, X-ray - diffraction method and derivation of Bragg equation. Crystal structure of NaCl and X-ray diffraction. Numerical problems.

UNIT IV PHYSICAL PROPERTIES AND MOLECULAR STRUCTURE [12]

Polarization concept and types Clausius - Mossotti equation (only qualitative treatment), 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 properties - paramagnetism, diamagnetism, ferromagnetism and antiferromagnetism effect of temperature Magnetic susceptibility and its determination by Gouy's balance method, effect of temperature on magnetic susceptibility. Relation between magnetic moment and number of unpaired electrons. Applications of magnetic measurement for molecular structure determination. Numerical problems.

UNIT V CHEMICAL KINETICS AND CATALYSIS [12]

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 reaction. Half-life and mean life. Examples

of first and second order reactions namely decomposition of H_2O_2 , hydrolysis of methyl acetate, inversion of cane sugar, saponification of ethyl acetate. Determination of order of reaction - method of integration, differential method, method of half life period, and Ostwald's Isolatin method. Effect of temperature on rate of reaction, Arrhenius equation, concept of activation energy. Catalysis, characteristics of catalysed reactions, classification of catalysis.

Practical

A] **Inorganic Chemistry Practicals :** 20 Laboratory sessions.

Semi-micro Analysis :

Analysis of inorganic salt mixture containing two basic and two acidic radicals. One of the following types of mixtures to be given in examination.

1] Type A :

Mixture containing two basic radicals of same group and two acidic radicals of different groups. At least 5 mixtures.

2] Type B :

Mixture containing two acidic radicals of same group and two basic radicals of different groups. At least 6 mixtures.

Note :

- 1] Student should be informed about the type of mixture given to him/her for Analysis.
- 2] Student is expected to write details of group reagent and reactions involved in confirmatory test of each radical he has reported in his answer book in annual practical examination.
- 3] Teachers are expected to devote sufficient time to explain theoretical basis of qualitative analysis and reactions involved in detection of different radicals before actually starting the experiments.

B] **Organic Chemistry Practicals :**

15 Laboratory sessions. A student is expected to perform at least ten preparations from the following and record,

(i) Crude % yield (ii) Crystallization (iii) M.P. / B.P. of the product

- 1] Acetylation of aniline : preparation of acetanilide.
- 2] Benzoylation of aniline : preparation of benzanilide.
- 3] Preparation of iodoform from ethanol or acetone.
- 4] Preparation of m-dinitrobenzene.
- 5] Preparation of p-bromoacetanilide.
- 6] Preparation p-nitroacetanilide
- 7] Preparation of benzoic acid from benzamide.

- 8] Preparation of benzoic acid from benzaldehyde.
- 9] Preparation of m-nitroaniline from m-dinitrobenzene.
- 10] Preparation of phenylazo - b naphthol dye.
- 11] Preparation of phenol - formaldehyde plastic.
- 12] Preparation of sulphanic acid from aniline.
- 13] Preparation of semicarbazone from acetone.
- 14] Preparation of glurosazone.
- 15] Preparation of aspirin.

C] Physical Chemistry Practicals :

15 laboratory sessions.

- 1] To determine the relative viscosity of given liquid by using Ostwald's Viscometer.
- 2] To determine percentage composition of a given mixture of liquids by viscosity method.
- 3] To determine surface tension of the given liquid by using stalagmometer.
- 4] To determine parachor value of CH_2 -group.
- 5] To compare cleaning power of detergents by stalagmometer.
- 6] To find the refractive index of a given liquid by Abbe's refractometer and specific and molar refraction.
- 7] To study the hydrolysis of methyl acetate catalysed by acid.
- 8] To study saponification of ethyl acetate with NaOH.
- 9] To study kinetically the reaction rate of decomposition of iodide by H_2O_2 .

BOOK RECOMMENDED FOR

PAPER-I (INORGANIC CHEMISTRY)

1. Principle of Inorganic Chemistry By - Puri, Sharma and Kalia-S. Naginchand & Co. Delhi.
2. Text book of Inorganic Chemistry By A. K. De., Wiley East Ltd.
3. Selected Topics in Inorganic Chemistry by Malik, Tuli And Madan's. Chand & Co.
4. Modern Inorganic Chemistry by R.C. Agrawal, Kitab Mahal.
5. Instrumental Methods of analysis by Chatwal & Anand, Himalaya Publishing House.
6. Concise Inorganic Chemistry by J.D.LEE., ELBS.
7. Inorganic Chemistry by J.E. Huheey-Harper & Row.
8. Fundamental concepts of Inorganic Chemistry by E.S.Gilreath, McGraw Hill book Co.

9. Modern Inorganic Chemistry by W.L.Jolly, McGraw Hill Int.
10. Chemistry Facts, Patterns & Principles by Kneen, Rogers & Simpson ELBS.
11. Theoretical Principles of Inorganic Chemistry by G.S. Manku, Tata McGraw Hill.
12. Inorganic Complex Compounds by Murmann Chapman & Hall.
13. Text Book of Inorganic Chemistry by K.N.Upadhyaya, Vikas Publishing House, Delhi.
14. Advance Practical Inorganic Chemistry by Gurdeep Raj, Goel Publishing house, Meerut.
15. Co-ordination chemistry by D. Banerjee, TMH Publication.
16. Text Book of Inorganic Chemistry by Marathe, Bhadange, Mopari, Kubade.

BOOKS RECOMMENDED FOR

PAPER-II (ORGANIC CHEMISTRY)

1. Organic Chemistry by R. T. Morrison & R.N. Boyd: 6th EDN PHI.
2. Organic Chemistry by Pine 5th Edn.
3. Organic Chemistry vol.I, II And III by Mukharjee, Singh and Kappor -Wiley eastern.
4. Organic Chemistry by S.K. Ghosh.
5. Reaction Mechanism in Organic Chemistry by S.M. Mukharjee and S.P. Singh.
6. Spectroscopy of Organic Compounds by P.S. Kalsi.
7. Stereo-Chemistry & Mechanism Through solved problems by P.S. Kalsi.
8. Organic Chemistry by TWG Solomons 4th John Wiley.
9. Hand Book of Organic Analysis by H.J. Clarke, Arnold Heinmen.
10. Text Book of Practical Organic Chemistry by A.I. Vogel.
11. Text Book of Organic Chemistry by Jamode, Ganar, Makode, Waghmare, Mahajan, Toshniwal.
12. Text Book of Organic Chemistry by P.S.Kalsi, published by Macmillan India Ltd., 1999, Delhi.
13. Practical Organic Chemistry by F.G.Mann, B.C.Saunders Orient Longman.
14. Comparative Practical Organic Chemistry (Qualitative Analysis) by V.K.Ahluwalia, Sunita Dhingra Orient Longman.
15. Comprehensive practical org. chem. (Preparation and Qualitative Analysis By V.K. Ahluwalia, Renu Agrawal O.L.

BOOKS RECOMMENDED FOR

PAPER-III (PHYSICAL CHEMISTRY)

1. Physical Chemistry : Walter, J. Moore, 5th EDN. New Delhi.
2. Physical Chemistry : GM Barrow, MacGraw Hill, Indian EDN.

3. Principles of Physical Chemistry : Maron And Prutton.
4. Principles of Physical Chemistry : Puri & Sharma.
5. Physical Chemistry : P.W. Atkins 4th EDN.
6. Text Book of Physical Chemistry : PL Sony, OR Dharma.
7. Physical Chemistry : Levine.
8. Practical Physical Chemistry : Palit And De.
9. Practical Physical Chemistry : Yadao.
10. Practical Physical Chemistry : Khosla.
11. Laboratory Mannual of Physical Chemistry : W. J. Popiel.
12. Practical Chemistry : Dr. S. B. Lohiya, Bajaj, Publ. Amt.
13. Text Book of Physical Chemistry : Satpute, Kabra, Raghuwanshi, Wankhade, Jumle, Murarka.

Additional Books suggested for Theory Courses.

- 1) Basic Inorganic Chemistry, F.A.Cotton, G. Wilkinson and P.L.Gaus, wiley.
- 2) Concise Inorganic Chemistry, J.D.Lee, ELBS.
- 3) Concepts of models of Inorganic Chemistry, B.Duglus, D.McDonial and J.Alexander, John Wiley.
- 4) Inorganic Chemistry, D.E.Shriver, P.W.Atkins and C.H.Langford, Oxford.
- 5) Inorganic Chemistry, W.W.Porterfield Addison Wisley.
- 6) Inorganic Chemistry, A.G.Sharpe, ELBS.
- 7) Inorganic Chemistry, G.L.Miessler and D.A.Tarr, Prentice Hall.
- 8) Organic Chemistry, Morrison and Boyd, Prentice Hall.
- 9) Organic Chemistry, L.G.Wade Jr.Prentice Hall.
- 10) Fundamentals of Organic Chemistry, Solomon's John Wiley.
- 11) Organic Chemistry, Volume I, II and III, S.M.Mukherji, S.P.Singh and R.P.Kapoor, Wiley Eastern Limited, (New Age International).
- 12) Organic Chemistry, F.A.Carey, McGraw Hill, INC.
- 13) Introduction to Organic Chemistry Streitwieser, Heathcock and Kosover, McMillan.
- 14) Physical Chemistry, J.M.Baro, International Student Edition, McGraw Hill.
- 15) Basic Programming with application, V.K.Jain, Tata McGraw Hill.
- 16) Computer Science Common Sense, R.Hant and Shelly, Prentice Hall.
- 17) University General Chemistry, C.N.R.Rao, Macmillan.
- 18) Physical Chemistry, R.A.Alberty, Wiley Eastern Limited.
- 19) The Element of Physical Chemistry, P.W.Atkins, Oxford.
- 20) Physical Chemistry through problem, S.K.Dogra and S.Dogra, Wiley Eastern Limited.

LIST OF EQUIPMENTS APPARATUS REQUIRED FOR THE CHEMISTRY PRACTICALS FOR B.SC.

- | | |
|--|---------------|
| 1. Abbe's Refractometer | 2Nos./Batch. |
| 2. Viscometer | 10Nos./Batch |
| 3. Stalagmometer | 10 Nos./Batch |
| 4. Melting Point Apparatus | 10 Nos./Batch |
| 5. Thermometer 0 to 360C | 20 Nos./Batch |
| 6. Thermometer 0 to 110 C | 20 Nos./Batch |
| 7. Analytical Balance | 15 Nos./Batch |
| 8. Weight Box | 15 Nos./Batch |
| 9. Density Bottle | 20 Nos./Batch |
| 10. Kipp's Apparatus | 02 Nos./Batch |
| 11. Quick fit Distillation Assembly/
Multipurpose assembly | 10 Nos./Batch |
| 12. Sinterd Glass Crucible | 20 Nos./Batch |
| 13. Silica Crucible | 20 Nos./Batch |
| 14. Vacuum Suction Pump | 02 Nos./Lab |
| 15. Potentiometer | 02Nos./Batch |
| 16. Metzer Electronic one Pan Balance | 01 Nos./Lab |
| 17. Filtration Flasks with Buckner Funnels | |
| 100 MI | 10 Nos./Batch |
| 250 MI | 05 Nos./Batch |
| 500 MI | 02 Nos./Batch |
| 18. Descicators | 10 Nos./Batch |
| 19. Magnetic Stirrer | 10 Nos./Batch |
| 20. Water Suction | 10 Nos./Batch |
| 21. Conductometer with conductivity cell | 04 Nos./Batch |
| 22. Colorimeter | 02 Nos./Batch |
| 23. PH-Meter | 02Nos./Batch |
| 24. Chromatographic Jar | 05 Nos./Batch |
| 25. Separating Funnels 250 MI, 500 MI | 05 ECH/Batch |
| 26. Hot Air Oven | 02 No./Lab |
| 27. Hot Cold Air Blower | 01 No./Lab |
| 28. Centifuge machine
(Electrically Operated) | 02 No/Lab |
| 29. Deioniser/Water Still
(Electrical Operated) | 01 No/Lab |
| 30. Hot Plate/Heating Mentle | 05 Nos/Batch |
| 31. Models of Elements
(Seven cryst, types and their summety) | |

32.	Flame Photometer	01 Nos./Batch
33.	Spectrophotometer	02 Nos./Batch
34.	Shaking Machine	01 Nos./Batch
35.	Polarimeter	02 Nos./Batch

19. BOTANY

[Effective from the session 2003-2004]

The syllabus is based on six lectures and two practicals [each of three periods duration] per week.

The examination shall comprise of three theory papers and a practical. Each theory paper shall be of three hours duration and carry 40 (forty) marks.

The practical shall be of four hours duration and carry 30(thirty) marks.

Paper-I : Diversity of Microbes, Algae & fungi

Paper-II : Bryophyta, Pteridophyta and Utilization of plants.

Paper-III : Plant Ecology

PAPER-I

(DIVERSITY OF MICROBES, ALGAE & FUNGI)

- UNIT-I** : 1. Viruses: General account with reference to characteristics, chemical composition, multiplication and their types including HIV.
2. Mycoplasma : Structure and Reproduction.
3. Bacteria : Structure, Nutrition, Reproduction, Economic Importance.
4. Cyanobacteria : Cell structure, reproduction, Economic importance with reference to NOSTOC.
- Unit-II** : Algae: [A] General characteristics, classification (Fritsch & Smith) and economic importance
[B] Life cycles of the following:-
Chlorophyceae : Volvox, Oedogonium.
- Unit-III** : Life cycle of the following:-
(a) Xanthophyceae : Vaucheria
(b) Phaeophyceae : Ectocarpus
(c) Rhodophyceae : Batrachospermum
- Unit IV** : Fungi:- General characteristics, classification (Alexopolous

and Mims) and Economic importance.

Life cycle of the followings.

[a] Mastigomycotina :Albugo

[b] Zygomycotina :Mucor

[c] Ascomycotina :Uncinula, Eurotium

Unit V : Life cycle of the followings-

[a] Basidiomycotina :- Puccinia graminis tritici and Agaricus

[b] Deuteromycotina :- Cercospora, Colletotrichum

[c] Lichens :- General characteristics, types & Economic importance.

PAPER-II

(BRYOPHYTA, PTERIDOPHYTA AND UTILIZATION OF PLANTS)

Unit-I : Bryophyta- Amphibians of plant kingdom.

Structure, reproduction, classification and alternation of generations of the following:-

A. Hepaticopsida — Marchantia

B. Anthocerotopsida — Anthoceros

C. Bryopsida — Funaria

Unit-II : Pteridophyta:-

A. Pteridophytes - As first vascular plants. Important characteristics of Psilopsida, Lycopsida, Sphenopsida, Pteropsida

B Structure and reproduction in:-

a- Rhynopsida — Rhynia

b- Lycopsida — Selaginella

c- Sphenopsida — Equisetum

Unit III : Pteridophyta:- Structure and reproduction in:-

A- Filicopsida - Adiantum, Marsilea

B- Concept of Heterospory and seed habit

C- General account of Apospory and apogamy.

Unit IV : Utilization of Plants:-

A- Food Plants- Morphology, Varieties and economic importance of Wheat, Potato.

B- Fibre plants- Morphology, Varieties and economic importance of cotton

C- Oil yielding plants—Morphology, varieties and economic

importance of Groundnut.

D- General account of sources of Firewood, Timber and Bamboos.

Unit-V : Utilization of Plants

A- Spices-General account and economic importance of Black pepper, Clove, Cinnamon and Cardamon

B- Medicinal Plants-

Family, parts used and medicinal significance of-

- | | |
|------------------------|------------------------------|
| 1. Aloe vera | 6. Chlorophytum borivillanum |
| 2. Asparagus racemosus | 7. Emblica officinalis |
| 3. Azadirachta indica | 8. Ocimum sanctum |
| 4. Calotropis gigantea | 9. Zingiber Officinale |
| 5. Catharanthus roseus | 10. Withania somnifera |

C- Beverages - Cultivation and preparation of Tea and Coffee.

D- Essential Oils -General account, economic importance and varieties of Cymbopogon.

[Note:- Omit the details of development of sex-organs and sporophyte)

PAPER-III

PLANTECOLOGY

UNIT-I : Plants and Environment.

- | | | |
|----------------|---|---|
| A. Atmosphere | - | Gases composition |
| B. Water | - | Properties and water cycle |
| C. Light | - | Global radiations and photosynthetically active radiations. |
| D. Temperature | | |
| E. Soil | - | Formation, soil profile and Physico-Chemical properties. |
| F. Biota | | |

Unit-II : Morphological, Anatomical and Physiological responses of plants, to-

- | | | |
|----------------|---|---|
| A. Water | - | Hydrophytes and Xerophytes. |
| B. Temperature | - | Thermoperiodicity and Vernalization. |
| C. Light | - | Photoperiodism, Heliophytes and Sciophytes. |

Unit-III : Population Ecology and Community Ecology.

A- Population Ecology - Growth curves, Ecotypes, Ecads.

B- Community Ecology - Community characteristics, Frequency, Density, Cover, Life forms, Biological spectrum and Ecological, Succession (Hydrosere and Xerosere).

Unit-IV : Ecosystems :

A- Structure, Abiotic and Biotic components.

B- Food-chain, Food-web, Ecological pyramids and Energy flow.

C- Biogeochemical cycles of Carbon, Nitrogen and Phosphorus.

Unit-V : A- Phytogeographic regions of India.

B- Vegetation types of India- Forest and Grassland.

B.Sc.-I (Botany)

Laboratory Exercises :

- 1] Observation of Disease symptoms in Host infected by viruses, Bacteria, Fungi and Mycoplasma.
- 2] Gram staining of Bacteria.
- 3] Study of genera cited in theory in Algae and fungi.
- 4] Study of Crustose, Foliose and Fructicose lichen thalli.
- 5] Study of morphology, anatomy and reproductive structure of genera of Bryophyta & Pteridophyta cited in theory.
- 6] Microscopic Examination of Starch grains in wheat and Potato.
- 7] Microscopic study of cotton fibre and test for cellulose.
- 8] Staining of oil droplets in groundnut seed sections by Sudan-III and Sudan Black.
- 9] Study and observation of black - pepper, cloves, Cinnamon and Cardamon.
- 10] Medicinal plants - Observation of parts of medicinal significance of medicinal plants cited in theory.
- 11] Beverages - Observation and study of coffee and Tea plant. Essential Oil - Cymbopogon plant specimens. Ecology-(Any three experiments of the followings.)
- 12] To estimate transparency, pH and Temperature of different water bodies.
- 13] To determine soil texture by simple sieve method.
- 14] To determine pH of soil by Lovibond or pH- paper.
- 15] Study of community characteristics by quadrat method.

- 16] To determine moisture content and water holding capacity of grassland and woodland soil.
- 17] To estimate dust holding capacity of the leaves of different plant species.
- 18] To study Ecological characters (Morphological and anatomical) of following plants.

- A. Hydrophytes-Hydrilla, Vallisneria, Nymphaea Eichhornia and Typha (any two)
- B. Xerophytes - Asparagus, Nerium, Casuarina, Opuntia, Euphorbia (any two)

- Note :**
- 1] Atleast two short and one long excursions are essential.
 - 2] Students are required to submit-
 - a) Excursion Report duly signed by Teacher incharge and countersigned by Head of the department.
 - b) Collection of Bacterial, Algal, Fungal, Bryophytic and Pteridophytic materials and plants of economic importance.
 - c) Practical record duly signed by teacher-in-charge and certified by Head of Department.

B.Sc.-I (Botany)

Schedule for Practical Examination

(Time : 4 Hrs.)

Marks : 30)

- Q.1 Preparation of temporary mount, identification with reasons of given algal material. (Material be given alternately to the examinee) — 4
- Q.2 Preparation of temporary mount, identification with reasons of given fungal material. — 4
- Q.3 Preparation of temporary mount, identification with reasons of the given Bryophytic and Pteridophytic material. — 6
- [Note : Bryophytic and Pteridophytic material be given alternately in such a way that examinee gets material either from Bryophytes or Pteridophytes] — 6
- Q.4 Perform the given Ecology experiment — 4

- Q.5 Spottings - — 6
- A. Algae B. Fungi / Plant disease.
- C. Bryophyta D. Pteridophyta
- E & F Utilization of plants
(One from medicinal plant)
- Q.6 Practical record book, Excursion report and plant collections. — 6

Books Recommended :

- 1] Kumar & Singh (1970) : Text book of Algae
- 2] Chavan V.J. (1968) : The Algae (Macmillan)
- 3] Round F.F. (1970) : Biology of the Algae
- 4] Smith G.M. (1955) : Cryptogamic Botany Vol.1
- 5] Das Ganguli, Kar : College Botany Vol.II
- 6] Vasistha B.R. : Algae
- 7] Kamat N.D. : Algae
- 8] Sarabhai & Sexena : A Text Botany Vol.1
- 9] Fritsch F.E. : Structure and Reproduction of Algae Vol.I & II.
- 10] Sharma O.P. : Algae
- 11] Sharma O.P. (1992) : A Text Book of Thallophytes
- 12] Pandey B.P. : College Botany (Paper-I)
- 13] Sh.Gemawat Kapoor : Text Book of Algae
- 14] Pandey D.C. : Algae
- 15] Sharma P.D. (1991) : The Fungi
- 16] Dubey H.C. (1990) : An introduction to Fungi.
- 17] Alexopoulos G.I. : An introductory mycology.
- 18] Bessey C.E. : Morphology and Taxonomy of fungi.
- 19] Mundkar B.B. : Fungi and Plant Diseases.
- 20] Rai J.N. and Sharma B.B. : Fungi
- 21] Kamat M.N. : Introduction to Mycology
- 22] Prescott and Dunn : Industrial Mycology
- 23] Clifton, A 1958 : Introduction to Bacteria.
- 24] Pawar & Dagainawala : General Microbiology Vol.II
- 25] Singh & Kamal : An introduction to Microbiology.
- 26] Rivierre, 1972 : Industrial application of Microbiology.
- 27] Smith G.M. (1971) : Cryptogenic Botany Vol.II, Bryophytes, Pteridophytes.

- 28] Sharma O.P. (1990) : Text Book of Pteridophyta.
 29] Puri P. (1980) : Bryophyta
 30] Parihar N.S. : Bryophyta
 31] Vashishat.B.R. : Bryophyta
 32] Sharma P.D. : Introduction of Bryophytes
 33] Ram Udar : Bryophyta
 34] Saxena and Sarabhai : A text book of Botany Vol.II
 35] Sporne K.R. : Morphology of Pteridophyta.
 36] Rasheed : Pteridophyta
 37] Vasistha P.C. : Pteridophyta
 38] Singh R.S. : Land Diseases
 40] Shrimali J.L. : Botany
 41] Hill A.T. : Economic Botany
 42] Pandey B.P. : Economic Botany
 43] Verma V. : Economic Botany
 44] Kochar S.L.(1988) : Economic Botany intropics
 Edition 2nd.
 45] Sambamurthy A.V.& : A text book of Economics Botany,
 Subramanyam, N.S.1989
 46] Sympson B.B. and Conner : Economic Botany Plant in Our
 World. Ogorzaly, M, 1986.
 47] Swaminatha M.S. & : Plant and Society Kochar S.L. &
 (Eds) 1989
 48] Sharma O.P. (1996) : Hills Economic Botany.
 49] Jain, S.K. : Ethnobotany
 50] Sinha L.R.K. : Ethnobotany
 51] Jain S.K. : Ethnobotany
 52] Council of Scientific : The useful plants of India,
 and Industrial Research 1986. publication and information,
 directorate.
 53] Krebs, C.J., 1989 : Economical Methodology
 54] Misra R., 1968 : Ecology Workbook
 55] Moore P.W. & Chapman S.B. : Methods in plant Ecology.
 1986.
 56] Odum E.P., 1983 : Basic Ecology
 57] Kormandy, E.J., 1996 : Concepts of Ecology
 58] Mackenzie A Et al 1999 : Instant notes in Ecology
 59] Ambasht R.S., : Text book of Plant Ecology
 60] Kumar : Modern concept of plant Ecology.

- 61] Mishra R. : Manual of plant Ecolog.
 62] Shukla and Chandel : Plant Ecology
 63] Brij Gopal and Bhardwaj : Element of Ecology
 64] Weaver J.L. : Plant Ecology
 65] Doubernmaire : Plant and Environment.
 66] Kochher P.L., : Ecology
 67] Puri G.S. 1960 : Indian Forest Ecology Vol.I & II.
 68] Gupta R.K. : Plants for Environmental
 Conservation.
 69] Turk & Turk : Pollution and Environmental
 Biology.
 70] Sharma, P.D. : Ecology.

20. ZOOLOGY**Revised from the Session 2009-2010**

There shall be the following papers and practical for B.Sc.Part-I examination. The syllabus is based on 6 theory periods and six practical periods per week. There shall be three compulsory papers of 3 hours duration each, in theory as stated below and practical examination extending for four hours. Every examinee shall offer the following three papers of 40 mark each and practical examination of 30 marks of 4 hours duration. Candidates are required to pass separately in theory and practical examination.

	Marks
1) Paper-I: Life and diversity of Non-Chordata...	40
2) Paper-II: Cell Biology	40
3) Paper-III: Developmental Biology	40
4) Practical:	30
Total :	150 Marks

Paper-I**LIFE AND DIVERSITY OF NON-CHORDATA**

- UNIT-I:**
1. Classification of non-chordata.
 2. Phylum Protozoa: General characters.
 3. Type study: *Plasmodium vivax*: Structure, Life-cycle and its pathogenecity.
 4. Pathogenesis of Protozoan parasites in Man: Amoebiasis, Trypanosomiasis, Leishmaniasis.
 5. Phylum Porifera: General Characters.

- Type study: Scypha: Habits and habitat, External features, cell types & canal system.

- UNIT-II:**
- Phylum Coelenterata: General Characters,
 - Type study: Metridium: Habits and habitat, External features, Gastro-vascular cavity, Mesenteries, Reproduction.
 - Phylum Platyhelminthes: General Characters.
 - Type study: *Fasciola hepatica*: Habits and habitat, External features, Digestive, Excretory, Reproductive system and Life cycle.
 - Phylum Aschelminthes: General Characters. Pathogenesis of *Ascaris lumbricoides*
- UNIT-III:**
- Phylum Annelida: General Characters.
 - Type study: *Leech*: External features, Digestive, Excretory and Reproductive system.
 - Phylum Arthropoda: General Characters.
 - Type study: Cockroach: Habits and habitat, External features, Respiratory system, Reproductive system.
- UNIT-IV:**
- Phylum Mollusca: General Characters.
 - Type study: *Pila globosa*: Habits and habitat, External features, Digestive, Respiratory and Reproductive system.
 - Phylum Echinodermata: General Characters.
 - Type study: Asterias: Habits and habitat, External features, Water vascular system, Locomotion.
- UNIT-V:**
- Phylum Hemichordata: General Characters, Affinities of Hemichordates with phylum Annelida, Echinodermata, and Chordata.
 - Corals and coral-reefs.
 - Parasitic adaptations in Helminthes: Morphological and physiological
 - Larval forms and their significance: Amphiblastula, Planula, Trochophore, Bipinnaria, Brachiolaria,

Paper-II
CELL BIOLOGY

- UNIT-I:**
- Principles and Use of: a) Compound microscope, b) Electron microscope
 - General Organization of viruses.
 - General organization of Prokaryote Cell.
 - General organization of Eukaryote Cell.
- UNIT-II:**
- Ultra structure and functions of, Plasma membrane,
 - Ultra structure and functions of, Endoplasmic reticulum.

- Ultra structure and functions of, Golgi complex.

- UNIT-III:**
- Ultra structure and functions of Ribosome
 - Ultra structure and functions of Mitochondria..
 - Ultra structure and functions of Lysosomes.

- UNIT-IV:**
- Ultra structure and functions of nucleus.
 - General organization of Chromosome.
 - Structure of Polytene and Lampbrush Chromosomes.

- UNIT-V:**
- Cell cycle
 - Mitosis and its significance
 - Meiosis and its significance.
 - Characteristics of cancer cell & types of tumors.

Paper-III

DEVELOPMENTAL BIOLOGY

- UNIT-I:**
- Spermatogenesis, Morphology of mammalian sperm
 - Oogenesis, Morphology of mammalian egg.
 - Fertilization: Types of fertilization, Mechanism of fertilization, Sperm preservation.
 - Parthenogenesis: Natural and artificial, Significance of Parthenogenesis.
- UNIT-II:**
- Cleavage: Types of cleavage :(Holoblastic and meroblastic, Determinate and indeterminate), Factors affecting cleavage.
 - Cleavage and Blastulation in Frog, A fate map of blastula of Frog.
 - Process of gastrulation up to the formation of three germ layers in frog.
- UNIT-III:**
- Cleavage and blastulation in chick. A fate map of blastula of chick.
 - Process of gastrulation up to the formation of three germ layers in chick.
 - Extra embryonic membranes in chick: Development and significance.
- UNIT-IV:**
- Development of Eye, in frog.
 - Development of, Brain, in frog
 - Development of heart in frog
- UNIT-V:**
- Formation of Placenta in mammals; (Choriovitelline and chorioallantoic placenta), Functions of Placenta.
 - Concepts of primary organizer and embryonic induction:
 - Regeneration in invertebrates and vertebrates.

4. Elementary idea of sources, types and use of Stem cells.

Reference Books Recommended (All latest editions):

- 1] Hickman, C.P. Jr.F.M. Hickman and L.S.Roberts, Integrated principles of Zoology Mosby College publication St.Louis.
- 2] Ayyar, E.K. and T.N.Ananthkrishnan, Manual of Zoology Vol.I (Invertebrata), Part-I & II S. Viswanathan (Printers and Publishes) Pvt. Ltd. Madras.
- 3] Jordan, E.L. and P.S.Verma Invertebrate Zoology, S.Chand and Co., Ltd. Ram Nagar, New Delhi.
- 4] Parker and Haswell, Text book of Zoology, Vol. I (Invertebrata), A.Z.T.B.S. Publishers and Distributors, New Delhi – 110051.
- 5] Waterman, Allyn J. *etal.*, Chordate structure and Function, Mac Millan and Co Newyork.
- 6] S.N.Prasad : Text Book of Invertebrate Zoology.
- 7] Vishwanathan : Invertebrate Zoology.
- 8] Majpuria : Invertebrate Zoology.
- 9] Dhami and Dhami : Non-chordate Zoology.
- 10] Bainsi Prasad : Indian Zoological memoir. Pila.
- 11] R.L.Kotpal : Modern Text Book of Invertebrate Zoology.
- 12] P.G.Puranik and Thakur, Invertebrate Zoology.
- 13] S.S.Lal, Practical Zoology, Invertebrate.
- 14) Cell Biology : By C.B.Pawar
- 15] Alberts Bray, Lewis, Raff, Roberts and Watman Molecular Biology of the cell (Garland)
- 16] Balinsky, An introduction to Embryology, (CBS College Publishers)
- 17] Grant : Biology of developing system (Halt, Reihart and Winston.)
- 18] Gilbert : Developmental Biology (Sinauer)
- 19] Gharpure : Snakes of India.
- 20] Majpuria : Vertebrate Zoology.
- 21] Beddard : C.N.H. Volume. Mammalia.
- 22] Tyagi, Verma and Agrawal : Chordate embryology.
- 23] Text Book of Cell Biology and Developmental Biology by Dr.R.A.Malu, et.al publisher - Shivneri Publishers, Amravati.
- 24] Korak Kanti Chaki, Gautam Kundu, and Supriti Sarkar: Introduction to General Zoology Vol. 1 and Vol.2
- 25] Cell and Molecular biology By De robertis26) Text Book of Invertebrate Zoology – G.N.Vankhede, R.R.Dhande & S.R.Akarte, Bajaj Publications, Amravati.

Practical :

Two practical per week each of 3 period's duration. The Examination shall be of 4 hrs duration and of 30 marks.

I-Life and diversity of non-chordata

1. Observation, Classification up to classes and sketching of the following animals, (Specimens or Models):
 - Phylum Protozoa: Plasmodium trophozoite, Euglena, *Entamoeba histolytica*.
 - Phylum Porifera: Sycon, Bath sponge, Euplectella.
 - Phylum Coelenterata: Obelia, Aurelia, Tubipora.
 - Phylum Helminthes: Taenia, Ascaris (male & female).
 - Phylum Annelida: Nereis, Earthworm, Leech,
 - Phylum Arthropoda: Prawn, Limulus, Aranea, Scolopendra, Julus, Moth, Mosquito.
 - Phylum Mollusca: Chiton, Pila, Dentalium, Unio, Octopus.
 - Phylum Echinodermata: Antedon, Holothuria, Echinus, Sea star, Brittle star
 - Phylum Hemichordata: Balanoglossus
2. **Study of Permanent slides:**
 - L.S.Sycon, nematocyst, Ascaris egg, T.S. Ascaris through gonads, T.S.Leech through crop, Compound eye of insect,
3. **Dissections: (Live/Preserved Animals)**
 - Leech/Earthworm : Alimentary canal, Reproductive system, Nervous system,
 - i) Grasshopper/Cockroach: digestive system, Nervous system, Reproductive system
 - ii) Pila: Nervous system.
4. **Mounting :**
 - Earthworm: Setae, nephridium,
 - Pila: Radula, osphradium, and gill lamella.
 - Grasshopper/Cockroach: Mouth parts, Salivary gland, trachea.
- II- Cell biology –**
 1. Use, care and maintenance of microscope.
 2. Bacterial Culture, Gram staining.
 3. Permeability tests using erythrocytes.
 4. Preparation of Polytene chromosome in Chironomous or Drosophila larva.

5. Preparation of various stages of mitosis in Onion root tip.
6. Preparation of various stages of meiosis in grasshopper testis.

III. Developmental Biology.

1. Study of stages of Gametogenesis in rat/frog, (Permanent Stained Slides)
2. Study of different of types animal eggs,
3. Collection of frog spawn.
4. Permanent Stained preparation : sperm in physiological saline using phase contrast optics.
5. Observation of live chick embryos.
6. Slides of developmental stages of frog: Cleavage, blastula, gastrula, neurula, and tadpoles.
7. Slides of developmental stages of chick embryos at 24, 36, 48, 72 hrs of incubation.

Distribution of Marks during Practical Examination:

Time : 4 hrs.

i)	Identification and comments on spots (1-8) - 4 specimens, 4 slides	8 Marks
ii)	Dissection	6 Marks
iii)	Permanent stained micro preparation. -.....	4 Marks
iv)	Cytological/embryological practical	4 Marks
v)	Study tour diary -	2 Marks
vi)	Permanent stained micro preparation Submitted by examinee -	2 Marks
vii)	Certified class record and animal collection -	2 Marks
viii)	Viva-voce-	2 Marks
Total: -		30 Marks

Note:

- 1] One or two short excursion / study tours are compulsory for the collection and observation of animals in their natural habitat.
- 2] Candidates shall be required to produce at the practical examination the following.
 - Practical record book duly signed by the teacher in charge and Certified by the Head of the department as bonafide work of the Candidate.
 - Five permanent stained micro preparations.
 - Study tour report and field diary duly signed by the teacher.
 - Animal collection.

List of Equipments / Apparatus required for the Zoology Practical. :

1. Compound Microscope -16

2. Dissecting Microscope -16
3. Dissection Box -02
4. Dissecting Trays- 25
5. Incubator -01
6. Phase contrast microscope-01
7. Computer set with LCD.

21. ELECTRONICS (INSTRUMENTATION)

(Effective from the session 2006-07)

The examination in Electronics (Instrumentation) at the end of 1st Year shall comprise three theory papers of 40 marks each of 3 hours duration and practical examination of 30 marks.

At the time of Practical examination every student will have to perform two experiments. One of two hour's duration from Section A and other of four hour's duration from Section-B.

The distribution of marks is as under :

Expt. (Section A)	-	06 Marks
Expt. (Section B)	-	12 Marks
Practical Record	-	06 Marks
Viva – Voce	-	06 Marks
Total :		30 Marks

PAPER I

Electronics (Instrumentation)

ELECTRONIC COMPONENTS AND MEASUREMENTS

UNIT I : Passive components :

Resistor (Carbon, Wires Wound), Potentiometer, Color codes, Capacitor (mica ceramic, electrolytic, variable capacitors), Inductor (Aircore, iron core and ferrite core), Transformer (construction and operation), Relays (definition and classification).
Constructions and application of above passive components.

Unit II : Network theorems :

Concept of ideal dc voltage and current source, Statements of KVL, KCL, Thevenin, Nortons, maximum power transfer, Millman's and superposition theorems (proofs, simple numericals applicable for dc only).

- Unit III : Measuring Instruments :** Principles of voltmeter, ammeter, ohmmeter, Multirange voltmeter (AC & DC), ohm per volt rating, loading effect, Multirange Ammeter, Series & shunt type ohmmeter, Multimeter, (uses & drawback).
CRO Block diagram & explanation, CRT construction & working,, uses of CRO (measurement of frequency , amplitude & phase.)
- Unit IV : Integrated Circuit :**
Introduction to IC technology, advantages and disadvantages, Classification of IC's, Basic steps in fabrication of monolithic Ics, Fabrication of diode, resistor & transistor. Concept of SSI, MSI, LSI , VLSI & V²LSI.
- Unit V : Basic Instrumentation :**
Block diagram of generalized instrumentation system, Concept of transducers (primary and secondary, active and passive, analog and digital). Resistive transducer - potentiometer, Inductive transducer - LVDT, capacitive transducer – by changing distance), measurement of displacement using capacitive transducer (by changing dielectric).

PAPER-II

ELECTRONIC DEVICES AND CIRCUITS

- Unit I : Semiconductor Diode and Application:**
Semiconductor Diode : P-type & N-type semiconductor, formation of P-N junction diode, Forward and reverse biased operation and characteristics, breakdown mechanism : avalanche and Zener, Zener diode characteristics.
Rectifier and Filter : Rectifiers – half wave and full wave (centertapped and bridge) ripple factor, efficiency, PIV ratings.
Filters : Basic idea of filter.
- Unit II : Transistor :**
Concept of NPN & PNP transistor, construction and working of BJT, CB, CE, & CC configuration, leakage currents, Input and output characteristics of CB & CE mode, relation between alpha and beeta, Load line and operating point concept. Amplification action of CB, CE amplifier, biasing and stability, Self bias circuit.
- Unit III : Regulated power supply :**
Concept of regulation, unregulated and regulated power supply, Block diagram of regulated power supply, line and load regulation, stability factor, Zener diode as voltage regulator, Transistor series and shunt regulator, IC regulator (block diagram), Basic idea of three terminal IC regulator., design of

regulated negative power supply(IC version), Block diagram & explanation of SMPS.

- Unit IV : Switching devices :**
Construction, working ,characteristics and applications : FET, , relation of FET parameters, MOSFET ,UJT, UJT as relaxation oscillator , SCR, Diac & Triac.
- Unit V : Optoelectronic Devices :**
Construction, working and characteristics & applications of LED, LDR, photodiode, phototransistor, photo multiplier tube, photovoltaic cell, Solar cell.

PAPER-III

DIGITAL TECHNIQUES

- Unit I : Number system and Binary codes :**
Number system : Decimal, Binary, Octal and hexadecimal & their interconversion. Binary arithmetic (addition, subtraction, - using one's & two's compliment), multiplication & division Alpha numeric, Parity, ASCII codes, Binary codes : 8421BCD, excess-3 & gray.
- Unit II : Logic gates :**
NOT, OR, AND, NAND, NOR gates (Truth table, logic symbol, simulation using diodes & IC version). XNOR & XOR gates, Half adder, full adder, Half subtractor, full subtractor & 7483 IC – 4 bit parallel adder.
- Unit III : Boolean algebra :**
Boolean laws, De-morgans theorem, Simplification of boolean equations using boolean algebra Fundamental products & K-map (K-map upto 4 variable), Representation of SOP & POS form on K-map.
- Unit IV : Logic families :**
Classification of logic families, characteristics (Fan-in, Fan-out, Noise immunity, Propagation delay, Power dissipation), construction and working of DTL, TTL, ECL & CMOS logic.
- Unit V : Combinational Logic circuit :**
Defination, construction & operation ;
Encoder : Binary to BCD, Decimal to BCD
Decoder : BCD to Decimal, BCD to seven segment
Multiplexer: 4x1, 8x1
De-multiplexer: 1x4, 1x 8

Books Recommended :

1. Elements of Electronics by Bagade and Singh (S.Chand and company)
2. Electronic devices, application and integrated circuits by Mathur(Kulshrestha,Chadha,Umesh Publication)
3. Pulse, Digital, Switching wave forms by Millman and Taub (Mcgraw Hill-Kogakusha)
4. Basic Electronics -by B.L.Theraja (S.Chand and company)
5. Electronic Instrumentation and measurements system - Cooper (Prentics Hall)
6. Electrical and electronic measurements and instrumentation. A.K.Sawhney (Dhanpat Rai and sons)
7. Principles of electronics instrumentation- A.I.Diefenderfer.
8. A text book of electrical technology B.L.Theraja (S.Chand & Company Ltd.)
9. Functional Circuits in Electronics by Sh.S.G. Pimple (Macmillan Publication, India)
10. Micro Electronic Circuits (Fourth Edition) By Sedra and Smith (Oxford publication)

Practicals :

Every student is expected to perform at least eight experiments from each section

Section A :

1. Identification of various electronic components.
2. Verification of Thevenin's theorem. (Determination of V_{TH} , R_{TH} and I_L)
3. Verification of Millman's theorem.
4. Verification of Maximum power transfer theorem. (Determination of internal resistance and maximum power)
5. Verification of Norton's theorem. (Determination of R_N and I_N)
6. Measurements of voltage, phase and frequency using C.R.O.
7. Measurement of displacement using Potentiometer.
8. Measurement of displacement using LVDT.
9. Measurement of displacement using capacitive transducer.
10. Study of FET characteristics (Determination of FET parameters)
11. Study of SCR.(To plot V-I Characteristics)
12. Study of LED.(To plot V-I characteristics)
13. Study of LDR.(To plot V-I characteristics)
14. Study of phototransistor (To plot V-I characteristics)

15. Study of photodiode (To plot V-I Characteristics)
16. Study of photovoltaic cell.
17. To plot V-I characteristics of solar cell.
18. Study of MOSFET.
19. Measurement of Strain by using strain Gauge.

Section B :

1. Construction of PN junction circuit under forward bias mode and plot V-I characteristics of PN junction & determination of its forward resistance.
2. Construction of PN junction circuit under reverse bias mode and plot V-I characteristics of PN junction & determination of reverse resistance.
3. Construction of half wave rectifier with filter. Determine ripple factor.
4. Construction of full wave rectifier with filter. Determine ripple factor.
5. Construction and study of transistor under CB mode. Determination of α (alpha).
6. Construction and study of transistor under CE mode. Determination of β (Beta).
7. Construction and study of UJT (To plot V-I characteristics).
8. Construction and study of multirange ammeter.
9. Construction and study of multirange voltmeter. Determination of ohm per volt rating of given voltmeter.
11. Construction of series type ohm-meter and determination of unknown resistance.
12. Construction of shunt type ohm-meter and determination of unknown resistance.
13. Identification and study of logic gates.
14. De Morgaris Theorem.
15. Verification of truth Table for given Boolean expression.
16. Study of full adder & Half adder circuit.
17. Construction and study of Zener diode characteristics.

List of optimum apparatus required to perform the practicals for a batch of 16 students for the subject electronics for B.Sc. -I/II/III.

Sr.No.	Name of Apparatus	Minimum Quantity
1.	VTVM/FET VOM	05
2.	CRO Single Trace	05
3.	CRO DUAL TRACE	02
4.	Function Generators	10
5.	Frequency Counter	01

6.	RF Generator	01
7.	Digital Multimeter	05
8.	Multimeters	15
9.	AC Millivoltmeter	01
10.	Voltmeters	a) 0 - 1 V 02
		b) 0 - 5 V 06
		c) 0 - 10 V 10
		d) 0 - 15 V 06
		e) 0 - 30 V 02
11.	Ammeters	a) 0 - 100 mA 02
		b) 0 - 250 mA 04
		c) 0 - 500 mA 04
		d) 0 - 1 mA 04
		e) 0 - 5 mA 04
		f) 0 - 10 mA 06
		g) 0 - 20 mA 06
		h) 0 - 50 mA 06
		i) 0 - 100 mA 06
		j) 0 - 250 mA 02
		k) 0 - 500 mA 02
		l) 0 - 1 A 02
12.	Stabilised D.C. Power Supply - 1A	
		a) 0 - 9 V 05
		b) 0 - 12 V 10
		c) 0 - 30 V 03
		d) 0 - 5 stabilised for 78xx series. 07
		e) +15 V and -15 V 04
13.	Dimmerstat	02
14.	Table Lamp	02
15.	Resistance Boxes	10
16.	Rheostates	05
17.	Soldering Gun & Desoldering pump	08
18.	Wire metal and paste	500 gm & 1 pack each.
19.	Stop watch, Continuity Tester	03
20.	Microprocessor kits	10
21.	PC (Pentium- 4 with Printer)	01
22.	Microprocessor unit 8086	01
23.	Experimental boards of each expt. as per syllabus	01 each.
24.	All electrical & electronic tools	each 01 of each type.

25.	bread boards	12
26.	Patch chords & sockets	as per req.
27.	Wires, buttons, fuses & other materials	-"-
28.	Linear & digital IC tester boards	each 01

LIST OF LOOSE COMPONENTS

Sr.No.	Component	Quantity
1.	Registers - 1W (Mixed)	50 (pieces of each)
2.	Capacitors - 30V (Mixed)	10 (pieces of each)
3.	Inductors - (Mixed)	2 (pieces of each)
4.	Transistors	a) AC 127/128
		b) BC 147/148
		c) SL/HL 100
		d) BC 107/108 15 pieces of each
		e) others if necessary
5.	Diodes (Mixed)	15 pieces of each.
6.	UJT/SCR/Diac/Triac	05 pieces of each.
7.	Potentiometers (Linear and non linear)	
		a) 0 - 500 05
		b) 0 - 1K 10
		c) 0 - 2K 10
		d) 0 - 5K 08
		e) 0 - 10K 05
8.	Step down transformers	03 pieces each.
9.	ICs 741/3085/555	each 05
		723/78XX/79XX
		74XX series
10.	Other Miscellaneous components	as per requirements.
		for designing & construction

22. BIOLOGICAL TECHNIQUES AND SPECIMEN**PREPARATION (VOCATIONAL)**

The examination in "Biological Techniques and specimen Preparation", will comprise of two theory papers and a practical examination. Each paper will be of three hours duration and carry 60 marks.

The practical examination will be of 6 (six) hours duration and carry 30 marks.

Each unit of theory paper will carry two questions with internal option to solve any one question. Candidates are required to pass separately

in theory and practical.

Project work at the end of IIIrd year will carry 10 marks.

Study tour will be compulsory for collection of animal/plant specimens during first year which will be treated as a part of "on the job training".

The following syllabus is based on 6(six) theory periods and 6(six) practical periods (of two terms of 3 periods each) per week.

THEORY

PAPER-I

BIOLOGICAL TECHNIQUES AND SPECIMEN PREPARATION (ANIMAL)

- Unit-I** Description and use of Light microscope, phase contrast microscope and stereoscopic microscope, magnification and resolution. Ocular and stage micrometers and their use in measurement of micro-objects. Some common problems associated with light microscopes : Care of microscope, Cleaning of lenses, Replacement of rack and pinion, use of condenser, mirror position and types, Double demonstration eye piece, Pointer eyepiece, Focussing problems. Haemocytometer : Neubaur's chamber for RBC and WBC counting and other uses. Camera Lucida - Construction and functions.
- Unit-II** Collection and fixation of materials for permanent slides : Fixation, Types of fixatives. Culture of protozoans-Paramecium, Amoeba, Vorticella and Euglena. Decalcification of bones. Dehydration, Clearing, Embedding, Types of embedding techniques, Preparation of paraffin blocks, trimming, Section cutting, Spreading of ribbons & preparation of permanent slides. Microtome: rocking and rotary. Use and care of microtome. Preparation and use of different stains-Types of stains, Preparation of some common stains for Anatomical, histochemical & histological studies, staining techniques for micro-organisms and blood smears. Procedure of double staining method, mounting and storage of slides. Mounting media-Glycerine, Water, Canada balsam and DPX, sealing agents.
- Unit-III** Broad classification of animals up to order. Identification of animals commonly used as specimens. Where and how to collect animals and preparation of museum specimens, Preservatives, Dissected animals as museum specimens and preparation of life cycles of specimens.
- Unit-IV** Organs and tissues commonly used in the classroom, skin,

liver, pancreas, tongue intestine, stomach, thyroid, kidney, gonads of frog and rat, striated muscles, cartilage, squamous epithelium, Bone, Medusa, Gills of Pila, Radula of Pila, Nephridium of earthworm and leech. Parapodium of Nereis and Heteronereis, Spiracles of cockroach, Mouthparts of insects (house fly, mosquito, honey bee, butter fly), Pedicellaria and larval forms of crustaceans, Scales of fishes (Placoid, Rhomboid, Cycloid and Ctenoid), Ampullae of Lorenzini, Oral hood of Amphioxus, Pecten in birds. Special staining method- Giant chromosomes and their staining; Staining for glycogen, and proteins, Silver staining.

- Unit-V** Preparation of skeletons. Taxidermy-stuffing of animals (fish, Reptile, Bird and a mammal). Preparation of resin embedded specimens. Alizarine preparation. Preparation of charts. Preparation of transparencies, slides.

PAPER-II

BIOLOGICAL TECHNIQUES & SPECIMEN PREPARATION (PLANT)

- Unit-I** Systems of classification, Classification of plants up to family by Bentham and Hooker's system. Broad idea about rules of plant nomenclature and Botanical names of plants which are locally available from following families and showing economical uses. Annonaceae, Papaveraceae, Cruciferae, Malvaceae, Rutaceae, Anacardiaceae, Papilionaceae, Mimosae, Curcubitaceae, Umbelliferae, Compositae, Apocynaceae, Solanaceae, Liliaceae and Graminae. Plants used as cereals, Pulses, Fruits, vegetables, fibre plants, species of medicinal value. Ethnobotanical plants of nearby locality.
- Unit-II** Tissue system in Angiosperms and special features of anatomical sections commonly used in the classrooms. Preparation of stains and single and double staining methods. Preparation of permanent slides & storage of slides. Methods of permanent staining e.g. Algae, Bryophytes & Pteridophytes. Mitosis and meiosis of plant cell and its comparison with animal cell. Collection of material for cell division and its preservation for marketing. Preparation of permanent slides showing stages of cell division. Use of chemicals to arrest cell division. Special stains for chromosomes and their preparation.
- Unit-III** Preparation and maintenance of plant herbarium. Where and How to collect the plants, Knowledge about instruments required for collection of plants and precautions during plant

collection, Preparation of dry specimens of herbarium sheets. Processes of storage of herbarium and precautions during storage. Type of specimens, its importance.

Unit-IV Preparation of dry plant specimens for display boxes. Preparation of museum specimens. Important herbaria of the world and in India. Brief knowledge about Indian Botanical survey of India. Modelling materials-Plaster of paris, epoxy resin and fibre glass. Characteristics of teaching models, preparations, durability, attractiveness, innovations.

Unit-V Preparation of media for fungal and Bacterial culture, solid and liquid medium used for cultural purposes. Sterilization methods. Autoclave and its maintenance, Inoculation techniques. Isolation of fungal organisms and preparation of pure cultures. Identification of common fungal and bacterial forms from culture.

Cultural Study - Measurements, use of micrometers. Use of colony counter in culture study. Storage and maintenance of stock cultures. Study of pathogenesis by Koch's postulate methods. Hanging drop culture. Staining and preparation of permanent slides of bacteria and fungi.

PRACTICALS

1. Use and maintenance of microscopes. Light compound and dissecting microscopes, Stereoscopic microscopes, Binocular microscopes.
2. Preparation of Stains : Eosine, Borax Carmine, Haematoxylin, Acetocarmine, Acid & Basic Fuschin, Methylene blue, Leishman stain, Safranin, Light green.
3. Fixatives and mounting media : Bouin's fluid (alcoholic/aqueous), Carnoy's fixatives, Glycerine, Canada balsm, DPX.
4. Hanging drop technique.
5. Micortomy : Preparation of Botanical/Zoological permanent microslides (Histological)
6. Preparation of Sterile culture media : Solid/Liq. and plants-Culture of bacteria, fungi, algae, protozoans and their maintenance.
7. Counting of cells by Haemocytometer and growth curve.
8. Plate and colony counting. (Bacteria/fungi).
9. Use of ocular and Stage micrometer scales for measurement of micro objects.
10. Study and use of Camera Lucida.
11. Preparation of herbarium sheet : 20 sheets.
12. Preparation of botanical/zoological museum specimens : Including life cycles.
13. Preparation of display boxes of dry plant., & Plant products.
14. Preparation of Botanical/Zoological whole mounts.

15. Preparation of Skeletons : Fish/Amphibian/Reptile/Bird/Mammal.
16. Collection and preservation of Botanical & Zoological materials for anatomical & cytological studies.
17. Preparation of alizarine stained preparation.
18. Dissection and display of dissected specimen.
19. Taxidermy.
20. Preparation of resin embedded specimen, preparation of teaching models of plaster of Paris, Epoxyresin and fibre glass.
21. Preserving materials for classwork use.
22. Cultures of some protozoans.

B.Sc.I Practical Examination

(30 Marks)

- | | | |
|-----|---|----------|
| Q1. | Dissection and its display with proper labelling.
or
Microchemical/Phytochemical test | 5 marks. |
| Q2. | Permanent stained micropreparation
or
Double stained preparation | 5 marks |
| Q3. | Squash/smear of root tip/anther
or
Blood Smear by using nuclear stains.
or
Mounting of bacteria/fungi/algae. | 5 marks |
| Q4. | Counting of blood cells by haemocytometer
or
Measurement of micro-objects by oculometer
or
Camera Lucida of the given slide/material | 5 marks |
| Q5. | Submission of herbarium, Botanical/
Zoological museum specimens, skeletons,
models, charts, Alizarine stained preparation;
doubled stained preparation, stuffing of animals
(At least 3 different types) are to be submitted
at the time of examination. | 5 marks |
| Q6. | Practical record viva voce | 5 marks |

Total : 30 Marks

Books recommended for Paper I and Paper II.

1. Microscopy : J.K. Soneja, Pub.: Soneja Brothers, Agra.
2. Techniques in Microscopy and Cell Biology : V.K.Sharma, Tata McGraw Hill Pub. Co.Ltd., New Delhi.
3. Zoological Microtechniques : Weissman W.B. Saunders & Co.1 Philadelphia.
4. Text book of Microtechniques and Environmental Biology: Dr. R.R.

- Dhande, Dr. G.N.Wankhede & Dr. S.R. Akarte, Bajaj Publications, Amravati.
5. Botanical Microtechniques : John E.Sass, Balckwell Scientific Publications Oxford, London.
 6. Text book of Histology : Bailey, Blackwell Scientific Publications Oxford, London.
 7. A Manual of practical Zoology, Vol. I,II & III : K.P.Achar, Pub.:Himalaya Publishing House.
 8. A manual of practical zoology (Invertebrates) : P.S.Verma S.Chand & Co.Ltd.
 9. A manual of practical zoology (Cordates) : P.S.Verma S.Chand & Co.Ltd.
 10. Cell Biology : C.B. Powar, Himalaya Pub.Co.
 11. A text book of Fungi, Bacteria and viruses : Dubey H.C.
 12. Taxonomy of Angiosperms : P.C.Vashishta
 13. Taxonomy of Angiosperms : V.N.Naik, Tata McGraw Hill.
 14. Taxonomy of Angiosperms : P.C.Vashishta, Pradeep Publi. Jalandar.
 15. Cytology, Histochemistry and Anatomy of Angiosperms : V.Venkateswarlu, S.Chand & Co.
 16. Angiosperms : Chopra G.L., S.Nagin & Co.
 17. Plant Taxonomy : O.P.Sharma, Tata McGraw Hill.
 18. An Introduction to Plant Anatomy : Eames A.J., Tata McGraw Hill.
 19. Plant Anatomy : Esan K.A., Wiley Eastern Ltd.
 20. Plant Anatomy : Pandey B.P., S.Chand & Co.
 21. Introduction to the principles of plant taxonomy : Shivraja V.V., Oxford & IBH.
 22. Systematic Botany-Angiosperms : Mathur R.C., Agra Book Stall.
 23. Introductory Mycology : Alexopalar C.J., Wiley Eastern Ltd.
 24. Microscopy for the students of Biology : Phadnis B.A., Associated Book Centre, New Delhi.
 25. Outline of Microtechniques : Prasad M.K., Emakay Pub. Delhi.
 26. Staining techniques in Botany : Prasad D.M., International Books Distributor, Deharadun.
 27. Manual for Herbarium Collections : Rao R.R., B.S.I. Calcutta.
 28. Medical Laboratory Technology Vol.I, II & III : Kanai L. Mukharjee, Tata McGraw Hill Co. Ltd., New Delhi.

23. INDUSTRIAL FISH AND FISHERIES

(VOCATIONAL)

The examination in Industrial Fish and Fisheries will comprise of two theory papers and a practical examination. Each theory paper will be of three hours duration and carry 60 marks.

The practical examination will be of six hours duration and carry 30 marks.

Each unit of theory paper will carry two questions with internal option to solve any one question. Candidates are required to pass separately in theory and practical.

Project work at the end of IIIrd year will carry 10 marks.

Study tour will be compulsory for observation and collection of fishes, prawns, crabs, molluscs during first year which will be treated as a part of "on the job training"

The following syllabus is based on 6 (six) theory periods and 6 (six) practical periods (of two terms of 3 periods each) per week.

PAPER I

FISH BIOLOGY

- Unit I**
1. Taxonomy and its applications.
 2. Taxonomic data and its collection methods.
 3. Binomial nomenclature.
 4. External morphology of commercially important species of Elasmobranch, Teleost, prawn, crab, lobster, bivalve, gastropod and cephalopods of India.
- Unit II**
1. Anatomy of Digestive system and associated structures.
 2. Food and feeding habits of F.W.fish, Marine fish, prawn, crab, lobster, bivalve, gastropod and cephalopods.
 3. Qualitative and quantitative estimation of food consumption : Experimental estimation of food consumption : Experimental studies and stomach content analysis.
 4. Nutrition in fishes and utilization of food , seasonal changes in food, availability of food, food preference, feeding intensity.
- Unit III**
1. Anatomy of circulatory and excretory system.
 2. Excretion & osmoregulation in marine & freshwater fish.
 3. Fish migration.
 4. Social behaviour of fish aggregation and shoalings.
- Unit IV**
1. Anatomy of Respiratory and nervous system.
 2. Accessory Respiratory organs.
 3. Sense organs.
 4. Lateral line receptors, Electric organs
 5. Sound Producing organ.
- Unit V**
1. Anatomy of Reproductive system.
 2. Sexual dimorphism.
 3. Fecundity and its estimation;

4. Fecundity in relation to length, weight, age and food supply.
5. Spawning, factors affecting spawning.
6. Types of eggs, pre-embryonic and post embryonic development in major carps.

PAPER II

CAPTURE FISHERIES

- Unit I**
- 1.1 Potential, estimates and significance of capture fisheries.
 - 1.2 Biological aspects of fishery management.
 - 1.2.1. Principles of conservation, Development and Management.
 - 1.2.2. Population dynamics
 - 1.2.3. Concept of recruitment and yield
 - 1.2.4. Problem of overfishing MSY, MEY and OSY.
- Unit II**
- 2.1 Important river systems of India and their fisheries.
 - 2.2. Cold water fisheries : Resources Development and Management
 - 2.3. Fisheries of trout, Mahaseer and other cold water species.
 - 2.4. Lacustrine fisheries.
 - 2.4.1. Origin, distribution and classification of Lakes.
 - 2.4.2. Salient physico-chemical features and fisheries of Kodaikanal lake, Yer caud Lake, Ooty lake, Logta Lake.
 - 2.5. Reservoir fisheries in India.
- Unit III**
- 3.1 Marine fishery Resources in India.
 - 3.2 Problem of inshore fishery.
 - 3.3 Sampling technique adapting for estimating marine fish landing.
 - 3.4 Pattern and growth of marine fishery exploitation.
 - 3.5. Exploitation and management of Under exploited and unexploited resources of the Exclusive Economic Zone (EEZ).
- Unit IV**
- 4.1 Fishery of oil sardine and other sardines mackerel, ribbon fish, Tunnies, seer fishes carangids and cephalopods.
 - 4.2. Midwater and dimersal fisheries.
 - 4.2.1 Fishery of Elasmobranch, Bombay duck, Catfishes, Silverbellies, Pomprets, Prawn, Crab, Lobsters, Mussels and Clamps.
- Unit V**
- 5.1 Definition, origin and classification of Estuarine fisheries.
 - 5.2 Major Estuaries of India and their fisheries.

- 5.3. Brackishwater lakes and their fishery.
 - a) Chilka Lake and Pulicat Lake.
- 5.4 Indian backwater and their fisheries.

PRACTICALS

DURATION : 6 HOURS

1. External morphology and morphometrical study of a fish, prawn, crab, Lobster, bivalve and Cephalopod.
2. Methods of collections, handling, identification and preservation of above animals for taxonomic purposes.
3. Identification of commercially important F.W. and Marine fishes, prawns, crabs, bivalves and cephalopods of India.
4. Preparations of wet and dry mounts, wax and plaster castings of fish. Aizarine Preparations and study of skeleton of Teleosts.
5. * Dissections - Digestive, Nervous, Circulatory, Reproductive systems in type specimens of fish,
 - * Accessory Respiratory organs and gas bladder of fish.
 - * Dissections of prawn :- Digestive, Nervous system.
 - * Dissections of Crab :- Digestive, Nervous.
6. Study of food and feeding habits of fishes - Analysis of stomach content qualitative and quantitative methods.
7. Estimation of growth rate and ageing by indirect methods- (Using scales and otoliths, length weight relationship & ponderal index.)
8. Sexual dimorphism in fishes
9. Plankton analysis: qualitative and quantitative, permanent stained preparations of planktons.
10. Estimation of relative conditions factors, gonadosomatic index and fecundity.
11. Study of spawning habits based on ova diameter polygons.
12. Identification of egg hatching spawn, fry and fingerlings of Indian major carps.
13. Study of larval stages of crustacean and molluscs.
14. Study of various types of external and internal fish tags.
15. Field visits -
 - (1) Visit to fish catching, center to assess catch species compositions.
 - (2) Study of crafts and gears in inland water
 - (3) Fish market statistical data.
 - (4) Visit to a polluted water body to assess its impact on fishery.
 - (5) Visit to fish farm.

Distribution of Marks.

1. Identification and comments on given specimens 1 to 5—	5 Marks
2. Identification of a given species of fish by morphometric study.	— 3 Marks.
3. Dissection	— 6 Marks.
4. (a) Plankton analysis or determination of feeding habit of fish by stomach content analysis	— 3 Marks.
(b) Permanent stained micropreparation of any planktonic organism.	— 3 Marks.
5. (a) Viva voce	— 2 Marks
(b) Record book	— 4 Marks
(c) Field diary	— 2 Marks
(d) Collection	— 2 Marks
Total :	<u>30 Marks</u>

List of Equipments

- 1) Microscopes
 - (a) Inverted Microscope
- 2) Fish measuring Boards.
- 3) Dissection sets.
- 4) Scale reader
- 5) Hot air oven.
- 6) Weighing Balance (Single Pan Balance)
- 7) Otolith cutter and grinder
- 8) Bone cutters.
- 9) Oculometer and stagemicrometer
- 10) Microtome
- 11) Camera lucida
- 12) Projection microscope
- 13) Centrifuge (Electrically operated)
- 14) Sedgwick Rafter Cells.
- 15) Tissue homogenizer
- 16) Cathater
- 17) Refrigerator
- 18) Water analysis kit (Digital), Spectrophotometer, Colorimeter
- 19) pH meter, Oxygen analyser.
- 20) Autoclave
- 21) Phage-Contrast microscope
- 22) Aluminium and wooden frames for fabrication of aquarium.
- 23) Acrylic and glass sheets.
- 24) Magnifying glasses.
- 25) Breeding Hapa, Hatching Hapa, Drag net, Hand net,
- 26) Plankton net, sieves for soil texture analysis.
- 27) Beakers, droppers.
- 28) Enamel trays.

- 29) Facility for tissue block making staining and mounting
- 30) Glassware for analysis of CO₂
- 31) Petridisces, test tubes etc.
- 32) Glass troughs
- 33) Earthen ponds.
- 34) Cement custemes
- 35) Millpore filters
- 36) Pressere cookers
- 37) Drilling Machines.

References for Fish Biology

1. Ichthyology, Lagler, K.F.J.E. Bardach and R.R. Miller. 1962. Wiley International. New York.
2. History of fishes. Greenwood P.H. 1963. Ernest Benn Ltd. London.
3. Fishes : An Introduction to Ichthyology. P.B. and J.J. Cech. 1982. Prentice-Hall Inc U.S.A.
4. The Biology of Fishes. Kyle, H.M.T.F.H. Publication. Hong Kong.
5. The life of Fishes. Marshall. N.B. 1965. Weidenfeld and Nicolson, London.
6. The Marine and Freshwater Fishes of Ceylon. Munro. I.S.R. 1982. Soni Reprints Agency New Delhi
7. Inland Fishes of India and Adjacent Countries. Vol. I and II Talwar, P.K. and A.G. Jhingran. 1991. Oxford and IBH Publishing Co. Pvt. Ltd. New Delhi
8. Commercial Sea Fishes of India. Talwar, P.K. and R.K. Kacker. 1984. Zoological survey of India Calcutta.
9. FAO Species Identification Sheets for Fishery Purposes. Western India Ocean Fishing Area 51. Vol I to V and Eastern Indian Ocean Fishing Area 57 and Western Central Pacific Fishing Area 71. Vol I to III.
10. Handbook of Museum Techniques. Aivappan A and S.T. Satyamurthy 1960 Govt. of Madras.
11. Fisheries Ecology Pitcher T.J. and P.J.B. Hart. 1982. Croom Helm. London.
12. Introduction to the Pacific of fishery Science. Rovce. W.F. 1984 Academic Press.
13. Fish Stock Assessment : A manual of basic methods. Gullad. J.A. 1983 FAO. Rome.
14. Manual of Methods of Fisheries Biology Fishicicle 9. Research on Fish stocks. Laevastu T. 1965 Food and Agriculture Organisation of the United Nations. Rome.
15. Fishery Science : Its Methods and Application. Rounsfell G.A. and W.H. Everhart 1953 John Wiley & Sons New York.

24. INSTRUMENTATION**(Vocational)**

The examination in Instrumentation will comprise of THREE theory papers, and practical examination. Each paper will be of three hours duration and carry 40 marks.

The practical examination will be of six hours duration and carry 30 marks.

The distribution of marks is as follows:

University Practical examination	Marks 30	Duration 6 hours.
1) Practical	Marks 15	Duration 4 hours.
one experiment	Marks 9	
sessional work	Marks 3	
Viva-voce	Marks 3	
2) Entrepreneurship	Marks 15	Duration 2 hours.
Sessional	Marks 5	
Oral/		
Group discussion	Marks 5	
Assignments	Marks 5	

Paper I**Instrument Mechanics and Metrology**

Unit I Introduction, Meaning of Metrology, Physical measurements, Classification of methods of measurement, Sources of errors: Linearity, Precision.

Linear measurement: Steel rule, Calipers, Surface plates, V-block, Angle gauges. **Vernier Instruments:** Vernier Caliper, Height gauge, Dial indicator, Depth gauge, Inside and outside micrometer

Standards of measurement: Line standards, End standards, Wavelength standards.

Scope: Engineering Metrology: R.K.Jain: Khanna Publishers: Sixteenth Ed. 1997. **Chapters** (1.1, 1.2, 1.3, 1.6), (2.3, 2.4, 2.5, 2.12, 2.24, 2.26, 2.27, 2.31, 2.37, 2.38, 2.39, 2.44, 2.61, 2.62), (3.1 to 3.7)

Unit II **Limits and Fits:** Tolerances, Interchangeability, Limits of size, Indian standards, ISO system of limits and fits.

Comparators: Characteristics and uses of comparators, Advantages and disadvantages.

Mechanical, Mechanical optical, Electrical, Electronic and Pneumatic comparators.

Scope: Engineering Metrology: R.K.Jain: Khanna Publishers:

Sixteenth Ed. 1997. **Chapters** (4.1 to 4.5, 4.11), (5.1 to 5.8)

Unit III **Measurement by light wave interference:** Interference of two rays, Light sources for interferometry, Flatness testing, Surface counter test, Testing of parallelism, Interferometers, Laser interferometers, Optical flats, Scales and gratings, Moire scale and Moire fringes, Interferometric inspection of Optical components.

Laser equipment for alignment testing Clinometers, Autocollimator.

Scope: Engineering Metrology: R.K.Jain: Khanna Publishers: Sixteenth Ed. 1997. **Chapters** (6.1 to 6.14), (7.6), (8.8, 8.9)

Unit IV **Measurement of surface finish:** Surface texture, Surface roughness, Methods of measuring surface finish.

Metrology of screw thread: Screw thread terminology, Effect of pitch errors, Measurement of various elements of thread.

Measurement and testing of gears: Involute curve, Terminology of gear tooth, Sources of errors, Gear measurements.

Scope: Engineering Metrology: R.K.Jain: Khanna Publishers: Sixteenth Ed. 1997. **Chapters** (11.1 to 11.5), (13.1 to 13.4), (15.1 to 15.8)

Unit V **Machine tool metrology:** Machine tool tests, Alignment test on Lathe, Milling machine, Pillar type-drilling machine.

Quality control: Quality, Characteristics, Facets of quality, Quality control, Objectives, Areas of application, Quality concepts, Policy and Planning.

ISO 9000: System, Summary of elements, Advantages and Registration.

Scope: Engineering Metrology: R.K.Jain: Khanna Publishers: Sixteenth Ed. 1997. **Chapters** (16.1 to 16.5), (18.1 to 18.9), (21.1 to 21.5)

1) Engineering Metrology - Khanna

2) Engineering Metrology - Mahajan Vrunda Prakashan

Paper II**Optical and Vacuum Instrumentation**

Unit I **Review of light wave propagation.** Image formation (First order optics): Cardinal points, Image position and size, Paraxial Ray tracing Focal points and Principal points. Thin lens, Mirrors, Optical invariant.

Aberrations: Spherical aberration, Coma, Astigmatism,

Distortion, Chromatic aberration.

Basic optical devices: Telescope, Simple and compound microscope. Design of telescope system, Microscope objectives.

Scope: Modern Optical Engineering: Warren J. Smith: Second Ed.: McGraw Hill Int.

Chapters. (2.1 to 2.11), (3.1 to 3.2), (9.1, 9.4, 9.5), (13.1, 13.2)

Unit II

Optical Components: Dispersing prisms, Minimum deviation, Achromatic Prism, Direct vision prism, Total internal reflection, Reflection from plane surface, plane mirrors, Right angle prism, Roof prism, Erecting prism system, Inversion prism, Penta prism, Rhomboids and beam splitters.

The structure, characteristics and defects of eye, Ophthalmic lenses.

Optical materials: Optical glass, Special glasses, Crystalline materials, Plastic optical materials, Absorption filters, Diffusing materials, Polarizing materials, Reflection and Interference filters, Reflectors, Reticules, Cements and liquids.

Scope: Modern Optical Engineering: Warren J. Smith: Second Ed.: McGraw Hill Int.

Chapters (4.1 to 4.15), (5.1 to 5.4), (7.1 to 7.12)

Unit III

Optical manufacture: Rough shaping, Blocking, Grinding, Polishing, Manufacture of flat, spherical and non-spherical surfaces. Abrasives.

Optical specifications: Surface quality and Surface accuracy. Optical laboratory practice: The measurement of focal length, Collimation, Measurement of telescope power, Measurement of aberrations The Foucault test, Resolution test, Autocollimators, Interferometers.

Scope: Modern Optical Engineering: Warren J. Smith: Second Ed.: McGraw Hill Int.

Chapters (14.1 to 14.2), (14.4)

Unit IV

The vacuum: artificial and natural. Fields of application and importance.

Gas flow at low pressure: Flow regimes, conductance, throughput and pumping speed.

Production of low-pressure: Vacuum pumps, Mechanical pumps, Vapour pumps, Ion pumps, Absorption pumps, Cryopumping.

Scope: Vacuum Technology: A. Roth: Second revised Ed. North-Holland 1989

Chapters (1.1, 1.2, 3.1, 3.2, 5.1 to 5.6)

Unit V

Measurement of low pressure: Classification and selection of vacuum gauges, Mechanical gauges, liquid gauges, Thermal conductivity gauges, Ionization gauges. Calibration of vacuum gauges. Thin film deposition technique. Sputtering technique. Vacuum applications.

Scope: Vacuum Technology: A. Roth: Second revised Ed. North-Holland 1989

Chapters (6.1, 6.2, 6.3, 6.6, 6.7, 6.8)

Reference Books :

- 1) Fundamental of Optics, Jenkins & White McGraw Hill 1957
- 2) Optics & Optical Instruments, Johnson, Dover N.Y. 1960.
- 3) Optics & Atomic Physics, Satya Prakashan
- 4) Optical Glass Working , Twyman, Hilger & Watts, London 1955.

Paper III

Basic Electronics

Unit I

Resistors: Types of resistors, color-coding, variable resistors, Rheostats and Potentiometers, Power rating of resistors, Series and parallel combination of resistances, resistor troubles.

Ohm's Law: The current, The voltage, The resistance, Practical units, Multiple units, The linear proportion between V & I, Electric power, Power dissipation in Resistance. Power formulas, choosing the resistance for a circuit, Electric shock, Open circuit and short circuit troubles.

Series circuits: Series IR voltage drop, Polarity, Total power in series circuit, Analyzing series circuit, Effect of open circuit on series path.

Parallel circuits: Resistances in parallel, Total power in parallel circuit, Analyzing parallel circuits, Effect of open branch and short circuit across parallel branches.

Voltage dividers and current dividers: Series voltage dividers, current division, Series voltage divider with parallel load current, Design of a loaded voltage divider.

Scope: Grob Basic Electronics: Bernard Grob: McGraw-Hill Int. Ed. 7th Ed.

Chapters: (2,3, 4, 5, 7,)

- Unit II** **Kirchhoff's Laws:** KVL and KCL Method of branch currents, Node voltage analysis, Method of mesh currents.
Network theorems: Superposition theorem, Thevenin's theorem, Thevenizing a circuit with two voltage sources, Thevenizing a bridge circuit, Norton's theorem, Thevenin-Norton conversion, Conversion of current and voltage sources, Millman's theorem, Circuits with current sources, Star-Delta transformation. Maximum power transfer theorem.
Scope: Grob Basic Electronics: Bernard Grob: McGraw-Hill Int. Ed. 7th Ed.
Chapters: (9, 10, 11, 12)
- Unit III** Standard wire gauge sizes, Connectors, Switches, Fuses, General features of batteries, Internal resistance of a generator, Constant voltage and constant current sources, Matching a load resistance to a generator r_i .
Inductance: Induction by alternating current, Self and Mutual inductance, Transformers, Core losses, Types of cores, Variable inductance, Inductances in series and parallel, Stray inductance.
Inductive reactance: Inductive reactance X_L , Series and parallel inductive reactances, Ohm's law applied to X_L , Frequency response, X_L and R in series and parallel, Q - of a coil, AF and RF chokes
Scope: Grob Basic Electronics: Bernard Grob: McGraw-Hill Int. Ed. 7th Ed.
Chapters: (16, 17, 18, 19)
- Unit IV** **Capacitance:** Symbols, Color code, Types, fixed and variable capacitance. Series and parallel capacitances, Stray capacitive and inductive effects,
Capacitive reactance: Capacitive reactance X_C , Series and parallel capacitive reactances, Ohm's law applied to X_C , Applications, X_C and R in series and parallel, Frequency response,
 RC and L/R time constants
Scope: Grob Basic Electronics: Bernard Grob: McGraw-Hill Int. Ed. 7th Ed.
Chapters: (20, 21, 22, 23)
- Unit V** **Alternating voltage and current:** The sine wave, Alternating current, Voltage and current values for sine wave, Frequency, period, Wavelength, Phase angle, The time factor in frequency and phase, AC circuits with resistances

AC circuits: AC circuit with resistance alone, capacitive reactance alone, Inductive reactance alone, Series reactance and resistance, Parallel reactance and resistance, Series - Parallel reactance and resistance, Real power.

Complex numbers for AC circuits: The j - operator, Impedance in complex form, Magnitude and angle of complex number, Polar form of complex number, Complex numbers in series and parallel AC circuits.

Resonance: Series and parallel resonance, resonance frequency, Q -factor, bandwidth, Tuning & Mistuning, Analysis of parallel resonance circuit, Damping of parallel resonance circuits, Choosing L and C for a resonance circuit.

Scope: Grob Basic Electronics: Bernard Grob: McGraw-Hill Int. Ed. 7th Ed.

Chapters: (24, 25, 26)

1) Practicals: 15 practicals based on three theory papers.

2) Entrepreneurship - I

Reference Books :

- 1) Basic Electronics - B.L.Theraja
- 2) Electronics Principles - V.K.Mehata

Entrepreneurship - I

1. Subject overview - Importance of Entrepreneurship and its relevance in career growth, coverage of the subject and its scope.
2. Entrepreneur, Entrepreneurship & Enterprise: Concept & Role in development, Characteristics of Entrepreneurs, Developing Entrepreneurial competencies.
3. Types of Enterprises & Ownership: Manufacturing, service and franchise, Large, medium, SSI, tiny and cottage industries, Limited, public limited, private limited, partnership, sole proprietorship, Advantages and disadvantages of type of ownership, employment, self-employment and entrepreneurship.
4. Entrepreneurship for career growth: choosing a career path.
5. Charms of becoming an entrepreneur: being own boss, taking initiatives and personal responsibilities, becoming independent and rewards.
6. Creativity and Innovation: Definition of creativity and innovation, exercise on creativity, how to develop creativity and innovation.
7. Problem solving: Definition of problem solving, exercise on creativity.

8. Small Scale Industry (SSI) sector and its role in economic development: Economic environment and small scale industries sector, economic development through SSI, role and contribution of SSI in domestic as well as international markets.
9. Planning a small-scale enterprise: Importance of planning for SSI, Decisions for entrepreneurial tasks, procedures and formalities for starting small scale enterprise.
10. Schemes and assistance of support agencies: Banks, DIC, SFC, TCO, KVIC representatives.
11. Preparing the preliminary project report (PPR): Content and importance of PPR, How to prepare PPR, Expectations of financial institutions, selecting most feasible business opportunity.
12. Achievement Motivation training: Knowing the self, Importance of achievement motivation, How to develop N.ach., Preparing achievement action plan.
13. Visit to small-scale industries: Field visit to selected 3-4 small scale industries to provide students knowledge regarding process of becoming and entrepreneur and problems faced by them (preferable unit started by passed out students from the same college).
14. Interaction with entrepreneurs: selected existing entrepreneurs, preferably first generation ones, will be invited to interact with students. They will narrate their experience including problems, which they faced, and how they could overcome.

**List of Equipments components for B.Sc. I,II,III
Instrumentation (Vocational)**

	Quantity
1. Vernier Instruments	
a) Vernier Calliper,	01
b) Height gauge,	01
c) Depth gauge	01
d) Dial indicator	01
e) Micrometer	01
2. Comparator	01
3. Interferometer	
a) Optical interferometer	01
b) Laser interferometer	01
4. Lathe Machine	01
5. Pillar type drilling machine	01
6. Basic optical devices	01
a) Telescope	

b) Simple Compound Microscope	02
7. Different types of prism	each 1
8. Ophthalmic lenses	each 1
9. Special glasses	each 1
10. Vacuum pumps	1
11. Electronic Components (Caoacutir, Resistor) standard values Inductor, Transformer)	each 6
12. Voltmeter of standard range	each 10
13. Ammeter of standard range	each 10
14. Multimeter	05
15. Semiconductor diode, Zener,	1 dozen
16. D.C. power supply	05
17. Transistors	1 dozen
18. Audio Oscillator	04
19. FET 04	
20. Mosfet	04
21. UJT 02	
22. Thyristor	02
23. Optoelectronic Devices	1 dozen
24. A C ammeter, Voltmeter walthourmeter & powerfactormeter	each 2
25. Digital multimeter	06
26. RF Voltage & power meter, Q meter	01
27. CRO 03	
28. LVDT	01
29. Tachometer	01
30. Thermocouple	01
31. Op Amp Ic (741)	06
32. Signal generator (AF & RF)	03
33. A/D converter	01
34. D/A converter	01
35. Logic trainer kit	04
36. ICS, 7400, 7402, 7404, 7408, 7432, 7494, 7483, 7490, 7476, 7495	each 5
37. Flip flops, unit	01
38. Counters unit	01
39. Shift register unit	01
40. Microprocessor Trainer Kit 8085	05
41. S.M.P.S.	03
42. ADC & DAC interfacing unit	each 1
43. Seven Segment display	01

25. SEED TECHNOLOGY (VOCATIONAL)

There shall be three theory papers of 40 marks each. Duration of each paper shall be 3 hours. Practical examination shall be of 4 hours duration and of 30 marks.

The syllabus is based on 6 lectures and 6 practical periods per week.

“Two, on job training” of one month duration shall be compulsory during three years degree course.

PAPER I**SEED DEVELOPMENT, MORPHOLOGY AND SEED PHYSIOLOGY**

- Unit-I**
- Fertilization
 - Seed structures and texture
 - Endosperm and embryo development Immature Seed and germination
 - Polyembryony
 - Apomixis
 - Development of fruit and Seed - Monoanxic, Diauxic Physiological and Harves Table Maturity
- Unit-II**
- Classification of fruits
 - Use and limitation of laboratory techniques
 - Biochemical methods, electrophoresis, phenol colour, peroxidase test, GA3 test, RFLP maps
 - Sequential approach in testing
- Unit-III**
- Physiology of Seed Development - allometry
 - Seed ripening and maturation processes
 - Chemical composition of seeds
 - Synthesis of food reserves
 - Germination, pattern of water absorption
 - Types of germination and seedling abnormalities in major monocot and dicot crop species, its causes.
 - Factors affecting germination, its implications
 - Breakdown of different seed storage products during germination
- Unit-IV**
- Respiratory pathways during germination
 - Enzymatic activities during germination
 - Hormonal regulation of germination
 - Germination stimulators and inhibitors
 - Dormancy and its ecological implications.
 - Organic dormancy - Hardseededness

- Causes of dormancy and its breakage
 - Seedling establishment & role of endosperm and embryo size on seedling establishment
 - Seed deterioration during storage; factors affecting physiological changes, its implications on seed quality.
- Unit-V**
- Seed vigour, its measurement and crop productivity
 - Invigoration treatment to improve seedling establishment and its effect - planting value
 - Treatments to minimise seed ageing
 - Seed longevity behaviour: Orthodox and recalcitrant seeds
 - Specific problems of dormancy and seed longevity in some important crop species.
 - Micropropagation techniques: its significance use, scope and limitations.
 - Seed pelleting and coating artificial feed production (synthetic seeds)

PAPER II**PLANT BREEDING FOR CROP IMPROVEMENT AND TESTING FOR CULTIVAR GENUINENE**

- Unit-I**
- Major families of dicotyledons and monocotyledons
 - Flower structure, megasporangium, female gametophyte development.
 - Microsporangium, male gametophyte development.
 - Pollination, Autogamy, Allogamy Polyembryony.
- Unit-II**
- **Apoxixis**
 - Testing for cultivar genuineness: Objectives, General principles and methods
 - Morphology of seeds for variety identification
 - Variety descriptors: importance in variety release system, DUS system
 - Grow-out test in cotton
- Unit-III**
- **General Introduction to plant breeding**
 - Definition
 - History
 - Nature
 - Scope
 - objectives
 - **Mode of Reproduction in plants**

- Asexual : Parts of plants used for propagation, apomixis
- Sexual reproduction : Structure of flower, structure of floral parts - Heterostyly
- Pollination : Self pollination, and cross pollination; agencies for cross pollination (air, insects, water and animals),
- Fertilization : Germination of pollen grain, growth of pollen tube, fusion of egg and sperm nuclei, double fertilization.
- **Sterility and incompatibility**- Definition of sterility
- Types of Sterility
- cytoplasmic, genetic, cytoplasmic genetic.
- Utility of male sterility in hybrid seed production
- Definition of incompatibility
- Morphological, genetic and biochemical basis of self incompatibility
- Utility of self incompatibility
- Use of chemical hybridising agents
- **Genetic basis of crop improvement**- Mendelian principles of inheritance of characters(Segregation, independent assortment)
- Laws of probability
- Gene interactions
- Genes and Environment
- Inheritance of quantitative traits
- **Methods of plant breeding**
- **Plant exploration, introduction and acclimatization**
- Exploration :- Centres of origin, Centers of Genetic diversity, methods of survey, field study, agroclimatology herbarium preparation, collection of material, plant parts
- Definition of introduction and acclimatization
- Objectives of introduction
- Types of introduction (Primary and Secondary)
- Plant introduction agencies in India and world.
- Procedure for introduction (Procurement, quarantine, evaluation)
- Acclimatization
- Merits and demerits of introductions
- Achievements in field crops, flowers, fruits, vegetables and other plants

Unit-IV

- **Pure line selection**
- Definition of pureline
- Characters of pure line and its importance
- Field techniques of pure line selection
- Advantages and limitations
- **Clonal selection**
- Definition of a clone
- Characters of clone
- Source of clonal variation
- Importance of clonal selection
- Field techniques of clonal selection
- Advantages and limitation
- Achievement through clonal selection in some crop spp
- **Mass selection**- Definition
- Procedure of mass selection
- Merits and demerits
- Differences between pure line selection, clonal selection and mass selection.
- **Hybridization followed by selection in self pollinated crops**
- History, definition and types of hybridization
- Application and objectives
- Hybridization techniques in self pollinated crops
- Heterosis in self pollinated crops
- Advantages and limitations
- Handling of segregating population (Pedigree method, Bulk method, mass pedigree, back cross method, multiline varieties, F₁ hybrids)
- **Hybridization procedure in cross pollinated crops** -
- Development of inbred lines
- Effect of self pollination (selfing)
- Development of single cross and double cross hybrids
- Development of synthetic and composite varieties
- Achievement in field crops, vegetables & fruit crops
- **Mutation in crop improvement**
- Definition of mutation, mutagen, mutant etc.
- Classification of mutations (point mutation, chromosomal, somatic mutations; spontaneous and induced mutations macro and micro mutation.)
- Artificial induction of mutation

Unit-V

- Mutagens (Physical, chemical, radioactive isotopes)
- Mechanism of action of mutagens.
- Dosimetry
- Procedures for mutation breeding
- Significance of induced mutations in crop improvement
- Achievements through induced mutations
- **Polyploid breeding**
- Occurrence of polyploidy in crop plants
- Classification of polyploidy
- Effects of aneuploidy and euploidy
- Techniques of production of haploids, aneuploids, triploids, tetraploids etc.
- Evolution of crop plants through polyploidy.
- Achievements through polyploidy breeding
- **Breeding for disease resistance**
- Definition and history
- Nature of disease resistance
- Causes of disease resistance
- Methods of breeding for disease resistance
- Scope and application
- **Distant hybridization**
- Barriers in distant hybridization
- Methods to overcome the barrier : Embryo rescue
Embryo Culture
- Methods used for hybridization: Protoplast fusion.
- Advanced techniques in plant breeding : Anther culture, Tissue culture, Soma clonal variation.
- **Organisation for crop improvement in India**
- History of systematic crop improvement in India
- Setting up of council of Agricultural Research, Crop Research Institutes.

PAPER III

SEED PRODUCTION : PRINCIPLES AND PRACTICES

- Unit-I**
- **General Introduction**
 - Seed definition-difference between seed and grain
 - Seed as a basic input in agriculture
 - Role of high quality seeds in increasing and

- sustaining crop production.
 - Seed quality concept, quality control in seed production.
 - Characteristics of sowing quality seed.
 - **Mode of reproduction in relation to seed production**
 - Classification of crop plants in relation to mode of reproduction and choice of methods for seed production.
 - **Development and testing of varieties**
 - System of breeding and testing of crop varieties and hybrids in self, often, and cross-pollinated crops.
 - system of release and notification of varieties for general cultivation.
 - **Varietal purity and its maintenance**
 - Genetic purity of varieties - concept
 - Life span of varieties and factors responsible for their deterioration.
 - Methods of maintenance of genetic purity and techniques of maintenance breeding.
 - Generation system of seed multiplication.
 - System and methods of production of nucleus, breeder, foundation and certified seed.
 - **Flowering and seed production**
 - Flowering in crop plants, its modification for hybrid seed production.
 - Factors affecting seed set - temperature, relative humidity, day length, wind velocity and direction, duration of flowering, anthesis, pollen viability, stigma receptivity, nutrition and irrigation.
 - Male sterility and self incompatibility
 - Male sterility, its genetics and use in hybrid seed production.
 - Self incompatibility, its genetics and use in hybrid seed production.
 - **Pollination and seed production**
 - Improvement of pollination in seed production of forage legumes
 - tripping process and vegetables.
 - Improvement of pollination for hybrid seed production.
 - **Hybrid seed production**
 - Feasibility of hybrid seed production by the use of hand emasculation and pollination supplementary
- Unit-II**
- Unit-III**

pollination detarseling - male sterility,
geametocides and self incompetibility

- **Areas of seed production**
- Choice of area of seed production. Factors affecting the choice of area of seed production - soil types, climate, nutrition and weed status, insect-pest and disease incidence.
- Compact area approach in seed production
- Seed village concept generation system of multiplication.
- Unit-IV**
- **Agronomic management in Seed Production.**
- Selection of land for seed production.
- Previous crop effect
- Effect of environment before and after harvest on seed quality.
- Special agronomic management of seed crops.
- Benovalent
- malovalent effects on germination quality
- Harvesting and threshing of seeds - factors affecting time of harvesting and threshing, precautions at these operations especially in high value seeds.- Care at post harvest handling of seeds.
- **Seed Production Systems and Management**
- Systems of seed production in India
- Agencies responsible for seed production
- Seed Production planning
- Indian and International seed industry.
- Planning, organising and managing a seed production programme.
- Unit-V**
- **Seed Production procedures**
- Detailed seed production procedures in following crops with special reference to land and isolation requirement, special agronomic management, rogueing,harvesting and threshing in Wheat, Rice, Sorghum, Bjara, Maize, Chickpea, lentils, Cowpea, mung, urdbeans, Soybeans, Groundnut, Rapeseed, mustard, Sasame, Sunflower, Forages, Potato, Seed Plot technique of potato multiplication, Production of hybrid Potato seeds.

PRACTICALS

SEED DEVELOPMENT MORPHOLOGY AND SEED PHYSIOLOGY.

1. Morphology of docot seed
2. Morphology of monocot seeds
3. Seeldling morphology and adult plant morphology in some major crops for identification of a variety in Green House Expt
4. Phenol test in wheat and paddy
5. Peroxidase test, 2h-D test
6. G.A. test in wheat and other crops
7. Electrophoreses NaOH Test
Physical and chemical indices formaturity.
8. Factors affecting germination Temperature, Moisture, Substratum light pattern of water absorption (starchy/protein and oil)
9. Dormancy behaviour and its release - Hard Seedeness
10. Seed leachate conductivity test
11. Quicu viability test
12. Accelerated ageing test
13. Invigoration treatments
14. Meristem culture.

PLANT BREEDING

1. Cytological techniques for the study of chromosomes in plants
2. Preparation of slides for the study of mitosis and meiosis
3. Hybridization techniques
4. Studies on segregation using mixture of/coloured seeds
5. Studies on independent assortment
6. Studies on gene interactions
7. Embryo rescue & Media preparation for culturs
8. Visit to research farms

SEED PRODUCTION

1. Preparation of agroclimatic maps (India and States) for soil, crops and climatic conditions.
2. Identification of different crop seeds
3. Seed Production Planning - for hybrids and varieties. Computation of areas and seed requirements for seed production of certified class.
4. Study of inflorescence and flower structure of self and cross pollinated crops.
5. Study of pollination and fertilization, insect pollinators - their

- identification, management of insect pollinators especially honey bees - isolation distance
6. Study of seed production practices of cereals, pulses, oilseeds & fibre crops in relation to planting, irrigation, weed control, roguing, harvesting and threshing
 7. Visit of nucleus, breeder seed plots and study of maintenance of varieties
 8. Visit of foundation and certified seed plots and study of the techniques of seed production
 9. Seed planning - cost of seed production

PRACTICALEXAMINATION

Distribution of Marks

(Note: Draw neat and well labelled diagrams wherever necessary)

	Marks
1. Prepare temporary squash/smear of the given material and identify two stages.	4
2. Seed Test (Phenoltest and peroxidase test, G.A. Test) any one.	4
3. Problem based on Segregation/Independent assortment Gene interaction chi-square test using coloured seeds	4
4. Identify and describe specimens A,B,C and D, giving reasons (Inflorescence, Pollination, Embryology) Slides or models.	4
5. Identification and classification of seeds on the basis of seed production practices. (any two)	4
6. Submission of visit reports, specimens and viva voce	5
7. Record book.	5
Total Marks :	30

BOOKS RECOMMENDED

1. The embryology of angiosperms, Bhojwani, S.S. and Bhatnagar, SP. Physiology of seeds Crocker, W & Barton, L.V.
2. Principles of Seed Science & Technology - LO Copeland Business Publishing Co., USA.
3. Viability of Seeds - E.H. Roberts.
4. Germination of Seeds - Mayer and Poljakoff Mayber
5. Seed Biology vol I & II - TT Kozlowski Academic Press.
6. Physiology and Biochemistry of Seeds.- Bewley and Black

7. Seed Technology - R.L. Aggrawal Oxford IBH.
8. Allard, R. W. 1960 Principles of plant breeding John Willey & sons INC, Newyork.
9. Chandra sekharan, S.N. and Partha sarthy, S.V 1960. Cytogenetics and plant breeding.P. Vardachary and Co. Madras.
10. Chaudhary, H.K. 1971 Elementary Principles of plant breeding. Oxford and I.B.H. Publishing Co. New Delhi
11. Chaudhary, R.C. 1982. Introduction to plant breeding Oxford and IBH. Publishing Co. New Delhi
12. Chopra V.L. Plant breeding :Theory and practice. Prentice- Hall of India Pvt. Ltd. New Delhi.
13. Elliot, F-C. 1958. Plant breeding and Cytogenetics. McGraw-Hill Book Co., Inc. Newyork.
14. Gardner, E.J, and DP snustad 1984. Principles of Genetics John Willey & sons, Newyork
15. Singh, B.D. 1990, Plant breeding. Principles & Methods Kalyani Publishers, New Delhi.
16. Simmonds, N.W. 1979, Principles of crop improvement Longman, Newyork.
17. Strickberger M.W. 1985 Genetics, Mc Millian Publishing Co. Newyork.
18. Gupta, P.K. 1991, Genetics Rastogi Publications, Meerut.
19. Frankel, R. and Galun, E. 1977. Pollination mechanisms, Reproduction and Plant Breeding. Springer - Veriag, Berlin.
20. Poehlman, J.M. and Borthakur, D. 1972. Breeding Asian Field Crops. Oxford & IBH Publishing Co. New Delhi
21. Chopra, V.L. 3 year Plant Breeding Theory and Practice. Oxford and IBH Publishing Co. New Delhi.
22. Agrawal, P.K. and Dadlani, M. 1990. Techniques in Seed Science and Technology. South Asian Publishers, New Delhi
23. Feistritzer, W.P. 1975. Ed. Cereal Seed Technology. Food and Agriculture Organisation of United Nations. Rome.
24. Feistritzer, W.P. (1982). Ed. Technical guidelines for maize seed technology. Food and Agriculture Organisation of the United Nations, Rome.

26. COMPUTER APPLICATION (VOCATIONAL)

(Effective from the session 2007-2008)

The examinations in vocational Computer Application will comprise of two theory papers and practical examination. Each theory paper will be of 3 hours duration and carry 50 marks.

The practical examination will be of 6 hours duration and carry 50 marks.

The distribution of marks in the practical will be as follows

- | | |
|--|----------|
| 1) Practicals based on computer lab I | 15 Marks |
| 2) Practicals based on computer lab II | 15 Marks |
| 3) Viva Voce (based on lab.I & II) | 10 Marks |
| 4) Record/Practical Journal | 10 Marks |

Each unit of theory paper will carry two questions with internal options to solve any one question.

Candidates are required to pass separately in theory and practical.

The following syllabus is based in 8 theory periods and 4 practical periods (of 2 terms of 2 periods) per week.

Paper-I

Fundamentals of Information and Communication Technology

UNIT-I : Introduction to Computer : Characteristics, types of computers, computer block diagram, generation of computers, types of memories : RAM, ROM, PROM, EPROM, EAROM, Cache Memory, Secondary Storage Devices : Floppy disk, hard disk, CD, DVD.

I/O Devices : Keyboard, Mouse, Scanner, MICR, OCR, Light Pen; Printers : Impact and non-impact; Monitors : VDU, LCD & TFT; modem.

UNIT-II : Number System : Binary, Decimal, Octal and Hexadecimal and their inter-conversion. BCD, ASCII and EBCDIC codes.

Types of Softwares : System software, Programming Languages, Utility Program, Application Softwares, Program Processing Modes, Translator, Flowcharting.

UNIT-III : Operating System : Function of O.S., classification of O.S., Memory and File Management, Disk Operating system (D.O.S.) : Booting process, Directory Structure, FAT.

Windows 98 : Introduction, Features, Desktop, Customising Desktop, Icons, Windows Explorer, My computer, My documents, Control Panel : Files & folders, Printers and Run options.

UNIT-IV : Networking : Needs & objectives, LAN : Introduction, Classification, Topologies : Bus, Tree, Ring, Star, Hybrid, WAN,

MAN, Communication Protocols : Rolls of Communication Protocol and the OSI model. Client- Server architecture, its components, Benefits and approaches to client server application.

UNIT-V : Internet : History, Uses, Classification of Sites, URL, Domain, Protocol, Internet Service Providers, Internet Accounts : Dial up and direct access, FTP, Telnet, E-mail, WWW tools, Web Browser, Search Engines.

Books Recommended :

- 1) Computer Fundamentals & Networking-P.K.Sinha
- 2) Fundamentals of Computer - B.Ram
- 3) Internet Book - Clstenes
- 4) Information Technology - Alexies & Mathews - Vijay Nikole

Reference Books :

- 1) Fundamentals of Computer - V.Rajaraman
- 2) Computer Network-Andrew Tennanbaum
- 3) ABC of LAN - Michael Doprtch (BPB)
- 4) Local Area Network - Keiser -TMH
- 5) I.T. tools and applications - Alexie & Mathews - Vijay Nikole
- 6) ABC of Internet - Christian Crumblish (BPB)

Paper-II : 'C' Programming

UNIT-I : Structured Programming : Features, advantages, structure of C program, character set, identifiers, keywords, constants and variables, symbolic constants, qualifiers, type conversion. Operators and Expressions : Types of Operators - Arithmetic, Relational, logical, assignment, increment & decrement, conditional, bitwise, comma, sizeof().

UNIT-II : I/O Functions : Unformatted I/O : getchar(), putchar(), gets(), puts(), getche(), putche(), getch(), putch().

Formatted I/O : scanf(), printf()

Control structures :

Branching - if-else, simple if, switch, nester if.

Looping - while, do-while, for statements.

Nested Control Structure: goto label, break, continue, nested loops

UNIT-III : Arrays & Strings :

Arrays - Declaration and initialisation of one and two dimensional array.

String - String functions, string operations

Structure - Defination, declaration, initialisation, array of structure, nested structure, union.

Pointers - Declaration, initialisation, address and pointer

operations, indirection operations, pointer & array, pointer & string.

UNIT-IV : Functions in C : Introduction, definition of function, function proto type, function calling, call by value, call by reference, return value and their types, local and global variable, storage classes, functions with array, pointers and functions, pointers as function argument, pointer to functions, function returning pointers, function recursion.

UNIT-V : File Handling : Definition, opening and closing of file, I/O operations on file, fgetc(), fputc(), fgets(), fputs(), fscanf(), fprintf(), fread(), fwrite().

Random Access : fseek(), ftell(), rewind()

Error Handling : feof(), ferror().

Books Recommended :

- 1) C Programming - Byron Gottfried - Schaum Outline Series
- 2) Let Us C - Y.P. Kanetkar - BPB
- 3) Programming in C - E.Balagurusamy
- 4) C-Dennis Ritchie
- 5) Programming in C - V.Rajaraman
- 6) Programming in ANSI C - Ramkumar and Rakesh Agrawal - TMH

PRACTICALS

Computer Lab.-I : Minimum 16 practicals based on :

- 1) Windows 95/98/Me 2000/XP
- 2) M.S.Office (Word, Excel, Power Point)

Computer Lab.-II : Minimum 16 practicals based on Paper-II.

Study tour: Study tour may be arranged to computer industry, software development organisations, institute, software technology park, I.T. park.

List of equipments- (Minimum requirement) For Vocational Computer Application for B.Sc. Part I, II, III

I. Hardware

- a) Computer terminals-10 Nos.
Desirable configurations: Pentium-IV, 128MB RAM, 40GB HDD, 1.44MB FDD, 15" color monitor, 101KBD with modem, LAN card.
- b) Printer (DMP)-2nos.
Desirable configuration: 132/80 col with 240cps
- c) Inkjet Printer-1no.
- d) Multimedia kit-1no.

II. Accessories:-

- 1) Floppy boxes, 1.44 MB or 1.2MB-2Boxes
- 2) Printer ribbon(Cartridge)

- 3) Printer stationary-5000sheet
- 4) Stabilizer/UPS
- 5) Internet facility

III. Softwares legal Versions based on syllabus.

IV. Other accessories be available based on syllabus.

27.FOOD SCIENCE

The syllabus is based on six theory periods and six practical periods per week.

The examination in Food Science will comprise of two theory papers and a practical. Each theory paper shall be of three hours duration and carry 60 marks. The practical shall be of 06 Hours duration and shall carry 30 marks. The distribution of practical marks shall be as follows:

1. Record	05 marks
2. Viva-voce	10 marks
3. Exercise	15 marks
Total :	30 marks

PAPER I

CHEMISTRY OF FOODS

Unit-I : History of Food Science, plant & animal sources of food, food cycle. Sensory attributes of food such as appearance, taste, aroma and texture. Methods of sensory evaluation. Sampling, collection and preservation of food samples for analysis.

Unit II: Physicochemical properties of foods : PH and buffers, water activity, free and bound water, boiling, freezing and melting points, osmotic pressure, viscosity, surface & interfacial tension, optical rotation, Refractive Index, Food colloids.

Unit III: Functions of foods. Basic constituents of foods and food groups. Nomenclature, classification and structure of carbohydrates. Sources, physical and chemical properties of sugars. Polysaccharides and pectic substances.

Unit IV: Definition & classification of lipids. Chemistry of fatty acids and glycerides. Physical and chemical characteristics of fats and oils. Rancidity of fats and oil & its prevention.

Unit V : Nomenclature, classification and structure of amino acids, peptides and proteins. Sources of proteins. Isolation, identification and purification of proteins. Physical and chemical characteristics of proteins. Denaturation of proteins.

BOOKS RECOMMENDED:

1. Food Chemistry by L.H.Meyer, publishers Van Nostrand Reinhold Co, New York, 1960.
2. Foods :Facts and Principles by N.Shakuntala Manay and M.Shardakshavswamy, published by Wiley Eastern Ltd., New Delhi.
3. Principles of Food Science edited by Owen R.Fenemma, Part-I Food Chemistry, published by Marcel Dekkar Inc. New York.

PAPER - II**BIOCHEMISTRY OF FOODS**

Unit-I: Introduction, classification and nomenclature of enzymes. Specificity. Assay techniques. Isolation and purification of enzymes and their importance. Enzyme kinetics. Activators and inhibitors. Techniques of immobilization of enzymes. Allosteric regulation of enzymes.

Unit II: Cell membrane, structure and transport mechanism. Photosynthesis, transpiration. Respiration. Generation & importance of high energy phosphates. Biological oxidation.

Unit III : Digestion and absorption of foods. Metabolism of carbohydrates. Glycolysis, Krebs's cycle. Glycogen synthesis.

Unit IV: Metabolism of proteins, Deamination. Transamination. Glycogenic & ketogenic amino acids. Urea cycle. B-oxidation of fats. Biosynthesis of fats.

Unit V : Browning reactions in foods. Chemistry and biochemistry of plant pigments. Application of spectrophotometry, chromatography & isotopic techniques in food analysis.

BOOKS RECOMMENDED:

1. Outlines of Biochemistry by E.E.Conn & P.K.Stumpt, Wiley Eastern Pvt.Ltd.,New Delhi.
2. Text Book by Biochemistry by A.Lehninger
3. Text Book of Biochemistry by Agrawal & Agrawal.
4. Text Book of Biochemistry by K.Rangnathrao.
5. Text Book of Biochemistry by West & Todd.

PRACTICALS

1. Qualitative analysis of carbohydrates & proteins.
2. Estimations of Reducing & Non reducing sugars by Lane Eynon's method.
3. Saponification value & Iodine value of Fats/oil.
4. Estimation of proteins by Biuret method & Kjeldhal's method.
5. Paper chromatography for separation of amino acids.
6. Estimation of starch.

7. Demonstration of salivary amylase activity.
8. Effect of Heat on enzyme activity.
9. Estimation of Glycine.

**LIST OF RECOMMENDED APPARATUS
FOR BATCH OF 16 STUDENTS**

1. Thermometers. 0-110 oC		10/ Batch
2. Thermometers. 0-360 oC		10/ Batch
3. Silica crucibles.		16/ Batch
4. Sintered glass crucibles.		8/ Batch
5. Filtration flask with buchner funnel. 250 ml.		8/ Batch
6. Separating funnel		4/ Batch
7. Microscopic slides/coverslips.		6 doz/ Batch
8. Test tubes.		16 doz/ Batch
9. Pippettes. Vol-	10 ml.	16/ Batch
	25 ml.	16/ Batch
10. Pippettes. Graduated -	10 ml.	16/ Batch
	5 ml.	16/ Batch
	1 ml.	1/ Batch
11. Burrettes.	50 ml.	16/ Batch
12. Petridishes.		3 doz/ Batch
13. Vot Flask	100 ml.	18/ Batch
14. -do-	250 ml.	18/ Batch
15. -do-	500 ml.	4/ Batch
16. Conical Flask	250 ml.	36/ Batch
17. -do-	100 ml.	36/ Batch
18. Measuring cylinder	100 ml.	18/ Batch
19. Measuring cylinder	250 ml.	4/ Batch
20. Measuring cylinder	500 ml.	4/ Batch
21. Wash bottle	500 ml.	16/ Batch
22. Vernier Caliper (Digital)		1
23. Lactometer		2
24. Butyrometers		1 set

LIST OF RECOMMENDED EQUIPMENT FOR A BATECH OF 16 STUDENTS

1. Hot air oven 2/ Batch
2. Incubator microbiological 1/ Batch
3. Quickfit Nitrogen digestion/distillation
assembly (set of six) 1/ Batch

4. Controlled Temp. Waterbath	3/Batch
5. Analytical balance. (Digital preferred)	4/Batch
6. Weight box	10/Batch
7. Dessicators	16/Batch
8. Magnetic stirrer	3/Batch
9. Water Suction	8/Batch
10. Photoelectric Colourimeter	1/Batch
11. pH meter 2/Batch	
12. Centrifuge machine electrically operated	One
13. Water Deioniser/Distilled Water still	2/Lab
14. Heating Mantle	4/Batch
15. Inoculation needles	5/Batch
16. Microscopes with 10X,45X & 90-100x objective	6/Batch
17. Colony counter	1/Batch
18. Laminar air flow chamber	1/Batch
19. Busen burners	16/Batch
20. Test tube stands. 12 tubes	16/Batch
21. Tripod stands	20/Batch
22. Burette stands	20/Batch
23. Autoclave Portable Nonelectric	20/Batch
24. Refrigerator	2/Batch
25. Triple Beam Balance 100 gm capacity	1/Batch
26. Mixer/Food Processor	1/Batch
27. Gerber centrifuge with test tube	1/Batch One set.

28. COMPUTER MAINTENANCE (VOCATIONAL)

(Revised Syllabus implemented from the session 2005-06)

The Examination in Computer Maintenance will comprise of two theory papers & one practical. Each theory paper will be of three Hrs. duration & carry 60 marks. The practical examination will be of 6 Hrs. duration & carry 30 marks.

Each unit of theory paper will carry two questions with internal option to solve any one question.

The syllabus is based on six theory periods & 6 practical periods per week. Candidates are required to pass separately in theory & practical.

Distribution of Practical marks are as follows.

1. Practical based on computer lab.-I	9
2. Practical based on computer lab.-II	9

3. Viva-Voce on 1 & 2	6
4. Practical journal / Record	6

Total : 30

Paper-I

(Basic Analog & Digital Electronics)

- Unit-I : Electronics components (Passive elements) & Application :** Working Principles, Symbols, Measurements. Technique, Application areas for Resistors, Inductors, Capacitors, Transformers, Relays, Switches, Cables. Fuses, Batteries, PCB's. Network Theorems : KVL, KCL, Max, power transfer theorem, Thevenin's theorem. Norton's theorem, Superposition theorem (statements, proofs, numerical applicable for dc only)
- Unit-II : Electronics components (active elements) & Application :** Working principles, symbols, Types, technical Specifications, Identification & applications areas for PN junction Diode, Photodiode, LED, Zener diode, BJT UJT, JFET, MOSFET, SCR Power Supply : Basic block diagram of P.S., Bridge Rectifier using diode, Regulated P.S., Zener regulator, IC 723 based ERPS, CVT, short circuit protection, SMPS.
- Unit-III : Amplifier, Oscillator & Multivibrator :** Different terms used in Amp. such as signal source, input, output. Voltage & Current gain, Power gain, Decibel, input & output impedance, classification according to frequency. Response & biasing.
Operational Amp. : Basic idea of Op-Amp. with black box concept. Inverting & Non-inverting amplifier, Virtual ground concept, Op-Amp parameters, qualitative description of OP-Amp applications such as inverting & non-inverting, summing, difference amplifier.
Oscillator : Positive feedback, Barkhausen criteria, Phase shift, Wein bridge & Crystal oscillator.
Multivibrator : Biastable multivibrator.
- Unit-IV : Number Systems :** Introduction to Decimal, Binary, Octal, Hexadecimal number system & interconversion. Codes : BCD, Excess-3, Gray, concept of parity & ASCII, EBCDIC.

Logic gates : NOT, AND, OR, NAND, NOR, XOR.

- Unit-V :** **Digital Techniques :** Combinational circuits : MUX, DEMUX, Encoder, Decoder.
Flip-flops : RS, D, CLK RS, JK, JKMS flip-flops, Shift Registers (SISO, SIPO, PISO, PIPO) & counters, asynchronous & synchronous counter, Ring counter.
Data Convertors : ADC, DAC, basic ideas only.

Paper-II

(Computer Organisation)

- Unit-I :** **Computer Basics :** Simple model of computers, characteristics of computer, problem solving, flowchart, Program generation of computer, classification of computer.
- Unit-II :** **Processor :** Structure of instruction, Description of processor, CPU organization, Intel series of microprocessor. Computer Architecture, Units, Processor to memory communication I/O communications, Interrupts. Multiprogramming processor features, RISC, CISC.
- Unit-III :** **Memory & I/O devices :** Main memory, Cache memory, Virtual memory, semiconductor memory, Memory controllers, Magnetic memories (FD, HD, MTD), OD, Input units, Output units, other units.
- Unit-IV :** Computer S/W : Introduction, Systems S/W, Programming languages, Translator, Application S/W, 4GL, firmware, Middleware, Popular S/W packages.
- Unit-V :** **Operating Systems :** Need of OS, Types of OS, Introduction to DOS, Internal & External commands of DOS, BIOS & DOS Interrupts, Interrupt services, DOS interrupts & functional calls, Introduction to WINDOWS.
Desk top, Start menu, Status bar, Program manager, System settings menu, Accessories, System maintenance tools. Introduction to UNIX.

Books recommend for B.Sc.Part-I for Paper-I & II :

1. Elements of Electronics - Bagde & Singh.
2. Basic Electronics - B.L.Theraja.
3. Functional circuits in Electronics - Pimpale & Pimpale.
4. Fundamental of computer - V.Rajaraman.
5. Digital Electronics : Kapoor & Maheshwari
6. Introduction to Computers - Srivastav.
7. Understanding of Computer - Rajgopalan

LABORATORY EXPERIMENTS

Computer Lab.-I

Based on Syllabus of Paper-I

Computer Lab.-II

Based on Syllabus of Paper-II

LIST OF EQUIPMENTS/SOFTWARES

1.	(a) Oscilloscopes (15/20 Hrs.)	-	3 Nos.
	(b) Oscilloscope (100 Hrs.)	-	1 No.
2.	Power Supplies	-	4 Nos.
3.	Digital and Analogue Multimeter	-	10 Nos.
4.	Bread Boards	-	10 Nos.
5.	Microprocessor Kit / Mother board	-	4 Nos.
6.	Digital IC Tester	-	2 Nos.
7.	PC (80286, 8086 XT) Trainer Kits	-	3 Nos.
8.	Printer	-	2 Nos.
9.	Diagnostic Cards (as per syllabus)	-	4 Nos.
10.	P.C. with current configuration	-	2 Nos.
11.	Add-on Cards (as per syllabus)	-	4 Sets
12.	Monitor	-	3 Nos.
13.	SMPS	-	2 Nos.
14.	UPS	-	2 Nos.
15.	CVT	-	4 Nos.
16.	Function Generator	-	2 Nos.
17.	Logic Probes	-	2 Nos.
18.	Virus Cards/Filter	-	2 Nos.
19.	HDD	-	2 Nos.
20.	Floppy Drives	-	4 Nos.
21.	MASM Assembler (S/W)	-	2 Nos.
22.	MS-DOS, UNIX & NOVEL (S/W)	-	1 No.
23.	Computer Unit	-	2 Nos.
24.	Antistatic Mat, Wrist Band	-	1 No.
25.	Vac. Cleaner	-	1 No.
26.	Computer Spares & Cards related to syllabus	-	2 No Each
27.	Licensed Softwares related to Syllabus & General functionality.	-	1 No. Each

**29. BIOTECHNOLOGY (Regular/Vocational)
(Effective from the session 2001-2002)**

The syllabus is based on six theory periods and six practical periods per week.

The Examination shall comprise of three theory papers and one

practical. Each paper is divided into five units. There shall be one question on each unit with internal choice. Examinee shall attempt all five questions. Each theory paper shall be of three hours duration and carry 40 marks. The practical examination shall be of six hours duration and carry 30 marks.

**PAPER-I
BIOCHEMISTRY**

- Unit-I:** Scope and importance of biochemistry Nature of biological material, general properties of Organic and Inorganic compounds, hydrophilic and hydrophobic groups in biological molecules. Carbohydrates : classification, structure and biological importance.
- Unit-II:** Proteins, Amino acids, classification of amino acids, peptide bonds, perspectives of proteins, helicity, bending, looping, pleats, salt bridges etc. and their determinants. Biological importance of proteins, lipids, classification, structure, biological importance and importance in generation of mechanical stability.
- Unit-III:** Molecules involved in information storage and retrieval nucleic acids, repeating units in nucleic acids, helicity, bending, looping, etc. DNA replication.
- Unit-IV:** Nature of biochemical reaction under laying biosynthesis and degradation. Enzymes : classification and nomenclature, Protein and non-protein enzymes, kinetics of enzyme catalyzed reaction. In vitro activity of purified enzymes and their applications in industries, food processing, medicine, diagnostic and production of new compounds.
- Unit-V:** Biological techniques : Elementary colorimetry spectroscopy. Beer-Lambert's Law, chromatography. Enzyme as research tools :- ELISA methods, modification of biological compounds with the help of enzymes.

**PAPER-II
MICROBIOLOGY**

- Unit-I:** Scope and importance of microbiology, Development of microscopy (optical, TEM and SEM). Prokaryotes and eukaryotes, Pasteur's experiment disproving spontaneous generation. The concept of sterilization. Methods of sterilization (Dry heat, wet heat, radiation, chemical and filtration etc.) Concept of microbial species and strains, The various forms of microorganisms- PPLOs, cocci, bacilli and spirilla.
- Unit-II:** Nature of the microbial cell surface, Gram positive and gram negative bacteria. Kinds of flagella, Serotypes. Nutritional classification of microorganisms. Microbes in extreme

environments - the thermophiles and alkalophiles.

- Unit-III:** Microbial metabolism. Fermentation products. A survey of products from microorganisms. Symbiosis (*Rhizobium*, mycorrhiza), and antibiosis among microbial population, nitrogen fixing micro-organisms in agriculture (*Azotobacter*, *Rhizobium*, Cynobacteria).
- Unit-IV:** Pathogenic microorganisms : elementary knowledge of disease caused by mycoplasma, bacteria, viruses and fungi. Host parasite relationship. defence mechanism against microorganisms.
- Unit-V:** Mutations : Spontaneous and induced; chemical and physical mutagens; induced mutations in microbes for economic benefit of man. Basic microbial genetics-conjugation, transduction, transformation, isolation of auxotrophs, replica plating techniques, analysis of mutations in biochemical pathways, one gene-one enzyme hypothesis.

**PAPER-III
CELL BIOLOGY**

- Unit-I:** Cell as a basic unit of living systems. The cell theory. Precellular evolution : artificial creation of "cells" Broad classification of cell types : Prokaryotic and Eukaryotic cells. A detailed classification of cell types within an organism. Cell, tissue, organ and Organism as different levels of organization of otherwise genetically similar cells.
- Unit-II:** Ecological amplitude of cell in high altitude, sediments, arctic, hot spring, arid, brackish and freshwater environments. Ultra structure of the cell membrane. Structure and functions of cell organelles; ultra structure of cell membrane, cytosol, Golgi bodies, endoplasmic reticulum (rough and smooth), ribosomes; cytoskeletal structures (actin, microtubules etc.). Mitochondria, chloroplasts, lysosomes, peroxysomes, nucleus (nuclear membrane, nucleoplasm, nucleolus, chromatin).
- Unit-III:** Cell division and cell cycle (including cell synchrony and its applications). Cell-Cell interaction. Cell locomotion (amoeboid, flagellar and ciliar). Muscle & nerve cells. Cell senescence and death. Cell differentiation in plants and animals.
- Unit-IV:** Chromosomes : Chemical composition; structural organisation of chromatids, centromeres, telomeres, chromatin, nucleosome organisation; eu- and heterochromatin; special chromosomes (e.g., polytene and lampbrush chromosomes); banding patterns in human chromosomes.

Unit-V: Chromosome staining techniques : Squash & smear techniques. Feulgen technique.
Staining of sub cellular organelles. Mitochondria, Golgi bodies and Nucleous.
Method of separation of sub-cellular organelles. Methods of cell lysis. Membrane Ghost preparation. Composition of blood; ABO & Rh blood group.

PRACTICALS

BIOCHEMICAL AND MICROBIOLOGICAL TECHNIQUES.

- Quantitative determination of the following in biological samples:
 - Sugar in given solutions
 - Sugar in biological samples
 - Extraction and separation of lipids
 - estimation of proteins,
 - estimation of DNA/RNA.
- Isolation and purification of proteins.
- Assay of enzyme activity.
- Kinetic studies on enzymes.
- Chromatographic methods for separation of macromolecules.
- Cleaning of glassware, Preparation of media, cotton plugging and sterilization.
- Isolation of microbes from hands, tooth-scum and other body parts.
- Isolation of microorganisms from air, water and soil samples. Dilution and pour plating. Colony purification.
- Enumeration of microorganisms. Total vs viable counts.
- Identification of isolated bacteria. Gram staining, other staining methods, metabolic characterization (e.g. IMViC test).
- Growth curve of micro organisms
- Antibiotic sensitivity of microbes, use of antibiotic discs,
- Testing of water quality (MPN)
- Test for antibiotics against given bacteria.
- One step growth of bacteriophage.
- Culture from body fluids (stool, urine, blood)
- Alcoholic and mixed - acid fermentation.

CELL BIOLOGY

- Chromosome techniques
 - Squash in onion root - tip.
 - Smear in onion flower bud.
 - Polytene chromosomes - Drosophila and chironomus.
- RBC, WBC count and TLC & DLC
- Calibration of ocular micrometer, finding out average cell size, chromosome length.

Visit 21. Training programme for students - The students should be assigned visit/ training programme in clinic / hospital, dairy, water purification plant or biotechnological based industry, post graduate / research institution. Students should submit report of training / visit.

PRACTICAL EXAMINATION

(6 HOURS)

(30 MARKS)

- | | | |
|-----|---|----------|
| Q-1 | Qualitative tests of sugars/proteins/lipids | 6 marks |
| Q-2 | Preparation of slide showing mitotic / meiotic division. | 6 marks. |
| | or | |
| | Squash preparation of chromosome. | |
| | or | |
| | RBC, WBC count / measurement of micro object. | |
| Q-3 | Isolation of micro organism / IMViC / MPN count. | 6 marks |
| Q-4 | Practical record | 3 marks |
| Q-5 | Viva-voce | 3 marks. |
| Q-6 | Visit / Training to industries / institution related to biotechnology - report of visit / job training should be submitted. | 6 marks. |

Total	30 marks.
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List of Books :

- Biochemistry by Harper
- Biochemistry by Lehninger
- Biochemistry by Deb
- Biochemistry by Deb & Deb
- Microbiology by Power & Dagainawala
- Cell biology by D.Robertins
- General Microbiology by Pelczan, Chan, Krieg
- Fundamental of Bacteriology by A.J.Salle
- Cell and molecular biology by P.K.Gupta.
- Cytology, Genetics & Embryology by G.N.Vankhede & R.R.Dhande
- Cell biology by Veer Balla Rastogi
- Cell biology by Torpe
- Cell biology by Powar
- Preventive & Social medicine by Park.
- Genes V/VI by Lewin B.
- Laboratory techniques in Modern Biology by Swarup, Arora and Pathak.
- Outlines of microtechniques by Prasad & Prasad.

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30. INDUSTRIAL MICROBIOLOGY

The examination in Industrial Microbiology is comprised of two theory papers and one practical. Each theory paper is divided into five units. There shall be one question from each unit with internal choice. Examinee should attempt all five questions. Theory paper is of three hour duration and shall carry 60 marks each. Each practical Examination (each batch of students) will last for atleast two consecutive days with minimum five working hours each day. The syllabus is based on six theory periods and six practical periods per week.

PAPER-I**FUNDAMENTALS OF INDUSTRIAL MICROBIOLOGY**

- Unit-I :** General Introduction : History & development of Industrial microbiology. Scope of Industrial Microbiology.
Introduction, Discovery of microbial world. The experiments of pasteur. The era of discovery of antibiotics, the discovery of anaerobic life, the physiological significance of fermentation.
- Unit-II :** A) Classification & characteristics of microbes. Bacteria, Algae, fungi, Actinomycetes. Mycoplasma & Viruses.
B) Isolation & ultra structure of bacteria & fungi.
- Unit-III :** **Study of Micro organisms :**
A) Microscopy - Simple microscope, compound microscope, and its working. Phase contrast, fluorescence & Electron Microscope.
B) Methods of Staining : Simple & differential staining (Gram, Acidfast).
C) Procedure of Isolation. Identification & Preservation of micro organisms. Introduction, sterilization, preparation of media, Isolation methods for micro organisms, culture preservation.
- Unit-IV :** A) Nutrition - Types of media, determination of nutritional requirements & nutritional classification of microorganisms.
B) Growth - Growth rate, generation time, growth curve, synchronous & contineous culture growth measurement-cell number, cell mass & cell activity.
- Unit-V :** A) **Biostatistics :**
a) Statistical Methods : Measures of central tendency.
b) Co-relation & linear regression - Coefficient of correlation, linear least squares test, regression.

c) Test of significance - (chi square) X^2 test, t-test.

B) Introduction to Computers.

- a) Components of a computer system - hardware, input devices, CPU, output device, monitor, software.
b) Memory concept - Computer memory, primary & secondary memory in computers.
c) Windows operating systems - Introduction, graphical user interface systems, desk top menu, launching a programme through start menu.
d) MS-WORD - Creating, saving, opening, editing, closing a document, entering & editing text.
e) Using internet explorer, MS Power Point.

PAPER-II**ELEMENTARY GENETICS & TECHNIQUES IN INDUSTRIAL MICROBIOLOGY**

- Unit-I :** DNA - Its structure.
DNA - As a genetic material.
RNA - Structure & types of RNA.
- Unit-II :** Fundamentals of Genetics : Introduction - Method for selection of mutants. Direct selection methods for resistant mutants, Penicillin selection technique. Replica plating technique, other techniques for mutant selection, conditional lethality & its use in mutant selection, general account about the transfer of genetic information in prokaryotes, scope of genetic engineering.
- Unit-III :** Chromatography Technique :
A) Paper Chromatography, thin layer chromatography, column chromatography, affinity chromatography gel filtration.
B) Electrophoresis - Paper Electrophoresis. Moving boundary, PAGE, Immuno Electro-phoresis, Isoelectric focussing.
- Unit-IV :** Instruments, their principles & applications - pH meter, spectrophotometer (visible, UV, infrared). Principals & laws of absorption & radiation, densitometer, fluoro meter, colorimeter, centrifugation - principles & applications.
- Unit-V :** Types of fermentation :
A) Definition, types of fermentation, application of

fermentation process, advantages of fermentation process. Factors involved in fermentation. Classification of Biochemical reactions (primary metabolites, secondary metabolites, Aerobic & Anaerobic process & Bie-products)

- B) Fermentor, design of fermentor & its configuration. Types of fermentor (Batch, continuous, tubuler, fluidised bed, solid state) Principles, operating characteristics of fermentor and its computer control.

Practicals :

- 1) Introduction to laboratory instruments.
- 2) Preparation of media & cleaning of glasswares.
- 3) Autoclaving, sterilization of culture media & glass wares.
- 4) General staining techniques.
 - a) Simple staining
 - b) Gram staining
 - c) Acid fast staining.
- 5) Demonstration of motility of bacteria.
- 6) Isolation of bacteria by-
 - a) Streak plate, b) Pour plate.
- 7) Preservation & maintenance of pure cultures.
- 8) Counting of cells by a) slide method, b) viable cell count.
- 9) Study of industrially important microbes.
 - a) Bacteria, b) Fungi, c) Actinomycetes, d) Algae.
- 10) Demonstration of growth curve.
- 11) Demonstration of basic fermentation process.
 - a) Preparation of curd / yoghurt.
 - b) Preparation of Bread
 - c) Preparation of Idli.
- 12) Study of pH meter & its application.
- 13) Separation of amino-acids/sugars by paper chromatography.
- 14) Electrophoresis & its application.
- 15) Estimation of protein by ninhydrin method.
- 16) Microbiological study tour.

Distribution of marks for annual practical Examination. :

- 1) General staining techniques used in microbiology / demonstration of motility. - 05

2) Isolation of bacteria / study of industrially important microbes	-	05
3) Counting of bacteria / growth curve / fermentation processes	-	04
4) Experiments based on Instrumentation / Computer.-	-	04
5) Spotting	-	05
6) Viva-voce	-	04
7) Class record / tour report.	-	03

Total	-	30

[Note : List of books recommended for paper-I & II, list of books for practical and list of Instruments / Equipments with specification required for B.Sc.-I, II & Final Microbiology Laboratory are same as per the subject Microbiology printed on page No.35 to 40.

31. BIOINFORMATICS

(Introduce from the Session 2008-09 for B.Sc.I)

The examination shall comprised of 3 theory papers and one practical. Each theory paper shall be of 3 hours duration and carry 40 marks. The course is based on 6 theory periods and 6 practical periods per week.

The practical examination shall be of six hours duration and carry 30 marks.

PAPER I

Elementary Mathematics

- Unit I** : Sets. Types of sets . Subsets . Complement of set . Union and intersection of sets. Difference of sets. DeMorgan's law. Cartesian product of sets. Sets of numbers . Product of sets.
- Unit II** : Relations and functions, Types of functions, d-neighbourhood of point, Limit of function, Continuity of function, Theorems on Limits and Continuity of functions.
- Unit III** : Differentiation of function. Its physical significance. Differentiation of Sum, Difference, Product, Ratio of Functions. Derivative of Trigonometric, Exponential, Logarithmic, Inverse trigonometric, Polynomial, Implicit functions. Increasing and Decreasing functions. Maxima and Minima. Derivative as a rate of change.
- Unit IV** : Integration of a function , Finding a function from its derivative, Integration of Sum, Difference and Product of two Functions . Integration by substitution. Integration by partial Fractions . Definite integral . Definite integral as limit of sum.

Calculating Areas and Volumes of bounded regions.

Unit V : Differential equation, its Formation. Its general solution and particular solution. Order and degree of differential equation. First order differential equation. Variable separable method.

Books Recommended :

1. Binmore : "Mathematical Analysis", Cambridge University Press.
2. Edward Batschelet : "Introduction to Mathematics for Life Sciences" 3rd Edition(1992).
3. Edwards , J."Differential Calculas for Beginners", MacMilan and Co.ltd (1963).
4. Edwards , J." Integral Calculas for Beginners ", AITBS Publishers & Distributors(1994).
5. GorakhPrasad ." Differential Calculas ", Pothishala Pvt Ltd, Allahabad
6. GorakhPrasad ." Integral Calculas ", Pothishala Pvt Ltd, Allahabad.

PAPER II

Computer Fundamentals and Operating Systems

Unit I : **Introduction to Computers:** Characteristics, classification of computer block Diagram of computer, Memory: Types of memory, RAM, ROM, PROM, EPROM, I/O devices: keyboard, mouse, floppy disk, monitor, compact disk.

Printers: Impact, Non-Impact, dot matrix, inkjet, laser Interpreter, compiler, Assembler.

Introduction to Number System: Decimal, binary, octal, hexadecimal codes ASCII, EBCDIC.

Unit II : **Windows:** Introduction, features, desktop: Background screensaver, Customizing desktop, creating, moving, deleting Icons.

Windows Explorer Copying, renaming, moving, deleting, operations on files and folders.

My computer, My documents, control panel : Mouse, printer, date and time.

MS-Word: Introduction to word, features, page setup, views, text formatting, Auto correct, spell check, grammer, table, tabs, indentation mail merge, print Preview, printing of document, hyperlink.

Unit III : **MS- EXCEL:** Introduction, features, creating and formatting worksheet, Inserting data, entering mathematical formulas and functions, autofill,

Graphs: Type of charts, creating, moving charts, (column, bar, & pie)

Introduction to Internet: Types of Internet connection: Direct, dial-up, Protocol : TCP/IP, FTP, HTTP. Domain name, Electronic mail address, word Wide web, search engines, browser: Internet Explorer.

Unit – IV : **Based on Unix operating system:** Overview of unix O.S., Unix file system, Data structure for process and memory management, process states and state Transition diagram, process scheduling, memory management, Executing and Terminating program in unix. Unix commands: pwd, cd, ls, mv, ln, cp, mkdir, rm, rmdir, du

Unit V : **Based on Linux operating system :** Design principal, kernel modules, Process management, scheduling, memory management, file system, Inter Process communication, security.

Books Recommended

1. Computer fundamentals: B. Ram, Nas Age publication.
2. A first course in computer: Sanjay saxena
3. PC Software: Taxali R.K.
4. Fundamentals of computer: V.Rajaraman, PHI Publication.
5. Information Technology: Alexie and Mathews, Vijay Nikole Publiucation.
6. IT Tool and Application: Alexie and Mathews, Vijay Niklole publicaton.
7. Operating system by: Achut S. Godbole Tata megrow Hill publication.
8. Operating system concept, sixth edition by silberschutz, Galvin, Gagne Wiley publication.
9. Computer Fundamentals, Pradeep K. Sinha. BPB Publication.

PAPER III

Biostatistics

Unit I : Representation of data. Discrete data, continues data, Histogram, PolyGram's Frequency curves, Mean, Variability of data- the standard deviation, Median, quartiles, percentile, Skiwness, Box and Whisker diagrams.

Unit II : Regression and Correlation, Scatter diagrams, Regression function, Linear correlation and regression lines, Product moment correlation coefficient.

Unit III : Probability : Experimental probability, probability when outcomes are equally likely, subjective probabilities, Probabilities law. Probability rules for combined events, conditional probability and independent events, Probability trees. Bayes theorem.

Unit IV : Random Variables and Distributions : Discrete and Continuous Random Variables, Cumulative distribution function, Probability mass function and Probability density function, Expectation of random variables – Experimental Approach and theoretical.

Unit V : Approach Expectation of X and variance X, Expectation of function $\text{Exp}(X)$, Bernoulli Distribution, Binomial Distribution, Poisson Distribution, Uniform Distribution, Normal Distribution.

Books Recommended :

S.Dobbs and J.Miller, (2002), ‘Statistics (Advanced Level Mathematics) : Cambridge.

DISTRIBUTION OF PRACTICAL MARKS.

- | | | |
|-----|---------------------------------|------------|
| (1) | To perform two major experiment | : 20 Marks |
| (2) | Viva-voce | : 5 Marks |
| (3) | Practical Record | : 5 Marks |

Practical :

1. Use of Windows operating system (Notepad, WordPad, Calculator, Paint)
2. Use of Linux (basic commands)
3. Creating word file by using paragraphs, alignments
4. Create and print file using mail merge.
5. Working with spread sheet (all operations on cell like merging.)
6. Handling of different formula / function.
7. Using function wizard.
8. Calculate regression and correlation use excel.
9. Using different distribution.
10. Creation of presentation.
11. Practicals on Unix basic commands.
12. Practicals based on internet.

List of Equipments :

Quantity

- | | | |
|------|-------------------------------------|----|
| (1) | PC Pentium IV (1 PC for 2 students) | |
| (2) | Legal Software Windows-XP. | 01 |
| (3) | Legal Software Visual Studio | 01 |
| (4) | PC based Unix O.S. Legal Software | 01 |
| (5) | Printers | |
| (i) | 80 Column Dot Matrix | 01 |
| (ii) | Inkjet Printer | 01 |
| (6) | LCD Projector | 01 |
| (7) | Broad Band Connection. | 01 |

ORDINANCE NO. 143*Examinations Leading to the Degree of विज्ञान स्नातक
(Bachelor of Science)**

1. (i) The following shall be the examination leading to the Degree of विज्ञान स्नातक (Bachelor of Science), namely-
 - (a) The विज्ञान स्नातक भाग-१ (B.Sc. Part-I) Examination;
 - (b) The विज्ञान स्नातक भाग-२ (B.Sc. Part-II) Examination; and
 - (c) The विज्ञान स्नातक अन्त्य (B.Sc. Final) Examination; and
- (ii) The duration of teaching for each course of examination shall be one Academic Year.
2. The Examination specified in the preceding paragraph shall be held twice a year at such places and on such dates as may be appointed by the Academic Council.
3. Subjects to their compliance with the provisions of this Ordinance and of other Ordinances in force from time to time, the following persons shall be eligible for admission to the examinations, namely:-
 - (a) A student of a College who has prosecuted a regular course of study for not less than one academic year prior to that examination;
 - (b) A teacher in a Educational Institution eligible under the provisions of Ordinance No.18 ; and
 - (c) A women candidate who has not pursued a regular course of study.
Provided that in the case of the persons eligible under clauses (b) and (c) an applicant to the examination shall have attended a full course of laboratory instruction in a college in the subject in which laboratory work is prescribed. The candidate shall submit a Certificate to that effect signed by the Principle.
4. **(I) The Students passing H.S.C. Examination with Physics, Chemistry and Mathematics shall offer following subjects at B.Sc. Part-I Examination.**
 - (i) English and any one of the following languages Marathi, Hindi, Urdu, Sanskrit, and Supplementary English.
 - (ii) Three optional subjects atleast one subject from the following groups be selected.

* As amended by the Executive Council dated 6-7-85 vide Ordinance No. 6 of 1985, Ordinance No. 6 of 1986, Ordinance No.10 of 1987, Ordinance No.14 of 1987, ordinance No. 3 of 1992, Ordinance No. 3 of 1997, Ordinance No.10/98, Ordinance No.4 of 1999, Ordinance No. 18/2000, Ordinance No. 6 of 2002, Ordinance No.18 of 2004, 1 of 2005, 11 of 2005, 5 of 2008 and latest amended vide Ordinance No. 13 of 2009 (Management Council dt. 25.05.2009)

Group A :- Chemistry, Industrial Chemistry, Petro-Chemical Science, Electronics (Instrumentation), Mathematics.

Group B :- Physics, Geology, Statistics, Computer Science, Geography.

The Students passing H.S.C. Examination with Chemistry and Biology shall offer following subjects:-

- (i) English and any one of the following languages. Marathi, Hindi, Urdu, Sanskrit and Supplementary English.
- (ii) Chemistry.
- (iii) Two optional subjects from the following group be selected.

Group C : Botany, Zoology, Bio-Chemistry, Geography, Fisheries, Environmental Science, Microbiology, Geology, Food Science, Industrial Microbiology and Biotechnology.

For Vocational subject there shall be following scheme of Combination of subjects :-

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

Group D. : Physics, Chemistry, Mathematics, Electronics (Instrumentation), Statistics Computer Science, and Geology.

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

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

The students passing HSC examination with Physics, Chemistry, Biology and Mathematics shall be eligible for admission to B.Sc. (Bioinformatics) and

shall offer any one subject from Group-G and any one subject from Goup-H.

Group G : Botany, Zoology, Bio-Chemistry, Microbiology, Industrial Microbiology , and Biotechnology.

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

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

TABLE

Sr.No.	M.C.V.C. group and trade	Subjects allowed for admission to B.Sc.Part-I Any three from the following.
1.	2.	3.
1. Para Medical Group	Medical Laboratory Technician Trade.	Botany, Zoology, Computer Application, Microbiology, Biochemistry, Biotechnology, Geology, Geography, Environmental Science, Seed Technology, Fisheries, B.T.S.P., Chemistry.
2. Agricultural Group	Horticulture Trade or Crop Science Trade	Zoology, Chemistry, Computer Application, B.T.S.P., Seed Technology, Microbiology, Biochemistry, Biotechnology, Geology, Geography, Environmental Science, Botany.
3. Fisheries Group	Inland Fisheries Trade Fish Processing Technology Trade	Botany, Chemistry, Computer Application, B.T.S.P., Fisheries, Microbiology, Biochemistry, Biotechnology, Geology, Geography, Environmental Science, Zoology.

4. Engineering and Technology Group	Physics, Computer Science, Geology, Geography, Statistics, Chemistry, Mathematics, Industrial Chemistry, Computer Application, Electronics (Instrumentation)
Electronics Technology Trade	

(B) In the case of विज्ञान स्नातक भाग-२ (B.Sc. Part-II) Examination:- have passed not less than one academic year previously the विज्ञान स्नातक भाग-१ (B.Sc. Part-I) Examination of the University or an examination recognised as equivalent thereto, and

(C) In the case of the विज्ञान स्नातक अन्त्य (B.Sc. Final) Examination:- have passed not less than one academic year previously the विज्ञान स्नातक भाग-२ (B.Sc. Part-II) Examination of the University or an examination recognised as equivalent thereto;

5. Without prejudice to the other provisions of Ordinance No. 6 relating to the Examination in General, the provisions of Paragraph 5, 8, 10 and 31 of the said ordinance shall apply to every collegiate candidate.

6. The fee for the examination shall be:-

(a) For the विज्ञान स्नातक भाग-१ (B.Sc. Part-I) Examination-

i) For Theory Part Rs. 70.00

and ii) For Practical Examination Rs. 10.00
in each subject

(b) For the विज्ञान स्नातक भाग-२ (B.Sc. Part-II) Examination-

i) For Theory Part Rs. 70.00

and ii) For Practical Examination Rs. 10.00
in each subject

(c) For the विज्ञान स्नातक अन्त्य (B.Sc. Final) Examination-

i) For Theory Part Rs. 70.00

and ii) For Practical Examination Rs.10.00
in each subject

7. Every examinee for the विज्ञान स्नातक भाग-२ (B.Sc. Part-II) Examination shall be examined in each of the three Science subjects in which he has been examined at the विज्ञान स्नातक भाग-१ (B.Sc.

Part-I) Examination.

8. Every examinee for the विज्ञान स्नातक अन्त्य (B.Sc. Final) Examination shall be examined in each of the three science subjects in which he has been examined for the विज्ञान स्नातक भाग-२ (B.Sc. Part-II) Examination.
9. An examinee who is successful at the विज्ञान स्नातक भाग-१ (B.Sc. Part-I) Examination, may offer an additional subject mentioned in Para (4) (iii) not offered by him at the विज्ञान स्नातक भाग-१ (B.Sc. Part-I) Examination, on his prosecuting a regular course of study for one academic year in that subject. Such an examinee shall not be permitted to take any other examination simultaneously with the examination in the additional subjects. The fee for the additional subject shall be Rs. 70.00 for the Theory Part and Rs. 10.00 for the Practical Part.
10. The Scope of the subjects of B.Sc. Part-I, B.Sc. Part-II and B.Sc. Final shall be as indicated in the respective syllabi in force from time to time. The medium of instruction and examination shall be English except for the courses in Languages.
11. The maximum marks allotted to each subject and paper and the minimum marks which an examinee must obtain in order to pass the examination shall be as indicated in Appendices A.B. and C.
12. Successful examinees at the विज्ञान स्नातक अन्त्य (B.Sc. Final) Examination who obtain not less than 60% marks in aggregate of B.Sc. Part-I, B.Sc. Part-II and B.Sc. Final Examination taken together shall be placed in the First Division, those obtaining less than 60% but not less than 45% in the Second Division, and all other successful examinees in the Third Division.

Explanation :

Division at the विज्ञान स्नातक अन्त्य (B.Sc. Final) Examination shall be declared on the basis of the marks obtained in the Science Subject at the विज्ञान स्नातक भाग-१, विज्ञान स्नातक भाग-२ व विज्ञान स्नातक अन्त्य (B.Sc. Part-I, Part-II, and Final) Examination taken together.

13. There shall be no classification of successful examinees at the विज्ञान

* For the purpose of counting of three science subjects offered by a candidate at 12th Standard Examination, the subject Biology shall be counted as two Science Subjects, i.e. Botany and Zoology.

स्नातक भाग-१ (B.Sc. Part-I) and विज्ञान स्नातक भाग-२ (B.Sc. Part-II) Examinations.

14. An examinee successful in the minimum period prescribed for the examination, obtaining not less than 75% of the maximum marks prescribed in the subject shall be declared to have passed the examination with Division in the subject.

Explanation :

- (1) Distinction shall be awarded only in Science Subjects.
 - (2) Distinction at the विज्ञान स्नातक अन्त्य (B.Sc. Final) Examination shall be awarded on the basis of the marks obtained at the विज्ञान स्नातक भाग-१, विज्ञान स्नातक भाग-२ व विज्ञान स्नातक अन्त्य (B.Sc. Part-I, B.Sc. Part-II, and B.Sc. Final) Examination taken together.
 - (3) Distinction shall not be awarded to an examinee availing of the provision of the exemptions and compartments at any of the examination.
15. Provisions of Ordinance No. 7-A relating to the Condonation of Deficiency of Marks for passing an Examination and of Ordinance No. 10 relating to Exemptions and Compartments shall apply to the examinations under this Ordinance.
 - (A) The students who have passed B.Sc. Final examination of this University or any other statutory University shall be eligible to seek admission for studying practical of any other optional subjects offered for B.Sc. Degree for simultaneous study of complete three year course for that subject in one year and to appear simultaneously for all parts of examination leading to the degree of Bachelor of Science (additional) in that subject, subject to the following condition.

An examinees shall have attended full course of laboratory instructions in a college in the subject in which laboratory work is prescribed. An examinees shall submit a certificate to that effect signed by the Principal.
 - (B) On securing not less than minimum marks prescribed for the subject / subjects shall be issued a certificate of having passed the examination in the additional subject/subjects as the case may be.
 - (C) The application for admission to the examination under (A)

above shall be submitted to the Registrar not less than three months before the date of commencement of the examination.”

16. As soon as possible after the examinations the Executive Council shall publish a list of successful examinees at the B.Sc Part-I, B.Sc. Part-II and B.Sc. Final Examinations. Such list at the विज्ञान स्नातक अन्त्य (B.Sc. Final) Examination shall be arranged in three Divisions. The names of the examinees passing the examination as a whole in the minimum prescribed period and obtaining the prescribed number of places in First or Second Division shall be arranged in Order of Merit as provided in the Examinations in General Ordinance No. 6.
17. No Person shall be admitted to B.Sc. Part-I, B.Sc. Part-II and B.Sc. Final Examinations, if he has already passed the corresponding or an equivalent examination of any other Statutory University.
18. Successful Examinees at the विज्ञान स्नातक भाग-१ (B.Sc. Part-I) and the विज्ञान स्नातक भाग-२ (B.Sc. Part-II) Examination shall be entitled to receive a Certificate signed by the Registrar and successful examinee at the विज्ञान स्नातक अन्त्य (B.Sc. Final) Examination, shall on payment of the prescribed fees, receive a Degree in the Prescribed form, signed by the Vice-Chancellor.

APPENDIX-A
विज्ञान स्नातक भाग-१
(B.Sc. Part-I)

Subject	Examination		Maximum Marks	Minimum Pass Marks Per subject
	Theory	Practical		
1. Compulsory English	1 Paper	Nil	100	30
2. Language	1 Paper	Nil	100	30
3. Mathematics	3 Paper of 50 Marks each	Nil	150	45
4. Statistics, Geography, MicroBiology, Biochemistry, Computer Science, Fisheries, Petrochemical Science, Food Science and Industrial Microbiology.	2 Papers of 60 Marks each	One per subject	120 for theory Part 30 for Practical Part	36 09
5. Physics, Chemistry Botany, Zoology Electronics (Instrumentation), Industrial Chemistry, Geology, Biotechnology, Environmental Science, and Bioinformatics	3 Papers of 40 marks each	One Practical	120 for theory part 30 for Pract. part.	36 09
6. Vocational subject Biological Techn. & Spec.Prep., Industrial fish and Fisheries and Computer Maintenance.	2 Papers of 60 marks each	One Practical	120 for theory part 30 for practical part	36 09
7. Vocational subject (a) Industrial Chemistry (b) Instrumentation (c) Seed Technology (d) Biotechnology	3 papers of 40 marks each	One Practical	120 for theory part 30 for practical part	36 09
8. Computer Application (Vocational)	2 Papers of 50 marks each	One Practical of 50 marks	100 for theory part 50 for practical part.	30 15

APPENDIX-B
विज्ञान स्नातक भाग-२
(B.Sc. Part-II)

Subject	Examination		Maximum Marks	Minimum Pass Marks Per subject
	Theory	Practical		
1. Mathematics	3 Paper of 50 Marks each	Nil	150	53
2. Statistics, Geography, Micro-Bio logy, Bio-chemistry, Computer Science, Fisheries, Petrochemical Science, Industrial Microbiology and Food Science	2 Papers of 60 Marks each	One per subject	120 for theory part 30 for Practical Part	42 11
3. Physics, Chemistry Botany, Zoology, Electronics (Instrumentation), Industrial Chemistry, Geology, Biotechnology, Environmental Science, and Bioinformatics	3 Papers of 40 marks each	One Practical	120 for theory Part 30 for Practical part	42 11
4. Vocational Subject Biological Techniq. & Specimen Prep., Industrial Fish and Fisheries and Computer Maintenance.	2 Papers of 60 marks each	One Practical	120 for theory part 30 for Practical part	42 11
5. Vocational subject (a) Industrial Chem. (b) Instrumentation (c) Seed Technology (d) Biotechnology	3 Papers of 40 marks each	One Practical	120 for theory part 30 for Practical Part	42 11
6. Computer Application (Vocational)	2 Papers of 50 marks each	One Practical of 50 marks	100 for theory part 50 for practical part.	35 17

APPENDIX-C
विज्ञान स्नातक अन्त्य
(B.Sc. Final) Examination

Subject	Examination		Maximum Marks	Minimum Pass Marks Per Subject
	Theory	Practical		
1. Mathematics	3 Paper of 50 marks each	Nil	150	53
2. Statistics, Geography, Micro-Biology, Biochem., Computer Science , Fisheries, Petrochemical Science, Industrial Microbiology and Food Science.	2 Papers of 60 marks each	One per subject	120 for theory part 30 for Practical part	42 11
3. Physics, Chemistry, Botany, Zoology Electronics(Instrumentation) Industrial Chem., Geology, Biotechnology, Environmental Science, and Bioinformatics	3 Papers of 40 marks each	One Practical	120 for theory part 30 for Practical part	42 11
4 Vocational Subject Biological Tech. & Specimen Prep., Industrial Fish & Fisheries and Computer Maintenance.	2 Papers of 60 marks each	One Practical	120 for theory part 30 for Practical part	42 11
5. Vocational Subject (a) Industrial of 40 Chem. (b) Instrumentation (c) Seed Technology (d) Biotechnology	3 Papers of 40 marks each	One practical	120 for theory part 30 for practical part	42 11
6. Computer Application (Vocational)	2 Papers of 50 marks each	One Practical of 50 marks	100 for theory part 50 for practical part.	35 17

CERTIFICATE

Name of College/Institution.....

Name of the Department.....

This is to certify that this Book contains the bonafide record of
the practical work of Shri/Kumari/Shrimati
of B.Sc. Part-I, B.Sc. Part-II, B.Sc. Final

During the Academic year.....

Dated

Signature of the Teacher
who taught the examinee

Head of the Department

In the absense of the above Certificate, marks assigned to the
practical Record Book Shall not be awarded to the examinee.**AMRAVATI UNIVERSITY**The Executive Council, dated 1/2-4-1977, 11-7-1977 and 2-9-1977
has prescribed the Teaching periods in the various subject in the Faculty of
Science as follows.**Examination : B.Sc. Part-I**

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

B.Sc. Part-II and B.Sc. Final

1. Physics	6+2	6
2. Mathematics	9+1 Tutorial - -	
3. Chemistry	6	6
4. Botany	6	6
5. Zoology	6	6
6. Geology	6	6
7. Statistics	6	6
8. Biochemistry	6	6
9. Microbiology	6	6
10. Electronics	6	6
11. Computer Science	6	6

- Notes :** 1) *The strength of a batch of Practical and Tutorials for Under-Graduate classes shall be 16 with an addition of 10% with the permission of Vice-Chancellor.
*(As amended by the Executive Council dated 27/28-4-1979).
- 2) A Period will be counted of 45 minutes duration at Under-graduate level.
- 3) For Tutorial class a batch will be of 16 students with an addition of 10% with the permission of the Vice-Chancellor per week.

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