

B.Sc. Part-I (Sem-I & II)
Exam. 2012-13

Prospectus No. 2013121

संत गाडगेबाबा अमरावती विद्यापीठ
SANT GADGE BABA AMRAVATI UNIVERSITY

विज्ञान विद्याशाखा
(FACULTY OF SCIENCE)

अभ्यासक्रमिका
विज्ञान स्नातक भाग-१
सत्र-१, परीक्षा हिवाळी-२०१२
सत्र-२, परीक्षा उन्हाळी-२०१३

PROSPECTUS
OF
B.Sc. Part-I
SEMESTER-I EXAMINATION W-2012
SEMESTER-II EXAMINATION S-2013



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Pattern of Question Paper and Distribution of Marks.**Maximum Marks : 40****Time: Three Hours**

- Q.1: There shall be five short answer questions based on prescribed prose passages05 marks
- Q.2: There shall be five long answer questions based on prescribed prose passages. Out of these, students will have to answer any two questions of five marks each10 marks
- Q.3: There shall be four long-answer questions based on prescribed poems. Out of these students will have to answer any two questions of five marks each10 marks
- Q.4: There shall be five questions of one mark each, from Grammar Section-Parts of Speech, Use of articles and Prepositions, Tenses, Transformation of Sentences05 marks
- Q.5: There shall be one question either on Note-making or on Reporting
(Note: The paper setter shall have the discretion) 05 marks
- Q.6: There shall be one question on Paragraph Writing on topics of current relevance. Students will have to write a paragraph of about 200 words out of four given topics05 marks

Total 40 marks

२. मराठी अनिवार्य

विज्ञान स्नातक भाग-१, सत्र-१ व सत्र-२

अभ्यासक्रमासाठी सूक्ष्म वाचनाकरिता पाठ्यपुस्तक "शलाका" ओरिएन्ट ब्लॅकस्वॉन प्रा.लि.मुंबई ४००००१ यांनी प्रकाशित केले आहे.

उपरोक्त "शलाका" पाठ्यपुस्तक विज्ञान शाखा भाषा अभ्यास मंडळाने संपादित केलेले असेल व त्यात खालील घटकांचा व पाठ्यांशांचा समावेश राहिल.

सत्र-१**घटक अ (गद्य)**

- | | | | |
|----|------------------------------|---|-------------------------|
| १) | पुरुष सूक्त | - | लक्ष्मण लोंढे |
| २) | विज्ञान कथेतील सत्य आणि कथित | - | चंद्रकांत पाटील |
| ३) | येशूची लोकशिक्षणाची शैली | - | फ्रान्सीस दिब्रिटो |
| ४) | लोकभ्रम | - | विष्णूशास्त्री चिपळूणकर |

- | | | | |
|----|-----------------------------|---|------------|
| ५) | महात्मा ज्योतिराव फुले | - | भा.ल.भोळे |
| ६) | गाडगे बाबांचे अखेरचे किर्तन | - | गाडगे बाबा |

घटक ब (पद्य)

- | | | | |
|----|--------------------|---|------------|
| १) | पसायदान | - | ज्ञानेश्वर |
| २) | डोईचा पदर | - | जनाबाई |
| ३) | टिळा टोपी उंच दावी | - | तुकाराम |
| ४) | जैसा वृक्ष नेणे | - | नामदेव |

घटक क (व्यावहारिक मराठी)

कार्यालयीन पत्रव्यवहार

सत्र-२**घटक अ (गद्य)**

- | | | | |
|----|------------------------------------|---|-----------------------|
| १) | स्टीफन हॉकिंग | - | निवास पाटील |
| २) | मला शब्द द्या | - | वि.वा.शिरवाडकर |
| ३) | आंबेडकरांचे ग्रंथप्रेम | - | शां.शं.रेगे |
| ४) | विज्ञान, तंत्रज्ञान आणि मराठी भाषा | - | जयंत नारळीकर |
| ५) | चिंतन | - | ए.पी.जे.अब्दूल कलाम |
| ६) | जगायचं कशासाठी | - | डॉ.निर्मलकुमार फडकुले |

घटक ब (पद्य)

- | | | | |
|----|-------------------|---|----------------|
| १) | विद्यार्थ्यांप्रत | - | केशवसूत |
| २) | लपे कर्माची रेखा | - | बहिणाबाई चौधरी |
| ३) | मेंढर | - | विठ्ठल वाघ |
| ४) | संग्राम | - | यशवंत मनोहर |

घटक क (व्यावहारिक मराठी)**प्रसारमाध्यमांसाठी लेखन****मराठी अनिवार्य****विज्ञान स्नातक भाग-१, सत्र-१ व सत्र-२**

वेळ ३ तास

सत्र-१

गुण - ४०

या विषयाची एक प्रश्नपत्रिका राहिल.

सूक्ष्म वाचनाकरिता पाठ्यपुस्तक - "शलाका"

या पाठ्यपुस्तकातील घटक अ (पाठ क्र.१ ते ६) व घटक ब (कविता क्र.१ ते ४) व घटक क (व्यावहारिक मराठी) यावर प्रश्न व गुणविभागणी खालील प्रमाणे राहिल.

प्रश्न-१घटक अ -	दिर्घोत्तरी प्रश्न (कोणताही एक)	गुण - १०
प्रश्न-२घटक अ -	लघुत्तरी प्रश्न (कोणतेही दोन)	गुण- (५अ५उ१०)
प्रश्न-३घटक ब -	लघुत्तरी प्रश्न (कोणतेही दोन)	गुण- (५अ५उ१०)
प्रश्न-४घटक क -	व्यावहारिक मराठी- कार्यालयीन पत्रव्यवहार	गुण- (५अ५उ१०)

पाच गुणांचे दोन प्रश्न राहिल.

विज्ञान स्नातक भाग-१, सत्र-१ व सत्र-२

वेळ ३ तास सत्र-२ गुण - ४०

या विषयाची एक प्रश्नपत्रिका राहिल.

सूक्ष्म वाचनाकरिता पाठ्यपुस्तक - "शलाका"

या पाठ्यपुस्तकातील घटक अ (पाठ क्र.७ ते १२) व घटक ब (कविता क्र.५ ते ८) व घटक क (व्यावहारिक मराठी) यावर प्रश्न व गुणविभागणी खालील प्रमाणे राहिल.

प्रश्न-१घटक अ -	दिर्घोत्तरी प्रश्न (कोणताही एक)	गुण - १०
प्रश्न-२घटक अ -	लघुत्तरी प्रश्न (कोणतेही दोन)	गुण- (५अ५उ१०)
प्रश्न-३घटक ब -	लघुत्तरी प्रश्न (कोणतेही दोन)	गुण- (५अ५उ१०)
प्रश्न-४घटक क -	व्यावहारिक मराठी- प्रसारमाध्यमांसाठी लेखनगुण - (५अ५उ१०)	

पाच गुणांचे दोन प्रश्न राहिल.

३. हिंदी अनिवार्य

प्रथम सत्रांत परीक्षा शैक्षणिक सत्र २०१०-११

पाठ्यपुस्तक - अस्मिता

समय ३ घंटे		पूर्णांक - ४०
प्रथम इकाई -	आधारभूत पाठ्यक्रम	
प्रश्न-१ (क)	दीर्घोत्तरी प्रश्न (एक)	०८ अंक
प्रश्न-२ (ख)	लघुत्तरी प्रश्न (दोन)	०८ अंक
द्वितीय इकाई -	भाषागत पाठ्यक्रम (विज्ञान संकाय)	
प्रश्न-३ (ग)	दीर्घोत्तरी प्रश्न (एक)	०८ अंक

प्रश्न-४ (घ) लघुत्तरी प्रश्न (दोन) ०८ अंक

प्रश्न-५ अतिलघुत्तरी प्रश्न
आधारभूत पाठ्यक्रमपर आधारित चार एवं भाषागत पाठ्यक्रमपर आधारित चार ऐसे कुल आठ प्रश्न एक-एक अंक के लिए पुछे जाएंगे
८-१३०८

सूचना - प्रश्न ५ को छोडकर सभी प्रश्न विकल्प के साथ पुछे जाएंगे

हिंदी अनिवार्य

द्वितीय सत्रांत परीक्षा शैक्षणिक सत्र २०१०-११

पाठ्यपुस्तक - अस्मिता

समय ३ घंटे		पूर्णांक - ४०
तृतीय इकाई -	पद्य विभाग	
प्रश्न-१ ला	- संदर्भ सहित व्याख्या (एक)	१० अंक
प्रश्न-२ रा	- कविताओंपर आधारित (२ प्रश्न)	१० अंक
चतुर्थ इकाई -	व्यावहारिक भाषा एवं व्याकरण	
प्रश्न-३ रा	- अंग्रेजी से हिंदी में अनुवाद	०५ अंक
प्रश्न-४ था	- पत्रलेखन (कार्यालयीन)	०५ अंक
प्रश्न-५	- (अ) मुहावरे और लोकोक्तियों (२)	०४ अंक
	- (ब) शब्द समूह के लिये एक शब्द (२)	०४ अंक
	- (क) वाक्य शुद्ध कीजिए (१)	०२ अंक

कुल अंक ४०

५. संस्कृत
संस्कृत आवश्यक

या विषयाची एक प्रश्नपत्रिका राहिल.

सुक्ष्म वाचनाकरीता पाठ्यपुस्तक

कविकुलगुरु कालिदास विरचित रघुवंशम या महाकाव्याचा द्वितीय सर्ग वरील पाठ्यपुस्तकाची पुढीलप्रमाणे चार गटात विभागणी करावी.

गट-१ :	रघुवंशम (द्वितीय सर्ग) यातील श्लोक १ ते २४	गुण ४०
गट-२ :	रघुवंशम (द्वितीय सर्ग) यातील श्लोक २५ ते ५०	
गट-३ :	रघुवंशम (द्वितीय सर्ग) यातील श्लोक ५१ ते ७५	
गट-४ :	कालिदासांची शैली, दिलीपाचे व्यक्तिचित्र, नन्दिनी, वसिष्ठ, वज्रपाणि, सुरविद सेनानी: गौरीगुरु: कालिदासाची माहिती.	

प्रश्नपत्रिकेचे स्वरूप व गुणविभागणी पुढील प्रमाणे करावी.

वेळ : ३ तास	गुण : ४०
प्रश्न १ :	गट १ मधील २ श्लोकांपैकी एकाचा अनुवाद : ०६
प्रश्न २ :	गट २ मधील २ श्लोकांपैकी एकाचा अनुवाद : ०६
प्रश्न ३ :	गट ३ मधील २ श्लोकांपैकी एकाचा अनुवाद : ०६
प्रश्न ४ :	गट १, २, ३ यावर आधारित दीर्घोत्तरी प्रश्न : १०
	दोन पैकी एक
प्रश्न ५ :	गट ४ मधील टिपा ३ पैकी २ : १२

सत्र-२
संस्कृत (आवश्यक)

या विषयाची एक प्रश्नपत्रिका राहिल.

सुक्ष्म वाचनाकरीत पाठ्यपुस्तक भगवद्गीता १४ वा अध्याय.

वरील पाठ्यपुस्तकाची पुढील प्रमाणे चार गटात विभागणी करावी.

गट-१ :	भगवद्गीता १४ वा अध्याय श्लोक १ ते ८
गट-२ :	भगवद्गीता १४ वा अध्याय

श्लोक ९ ते १७

गट-३ : भगवद्गीता १४ वा अध्याय

श्लोक १८ ते २७

गट-४ : त्रिगुण, त्रिगुणांचे स्वरूप, कार्य, फल, प्रकृती गुणातीत इत्यादी.

प्रश्नपत्रिकेचे स्वरूप व गुणविभागणी पुढील प्रमाणे असावी.

वेळ : ३ तास	गुण : ४०
प्रश्न-१:	गट १ मधील २ श्लोकांपैकी एकाचा अनुवाद : गुण-६
प्रश्न-२:	गट २ मधील २ श्लोकांपैकी एकाचा अनुवाद : गुण-६
प्रश्न-३:	गट ३ मधील २ श्लोकांपैकी एकाचा अनुवाद : गुण-६
प्रश्न-४:	गट १, २, ३ यावर आधारित दीर्घोत्तरी प्रश्न : गुण-१०
	२ पैकी १
प्रश्न-५:	गट ४ मधील टिपा : गुण-१२
	३ पैकी २

6. SUPPLEMENTARY ENGLISH

1S Supplementary English

Time : 3 Hours

Total Marks : 40

Text Book Prescribed : Wisdom and Experience

Edited by Board of Editors, Sant Gadge Baba Amravati University, Amravati.

Publisher : Orient Blackswan Pvt. Ltd. Mumbai.

Prose Section : 1. The Sun, the Planets & the Stars – C. Jones

2. Water : The Elixir of Life – C. V. Raman

3. Sir Isaac Newton – Nathaniel Hawthorne

4. Toasted English – R. K. Narayan

5. What is Courage ? – William Slim

Poetry Section :

1. A Requiem – William Shakespeare

2. The Sun Rising – John Donne

3. From Paradise Lost – John Milton

4. The Chimney Sweeper – William Blake

Grammar : Parts of Speech, Use of Articles and Prepositions, Tenses, Transformation of Sentences.

Professional : 1) Interviews Communication
2) Group discussions

Distribution of Marks.

Maximum Marks : 40	Time: Three Hours
Q.1 :	There shall be five short answer questions based on prescribed prose. ....05 marks
Q. 2 :	There shall be five long answer questions based on prescribed prose, out of these students will have to answer any two questions of five marks each .....10 marks
Q. 3 :	There shall be four long answer questions based on prescribed poems. Out of these, students will have to answer any two questions of five marks each .....10 marks
Q. 4 :	There shall be five questions of one mark each, from Grammar Section-Parts of Speech, Use of articles and Prepositions, Tenses, Transformation of Sentences (Selection of Questions shall be at the discretion of paper setter) .....05 marks
Q. 5 :	There shall be one question either on Interviews or on Group Discussions 05 marks
Q. 6 :	There shall be one question either on Principles of Good Writing or on Report Writing. ....05 marks

	Total 40 marks

2S Supplementary English

Time : 3 Hours Total Marks : 40

Text Book Prescribed : Wisdom and Experience
Edited by Board of Editors, Sant Gadge Baba Amravati University, Amravati.

Publisher : Orient Blackswan Pvt. Ltd. Mumbai.

Prose Section :

1. The Gold Frame – R. K. Laxman
2. My Financial Career – Stephen Leacock
3. The Power of Prayer – A. P. J. Abdul Kalam
4. Why is the Sea Blue ? – G. Venkataraman
5. The Myths of Artificial Intelligence – Attila Narin

Poetry Section :

1. Ode to Autumn – John Keats
2. The Road not Taken – Robert Frost
3. Ballad of the Landlord – Longston Hughes
4. The Wind hover – G. M. Hopkins

Grammar : Parts of Speech, Use of Articles and Prepositions, Tenses, Transformation of Sentences.

Professional : 1) Soft Skills
Communication : 2) Public Speaking
Writing Skills
1) Curriculum Vitae
2) Report writing

Distribution of Marks.

Maximum Marks : 40	Time: Three Hours
Q.1 :	There shall be five short answer questions based on prescribed prose. ....05 marks
Q. 2 :	There shall be five long answer questions based on prescribed prose, out of these students will have to answer any two questions of five marks each .....10 marks
Q. 3 :	There shall be four long answer questions based on prescribed poems. Out of these, students will have to answer any two questions of five marks each .....10 marks
Q. 4 :	There shall be five questions of one marks each, from Grammar Section-Parts of Speech, Use of articles and Prepositions, Tenses, Transformation of Sentences .....05 marks (Selection of Questions shall be at the discretion of paper setter)
Q. 5 :	There shall be one question either on Soft skills or on Public speaking 05 marks
Q. 6 :	There shall be one question either on Curriculum Vitae or on Report Writing. ....05 marks

	Total 40 marks

[Notes : 1. For additional knowledge & practice of Grammar the following books are suggested.
English Grammar Practice by Raj N. Bakshi, Publisher – Orient Blackswan Pvt. Ltd. Mumbai.]

7. MATHEMATICS

- Notes: (1) There shall be Two Papers of 60 marks each for every Semester.
 (2) There shall be FIVE units in each theory paper.
 (3) There shall be Total Six Questions in each paper. Out of these Six, there shall be One Compulsory Question (based on all five units) and Five Questions on Five units with alternative choice from the same unit.
 (4) Each question will carry 10 marks.
 (5) Each paper will have 3Hrs.duration.

Layout of Question Paper

Question No.1	Compulsory question based on all five units	10Marks
Question No. 2	Either/Or (on unit-I)	10 Marks
Question No. 3	Either/Or (on unit-II)	10 Marks
Question No. 4	Either/Or (on unit-III)	10 Marks
Question No. 5	Either/Or (on unit-IV)	10 Marks
Question No. 6	Either/Or (on unit-V)	10 Marks
Total Marks :		60 Marks

1S-Mathematics-Paper I (Algebra & Trigonometry)

- Unit I :** DeMoivre's Theorem . Roots of complex number . Circular functions. Hyperbolic function, Inverse Hyperbolic function, Relation between circular functions and hyperbolic functions. Separation of real and imaginary parts of the circular and hyperbolic functions of complex variable.
- Unit II :** Polynomial equations over R, Fundamental theorem of Algebra (Statements Only). Division algorithm of polynomials (Statement only). Remainder theorem. Factor theorem.
 Complex roots of polynomial over R occurs in pair. Relations between roots and Coefficients of general polynomial equation of one variable. Transformation of equations . Solution of cubic equation(Cordons method)Descarte's rule of signs.
- Unit III:** Symmetric, Skew Symmetric, Hermitian and Skew Hermitian matrices. Row rank, Column rank and rank of a matrix. Equivalence of row and column ranks.Eigen values, Eigenvectors and the Characteristic equation of a matrix. Cayley Hamilton theorem(Statement Only).
- Unit IV:** Equivalence relation and partitions. Order relation. Well ordering

principle (Statement only). Divisibility in the set of integers. Division algorithm (Statement only), G. C. D. and L. C. M. of two integers. Theorem on prime integers. Congruence Modulo- n .

- Unit V :** Definition of a group with examples, Simple group properties. Subgroups. Permutation groups. Even and odd permutations. Cosets, Lagrange's theorem. Cyclic Groups. Order of a generator of a cyclic group.

Reference Books:

- 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. : Complx Variables, Schaum's outline series, McGraw Hill, 1981.
- 16) Shanti Narayan : A Text Book of Matrices, S. Chand & Co., Delhi.
- 17) Dr. P.K.Mittal : Mathematics for Degrees Studnets, S.Chand & Co. Ltd. New Delhi.

1S-Mathematics-Paper II (Calculus)

- Unit I :** Definition of Limit of function, Basic properties of limits, Continuous functions and classifications of discontinuities.
- Unit II :** Differentiability, Successive differentiation, Leibnitz theorem, Indeterminate forms and L' Hospital rule .
- Unit III:** Rolle's theorem. Cauchy's Mean Value theorem, Lagrange's mean value theorem. Maclaurin and Taylor series expansion.
- Unit IV:** Partial derivatives and differentiation of real valued function of two variables. Homogeneous function. Euler's theorem on homogeneous function.
- Unit V :** Tests for concavity and convexity. Points of inflexion. Multiple points, Asymptotes, Tracing of curves in Cartesian coordinates.

Reference Books :

- 1) Ayres F.Jr.:Calculus,Schaum's Outline Series,McGraw Hill,1981.
- 2) Edwards J.:Differential Calculus for Beginners,MacMillan and Co.Ltd.1963.
- 3) Edwards J.:Integral Calculus for Biginners,AITBS,Publishers and Distributors,1994.
- 4) Greenspan D.:Introduction to Calculus,Harper and Row,1968.
- 5) Gorakh Prasad:Differential Calculus,Pothishala Pvt.Ltd.Allahabad.
- 6) Gorakh Prasad:Integral Calculus,Pothishala Pvt.Ltd.Allahabad.
- 7) Gabriel K.:Mathematical Analysis,Marcel Dekkar,Inc.New York,1975.
- 8) Jain P.K. and Kaushik S.K.:An Induction to Real Analysis,S,Chand and Co.New Delhi.2000.
- 9) Karade T.M. and Bendre S.M.:Lecturers on Calculus and Differtial Equations,Sonu-Nilu,5,Bandu,Soni Layout Gayatri Road Parsodi,Nagpur
- 10) Murray R. Spiegel:Theory and Problems on Advance Calculus,Schaum's Outline Series,Schaum Publishing Co.,New York.
- 11) Erwin,Kreyszig:Advance Engineering Mathematics,John Wiley and Sons,1999.

8. PHYSICS

There shall be one theory paper and one practical of four hour duration for each semester examination of B.Sc. Part-I (Physics).

Theory papers :

Semester-I(1S-PHY: Mechanics, Properties of Matter, Waves and

Oscillation)

Semester-II(2S-PHY: Kinetic theory, Thermodynamics and electric currents)

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

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

Total	50 marks
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- a) A student will have to perform at least ten experiments per semester.
- b) The semester examination will be of Four Hour duration and student will have to perform one experiment in the semester examination.
- c) In assignment, every student should be asked to submit the detailed report on one of experiments he or she has performed. The detailed report should include the theoretical background of the experiment.

Evaluation of the student during the semester :-

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

Record of Marks scored in the assignments during the semester

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

Signature of the teacher incharge

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

Date-wise Record of the experiments performed

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

Signature of the teacher incharge

2. Completion Certificate: is must for practical record book.

1S-PHYSICS

Mechanics, Properties of Matter, Waves and Oscillation).

UNIT-I: Kepler's laws of planetary motion, Newton's law of gravitation, acceleration due gravity, variation with altitude and depth, Gravitational field, Gravitational Potential; Gauss's theorem, gravitational potential and intensity due to uniform solid sphere at a point inside and outside the sphere.

Numericals.

UNIT-II: Motion of a Rigid body; rotational motion; moment of inertia;

Principle of Perpendicular & Parallel axes, Radius of Gyration; M.I of regular shaped bodies like ring, disc, hollow sphere, solid sphere, cylinder & bar about different axes.

Linear momentum, angular momentum, Conservation of Linear Momentum & angular momentum

Numericals.

UNIT-III: Linear S.H.M, Angular S.H.M, Differential equations and solutions.

Displacement, Velocity and acceleration, Kinetic and Potential energy.

Simple pendulum, compound pendulum, Kater's Reversible pendulum,

Spring and mass system, Vibration of a magnet, bifilar oscillations, Damped and forced harmonic oscillations, Resonance.

Numericals.

UNIT-IV: Superposition of two SHM of same frequency along the same line

Interference, superposition of two mutually perpendicular SHM of same Frequency, Lissajous figures.

Standing waves, velocity of longitudinal waves (Newton's formula)

velocity of waves by Kundt's tube, velocity of transverse waves in stretched string, harmonics and overtones.

Production and detection of ultrasonic waves and its applications. Numericals

UNIT-V: Introduction of Elasticity; Hooke's Law of Elasticity, Three Elastic constants; Relation between, Y , σ , κ and η . Bending of beam and Bending moment; Cantilever, Depression of centrally loaded beam, twisting couple, torsional pendulum; Maxwell's needle.

Numericals.

UNIT-VI: Kinematics of moving fluids; Streamline and turbulent flow, viscous drag, Coefficient of viscosity, equation of continuity; Euler's equation, Bernoulli's theorem, Poiseuille's equation, Reynold's number, Terminal velocity, Stokes' law, Variation of viscosity with temperature.

Surface tension, angle of contact and wetting, Jaeger's method Numericals

Practical:

(Every student will have to perform at least 10 experiments from the following list. At the time of examination, each student will have to perform 1 (one) experiment)

1. Study of laws of Parallel and perpendiculars axes for moment of inertia.
2. Determination of coefficient of restitution for inelastic collision.
3. Moment of inertia of fly wheel.
4. Study of compound pendulum.
5. To determine moment of inertia of a body using bifilar suspension.
6. Modulus of rigidity by Torsional Pendulum.
7. Acceleration due to gravity by Kater's pendulum.
8. Study of Oscillations of mass under different combinations of springs.
9. Young's modulus by cantilever.
10. Young's Modulus by bending of beam.
11. Modulus of rigidity by statical method.
12. Young's modulus by Vibration Method.
13. Modulus of rigidity by Maxwell's needle.
14. Coefficient of Viscosity by Poiseuille's method.
15. Surface tension by Quincke's method.
16. Determination of Surface tension by Jager's method.

Reference BOOKS : Semester 1S-PHY

1. Mechanics – Chadha T.K.
2. Waves and Oscillations – Chaudhary R.N.
3. University Physics I Mechanics of Particles waves and Oscillations – Kamal, Anwar
4. Mechanics – Shukla R.K.
5. Mechanics – Shrivastava P.K.
6. Properties of Matter – Murugesan R
7. Properties of Matter – Brijlal
8. Text book of vibrations and waves – Puri, MacMillan Publisher India Ltd.
9. Barkeley Physics course Vol. I Eno Purcell Ed. (McGraw Hill)
10. The Feymann Lectures in Physics – Vol. I, R.P.Feymann, R.B.Lighton & M. Sands
11. Mechnics & properties of matter – D.S.Mathur
12. Fundamental of Physics – Halliday & Resncik (6th edition)
13. Concepts of Physics Vol I & Vol II by H.C.Varma

9. CHEMISTRY**1S Chemistry**

(Effective from session 2010-11)

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

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

B.Sc. Part – I (Semester – I)**1S Chemistry**

Total Lectures: 84

Marks: 80

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

UNIT I: A] PERIODIC PROPERTIES:

Atomic radii (various definitions - covalent radius metallic radius, Van der Wall's radius and ionic radius) periodic trends in period and group. Ionization energy, electron affinity and electronegativity (definition, factors affecting and periodic trends). Effect of ionization energy and electronegativity properties namely metallic and non-metallic character, reactivity, oxidising and reducing properties, acidic and basic nature of oxides and hydroxides. Scales of electronegativity Pauling scale and Mulliken Scales. Electronegativity and partial ionic character of a covalent bond. [6]

Screening effect, screening constant and effective nuclear charge. Slater's rules for calculating screening constant. Problems.[2]

B] IONIC BONDING:

Definition of ionic bond, formation of ionic bond, types of cations. Factors affecting ionic bond formation (energetic of ionic bond formation ionization energy, electron affinity and lattice energy). Born Lande equation (no derivation) to calculate lattice energy. Born-Haber's cycle to determine lattice energy. Solvation and salvation energy, factors affecting salvation energy. Determination of salvation energy. Solubility of ionic solids, lattice energy and salvation energy. [6]

- UNIT II :A] S-BLOCKELEMENTS:
Comparative study of 1st and 2nd group elements with reference to electronic configuration, ionisation energy, oxidation states, reactivity and flame colouration. Diagonal relationship between Li and Mg. [5]
- B] P-BLOCKELEMENTS:
Comparative study of 13th, 14th and 15th group elements with reference to electronic configuration, ionisation energy, oxidation states. Concept of inert pair effect. Diagonal relationship between Be - Al and B - Si. Structure of diamond and graphite. Abnormal behaviour of nitrogen. Hydrides of boron-diborane preparation, properties structure and bonding. Introduction to preparation, properties, structure and applications of carbides and fullerenes. [9]
- UNIT III :
- Reactive intermediates, Mechanisms of organic Reactions and cycloalkanes.
- A] Reactive Intermediates:
Homolytic and Heterolytic fission, Carbocations, Carbanions and free radicals, their generation stability and reactions. [4]
- B] Electronic Displacements:
Inductive effect, Electromeric effect, Resonance and Hyperconjugation (definition, examples and applications of these effects). [3]
- C] Types of Reagents: Electrophiles and Nucleophiles [1]
- D] Types of Reactions: (In brief with suitable example of each)
a) Addition, b) Elimination, c) Substitution, d) Rearrangement reactions. [2]
- E] Cycloalkanes:
Nomenclature, Method of formation (3 – 6 membered rings). a) Freund's method, b) Dickmann's method. [4]
- UNIT IV :
- A] Alkenes:
IUPAC nomenclature of alkenes (with mechanism). a) Dehydration of alcohols, b) Dehydrogenation of alkyl halides. Chemical reactions of alkenes a) Electrophilic and free radical addition of HX and X₂ (with mechanism), b) Epoxidation using peracids, c) Cis-hydroxylation using OSO₄ and alkaline KMnO₄, d) Oxidation with KMnO₄, e) Polymerization. [4]

- B] Source, Nomenclature, Isomerism of Aromatic Compounds. [1]
- C] Structure of Benzene, Stability, Orbital picture of benzene, Aromaticity and Huckel's rule [3]
- D] Mechanism of Electrophilic Aromatic Substitution: Nitration, Nuclear and Side Chain Halogenation, Birch Reduction, Friedal Craft Alkylation and Acylation. [4]
- E] Orientation: Effect of substituent groups. Activating and deactivating groups. Directing influence of following groups in the light of modern electronic theory (-OH, -Cl, -NO₂, -COOH and -CH₃ groups) [2]
- UNIT V :A] Mathematical Concepts: Logarithmic relationship, Curve Sketching graphs and slopes determinations, Differentiations and integration of simple functions like ex, xn, sinx, logx etc. Significant numbers. [2]
- B] Thermodynamics: Thermodynamic terms like adiabatic and isothermal process, concept of heat and work. Statement of Zeroth law of thermodynamics and its application, First law of thermodynamics (mathematical statement only) and its limitations Need of second law of thermodynamics, Different statements of second law, Carnot cycle, Derivation of expression for the efficiency of Carnot heat engine. Carnot theorem, Concept of entropy, Physical significance of entropy, Derivation of expression for entropy change(?S) for an ideal gas in terms of pressure and temperature, and also in terms of volume and temperature, Entropy change for an ideal gas in isothermal, isobaric and isochoric process. Calculation of entropy change in phase transformation like vaporization fusion and transition. Entropy change (?S) as a criterion for spontaneity. Numericals. [12]
- UNIT VI :A] Gaseous state:
Postulates of kinetic theory of gases, Maxwell-Boltzmann distribution of velocities (only qualitative treatment), RMS velocity, Average velocity, Most probable velocity, Relationship between RMS velocity and Average velocity, RMS velocity and Most probable velocity, Mean free path, Collision diameter, Collision number or Collision frequency, Deviation of real gases from ideal behaviour, Explanation of deviations, Derivation of van der Waal's equation for real gases. Critical phenomenon, Andrew's experiment (isotherms of carbon dioxide) Critical

constant P_c , T_c , V_c in terms of van der Waal's constant (a, b)
Derivation of reduced equation of state , Law of corresponding state, Numericals. [10]

B] Liquid State:

Origin of surface tension, Definition of surface tension, Its SI unit and effect of temperature on surface tension, Derivation of expression for relative surface tension by stalagmometer method. Applications of surface tension. Viscosity, definition of coefficient of viscosity , Its SI unit and effect of temperature on viscosity, Derivation of expression for relative viscosity by Ostwald's viscometer method, Applications of viscosity.

[4]

1S Chemistry Practicals

Total Laboratory Sessions: 30

Marks: 50

UNIT I: Inorganic Chemistry Practicals 10

Laboratory Sessions

Semimicro qualitative analysis of inorganic salt mixture containing two acidic radicals of same group and two basic radicals of different groups. At least six mixtures to be given. Analysis of basic radicals to be done by using spot test reagents. Following radicals to be given carbonate, nitrite, sulphite, sulphide, chloride, bromide, iodide nitrate, silver(I), mercury(II), lead(II), copper(II), bismuth(III), mercury(I), cadmium(II), tin(II), arsenic(III), antimony(III), iron(III), chromium(III), aluminium(III), nickel(II), cobalt(II), manganese(II), zinc(II), calcium(II), strontium(II), barium(II), magnesium(II), Sulphate.

UNIT II: Organic Chemistry Practicals 10

Laboratory Sessions

A] Purification of an impure organic compound by crystallization/ Sublimation method and determination of melting point of purified sample (Five compounds) 1) Phthalic acid, 2) Acetanilide, 3) Benzoic acid, 4) Phenylthiourea, 5) Naphthalene.

Note: a) Students should report the melting point of sample before and after crystallization/ Sublimation.

b) Solvents like water, water+alcohol, Alcohol can be selected for crystallization.

B] Organic Preparations (any Five):

1. Preparation of acetanilide (Acetylation of Aniline).
2. Preparation of Benzanilide (Benzoylation of Aniline).
3. Preparation of Iodoform from ethanol or Acetone.
4. Preparation of m-di-Nitrobenzene (Nitration).
5. Preparation of tri-Bromoaniline from Aniline (Bromination).
6. Preparation of Benzoic acid from Benzamide (Hydrolysis).
7. Preparation of Semicarbazone from Acetone.

Note:

- a) Student should perform the single stage preparation with the help of given procedure.
- b) Melting point and percentage yield should be reported.
- c) The sample should be submitted.
- d) Students should recrystallize the sample with suitable solvent.
- e) Students should know the reaction and its mechanism of given single stage preparation.

UNIT III: Physical Chemistry Practical's: 10 Laboratory Sessions

Expt. 1. To determine relative coefficient of viscosity of the given liquid by Ostwald viscometer.

Expt. 2. To determine percentage composition (v/v) of the given mixture of ethyl alcohol and water by viscosity measurement.

Expt. 3. To determine surface tension of liquid by stalagmometer

Expt. 4. To determine parachor value of $-CH_2$ group by stalagmometer.

Expt. 5. To compare cleaning power of detergents by stalagmometer.

Expt. 6. To determine refractive index of the given liquid by Abbe's refractometer.

Distribution of Marks for Practical Examination.

Time: 6 – 8 hours (One Day Examination) Marks: 50

Unit – I	: Inorganic Chemistry (Exercise)	.....	12
Unit – II	: Organic Chemistry (Exercise)	.....	12
Unit – III	: Physical Chemistry (Exercise)	.....	12
	Viva-Voce	.....	07
	Record	.....	07

Total : 50

10. INDUSTRIAL CHEMISTRY (REGULAR/VOCATIONAL)

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

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

1S INDUSTRIAL CHEMISTRY (REGULAR/VOCATIONAL)

Total Lectures: 84

Marks: 80

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

UNIT-I : [14]

- A] Dimensions and Units: Fundamental and derived quantities, Interconversions of units.
- B] Mole Concept: Mole, Atomic weight, Molecular weight, Equivalent weight, Methods of expressing compositions of i) solid mixtures, ii) liquid solutions, iii) gaseous mixtures
Problems based on these.

UNIT-II : [14]

- A] Material Balance without Chemical Reactions:
Distillation, Crystallization, Evaporation, Extraction, Filtration with flow sheet diagram and Problems
- B] Material Balance with Chemical Reactions:
Stoichiometric equation, Stoichiometric coefficient, Conversion, Yield, Selectivity, Limiting and excess reactants, Problems.

UNIT-III : [14]

- A] Energy : General idea about conventional energy sources, and non-conventional Energy Sources –Solar energy, Space heating and water heating by solar energy, Production of electricity by solar energy, Tidal power, Wind energy , Biomass energy
- B] Energy Balance: Heat capacity, C_p , C_v , Molar heat capacity, Heat of reaction, formation, combustion, neutralisation, Heat of solution, Hess's law of constant heat summation. Problems based on heat of reaction, heat of vaporization, fusion and sublimation.

UNIT-IV [14]

Fuels : Classification, Units of heat and calorific value

- A] Solid fuels: Coal-Types of coal, Coal formation, Coal analysis (proximate and ultimate), Destructive distillation of coal, Coal tar distillation, uses of coal tar products, Manufacturing of coal gas and water gas.
- B] Liquid fuels: Petroleum-Origin and classification, Fractional distillation of crude oil, Cracking, Mining of petroleum, natural gases, Uses of petroleum.

UNIT-V : [14]

Heat Transfer: Fundamentals of heat transfer: Modes of heat transfer, Fourier's law, Newton's law, Stefan Boltzmann's law, Problems.

Concept of heat conduction, General heat conduction equation, Thermal conductivity, Thermal diffusivity.

Nature of heat transfer by convection, Forced and free convection, Phenomenon of pool boiling, Filmwise and dropwise condensation.

Nature of heat transfer by radiation, Absorptivity, Reflectivity, and Transmissivity, Kirchoff's law, Emissive power and emissivity, Concept of black body, Planck's law and Wien's displacement law.

Heat exchangers, Classification of heat exchangers on the basis of direction of fluid flow, U-tube heat exchanger, Kettle reboiler.

UNIT-VI : [14]

Fluid Mechanics:

Definition and classification of fluids, Types of fluid flow-Laminar and Turbulent fluid flow, Equation of continuity, Bernoulli's equation, Pipe joints and fittings, Valves and pumps, Reciprocating and centrifugal pump, Venturimeter, Orificemeter, Pitot-tube, rotameter, Manometer, Reynolds's number, Reynold's experiment.

Books Recommended:

- 1) Stoichiometry - B. I. Bhatt and S. M. Vora
- 2) Introduction to Stoichiometry - K. A. Gavane
- 3) Chemical Process Principles, Part I - O. A. Hougen, K. M. Watson, R. A. Ragatz
- 4) Unit Operation: I - K. A. Gavane

- 5) Industrial Chemistry - B. K. Sharma
- 6) A Text Book of Engineering Chemistry- S. S. Dara
- 7) Conventional and Non-conventional Energy Sources – R.C.Rai
- 8) Non-conventional Energy Sources - G.D.Rai
- 9) Principles of Physical Chemistry - Puri and Sharma
- 10) A Text Book of Physical Chemistry - P.L.Soni
- 11) Unit Operation - McCabe and Smith, McGraw Hill
- 12) Engineering Heat Transfer- Gupta and Prakash
- 13) Unit Operations II - K.A.Gavane

1S Industrial Chemistry Practical List of Experiments

UNIT – I

1. Problems based on Mass Relation.
2. Numerical Problems on Units and Conversions.
3. Preparation of Standard Solution of (Any Two)
 - i) Oxalic acid ii) Copper sulphate, iii) Potassium dichromate
4. Standardization of following Solutions (Any Two)
 - i) Potassium Permanganate ii) Sodium hydroxide iii) Sodium thiosulphate
5. Determination of moisture content in the given coal sample.
6. Determination of ash content in the given coal sample.
7. Determination of flash point and fire point of given fuel sample.

UNIT – II

1. Determination of molecular weight of given sample by Rast's method.
2. Determination of viscosity of lubricant oil by Redwood viscometer.
3. Determination of Aniline point of diesel.
4. Comparison of the calorific value of the two fuels.
5. Measurement of pressure difference between two points within pipeline, using manometer.
6. Measurement of flow rate at a particular point by Venturimeter.
7. Determination of thermal conductivity of rubber by using Lee's disc method.

Distribution of Marks for Practical Examination.

Time: 6 – 8 hours	(One Day Examination)	Marks: 50
Unit – I: Exercise No.1 (Numericals)	.....	06
Exercise No.2 (Practical Expt.)	.....	12
Unit – II: Exercise No.2 (Practical Expt.)	.....	12
Viva-Voce	.....	10
Record	.....	10

Total:		50

1I. PETROCHEMICAL SCIENCE

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

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

1S Petrochemical science

Total Lectures: 84 Marks: 80

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

UNIT I (14)

Basic concept in Petro-chemistry.

PH, Molarity, Normality, Mole, Molality, Mole fraction, Mole ratio, Parts per million (p.p.m.), Weight fraction, Vapors pressure, Calorific value, Acid, Base, Equivalent weight, Atomic weight, Molecular weight, I.P., A.S.T.M, Arrhenius constant, Avogadro's number.

Units and Conversion of: - Temperature, Pressure, Length, Weight, Residence time, Viscosity.

UNIT II (14)

Fuel and Petroleum Industry

Definition Petroleum, Fuel, Conventional and nonconventional fuel

Type of Petroleum fuel, Primary and secondary, International Petroleum Scenario, National natural gas and petroleum scenario, Petroleum refineries in India, their location, capacity, year of installation, and organization. Map of petroleum reservoir in India. Types of Natural gas, Wet, Dry, Lean gas, Associated gas, Casing head gas.

UNIT III (14)

Formation, Exploration and Drilling of Crude oil or Petroleum
 Formation:- Condition under which petroleum crude is formed, Occurrence of petroleum crude, conversion of organic matter in to petroleum crude, Theories of origin of petroleum(organic, inorganic)
 Exploration:- Of Petroleum with, Seismic method, Magnetic method, Gravity method, Electric method. Introduction to bore hole logging.
 Drilling:- Method of drilling, Cable tool drilling, Rotary drilling, Drilling fluid their function, Composition, Classification.

UNIT IV (14)

Chemistry and Composition of Petroleum
 Composition, Characteristics, Constituents of Petroleum or crude oil Types of Hydrocarbons and Non- hydrocarbons present in petroleum
 Classification of crude oil:- with Characterization factor, Correlation index, Key fraction, Method of structural group analysis

UNIT V (14)

Refinery Operation
 Field operation, Desalting, Dehydration, De-emulsification
 Necessity of the fractionation crude oil, Distillation:- introduction, Atmospheric distillation(ADU), vacuum distillation(VDU), Fractions from ADU and VDU, the range of carbon number, boiling point, and molecular weight, and details of composition of various fraction

UNIT VI (14)

Quality Monitoring of petroleum product
 Classification of Laboratory tests
 Distillation, Vapor pressure, Flash point, Fire point, Octane number, Cetane number, Aniline point, Diesel index, Calorific value,

Smoke Point, Viscosity, Viscosity index, Penetration index, Freezing point, Cloud and pour point, Drop point of grease, Melting and Settling point of wax, Gum content, acidity and alkalinity, Copper corrosion test, Density and APT, Refractive index, Conradson carbon residue(CCR).

Semester – I

1S Petrochemical Science Practical

List of Experiments:

1. Density and API gravity of Given sample
2. Acid value of Petroleum sample
3. Drop point and melting of wax
4. Viscosity by U-tube Viscometer
5. Congealing point of wax
6. Saponification value of petroleum sample
7. Flash point and Fire point of petroleum sample
8. Numerical problems on unit conversion
9. Preparation of standard solution

Distribution of Marks for Practical Examination.

Time: 6 hours	(One Day Examination)	Marks: 50
Exercise No.1 (Practical Expt.)	.....	15
Exercise No.2 (Practical Expt.)	.....	15
Viva-Voce	.....	10
Record	.....	10

		Total: 50

12. GEOLOGY

1S – Geology

UNIT-I : General Geology – Geology, Branches and scope. Origin of Earth – Nebular, Planetsmal and Tidal Hypothesis. Age of Earth – Radioactive Methods – K/Ar, Rb/Sr., U/Pb and Carbon 14 Method. Constitution of Earth – Crust, Mantle and Core.

UNIT-II: Mineralogy and Crystallography :- Definition of Mineral, Rock Forming & Ore Mineral, Physical Properties of Minerals – Colour, Streak, Lustre Habit, Cleavage, Fracture, Hardness, Specific gravity and its determination by Spring balance, Walker's balance & Jolly's balance.

Crystallography – Definition crystal, Faces, edges & Solid angle. Crystallography axes, Parameters- Weiss and Millers. Symmetry elements in seven system.

UNIT-III: Petrology – Concept of Rock Cycle - Igneous, Sedimentary and Metamorphic Rocks. Mode of Occurrence & Forms of Igneous Rock (Intrusive & Extrusive Modes, Concordant & Discordant Bodies. Textures and Structures of Igneous Rocks.

Sedimentary Rocks – Formation of Sedimentary- Weathering, Transportation and deposition, Diagenesis and Lithification. Metamorphic Rocks – Agents and kinds of Metamorphism.

UNIT-IV: Physical Geology – I : Weathering – Physical Weathering and Chemical Weathering, biological weathering. Susceptibility of Rocks & Minerals to weathering.

Geological work done by Wind and River

UNIT-V: Physical geology – II

Earthquakes – Elastic rebound Theory – Causes, Effects, Magnitude & Intensity, Seismogram and Seismograph. Location of epicentre, Classification of Earth Quake; Seismic belts of India. Volcanism :- Structure of Volcano, Products of Volcanoes. Types of Volcanic eruption, Causes and distribution of Volcanoes.

Diastrophism – Epirogenic & Orogenic movements. Evidence of uplift and Subsidence, Stages in orogenic cycle.

UNIT-VI: Paleontology & Stratigraphy –

Fossils Definition - Modes of Preservation and Importance. Index and Zone Fossils.

Physiographic Division of India. Principles of Stratigraphy and Correlation. Geological Time Scale and Stratigraphic Scale of India.

Practicals

1. Megascopic identification of common Minerals – Quartz, Microcline/Orthoclase, Biotite, Muscovite, Calcite, Hornblende, Kyanite, Talc, Gypsum, Hematite, Chromite, Chalcopyrite.
2. Megascopic identification of following rocks. Granite, Trachyte, Gabbro Basalt Sandstone, Shale, Limestone Schist, Gneiss Marble, Quartzite.
3. Study of elements of Symmetry in the Crystals from Normal Seven Classes.
4. Demarcating Physiographic division of India on outline Map.
5. Identifying Mode of preservation in fossils - Cast / Mould / Imprint etc.

Practical Examination will be of 4 hours duration and Carry 50 Marks. The distribution of marks for Practicals will be as follows.

Semester – I

A)	I	Megascopic Identification of Minerals	12 Marks
	II	Megascopic Identification of Rocks	12 Marks
	III	Symmetry Elements of Crystals	10 Marks
	IV	Physiographic Division of India	02 Marks
	V	Fossil – Modes of Preservation	04 Marks
B)		Record	05 Marks
C)		Viva-Voce	05 Marks

		Total	50 Marks.

13. BOTANY

There shall be following paper and practical for B. Sc. Part – I Semester one examination. The syllabus is based on six theory periods and six practical periods per week (Total 75 – 80 theory sessions and 25 practical sessions per complete semester). There shall be one compulsory paper of 3 hours duration, in theory as stated below and practical examination extending for 4 hours. Every examinee shall offer the following paper of 100 marks (out of which 80 marks will be for written examination and 20 marks for internal assessment) and practical examination of 50 marks. Candidates are required to pass separately in theory and practical examination.

1.	Paper – 1		Marks
	a.	Theory	- 80
	b.	Internal Assessment	- 20
2.	Practical -		50

		Total	150 Marks

1S – BOTANY

Diversity & Applications of Microbes and Cryptogams

UNIT-I : Plant Diversity (15)

- 1.1 Cyanobacteria and its impact on origin of life
- 1.2 Introduction to Plant Kingdom: Cryptogams
- 1.3 Diversity of plants with respect to habitat, form, nutrition and ecological status

- 1.4 General Account of Viruses and structure of TMV and HIV
- 1.5 Bacteria: structure, Nutrition and reproduction
- 1.6 Role of microbes in Agriculture, Medicine and Industries

UNIT-II: Algae (15)

- 2.1. Classification according to F. E. Fritsch and G. M. Smith up to classes
- 2.2. General characters of algae with reference to Habitat, Thallus organization, Pigmentation, Reserve food and Reproduction
- 2.3. General characters of following classes with special reference to examples mentioned –
 - 2.3.1. Chlorophyta - Oedogonium
 - 2.3.2. Charophyta – Chara (Thallus structure and reproduction)
 - 2.3.3. Phaeophyta – Sargassum (Thallus structure and reproduction)
 - 2.3.4. Rhodophyta – Batrachospermum

UNIT-III : Fungi (15)

- 3.1. Classification according to Ainsworth (1973)
- 3.2. General characteristics of following classes with special reference to examples mentioned –
 - 3.2.1. Mastigomycotina : Albugo (Cystopus)
 - 3.2.2. Ascomycotina : Aspergillus
 - 3.2.3. Basidiomycotina : Puccinia graminis-tritici
 - 3.2.4. Deuteromycotina : General characters
- 3.3 Lichen-Types & Economic importance

Unit-IV : Bryophyte (15)

- 4.1. Classification according to G. M. Smith
- 4.2. General characters, thallus organization and life cycle of –
 - 1.2.1. Hepaticopsida – Marchantia
 - 1.2.2. Bryopsida – Funaria
- 4.3. Evolution of sporophyte in bryophytes
- 4.4. Affinities of bryophytes with algae and pteridophytes
- 4.5. Brief Account on some Indian Bryologist.

Unit-V : Pteridophyte (15)

- 5.1. Pteridophytes as First Vascular Plants.
- 5.2. Classification according to G. M. Smith
- 5.3. General characters of the following classes with special reference to examples mentioned –

- 5.3.1. Sphenopsida – Equisetum
- 5.3.2. Filicopsida – Marsilea
- 5.4. Stele types in pteridophytes
- 5.5 Heterospory and Seed Habit in Pteridophytes

Unit-VI : Application of Microbes Cryptogams (15)

- 6.1. Economic Importance of Algae with special reference to Food, Industries, Agriculture and Harmful aspects
- 6.2. Mycorrhiza – Types and Application
- 6.3. Role of Fungi in Industries, Medicine, Food & Agriculture
- 6.4. Plant Diseases –
 - 6.4.1. Viral – TMV
 - 6.4.2. Bacteria – Black arm of cotton (Xanthomonos malvacearum)
 - 6.4.3. Fungal – Tikka disease of groundnut (Cercospora sps.)
- 6.5. Economical and Ecological Importance of Bryophytes

LABORATORY EXERCISE :**I. ALGAE**

Preparation of temporary mount, identification with reason of following algal materials-
Oedogonium, Hydrodictyon, Chara, Vaucheria, Ectocarpus, Sargassum, Batrachospermum

II. FUNGI AND PLANT PATHOLOGY

- (1) Study of following genera
Albugo, Uncinula, Penicillium, Agaricus, Puccinia, Cercospora
- (2) Study of Crustose, Fruticose & Foliose Lichen
- (3) Study of symptoms of fungal, viral, bacterial and Mycoplasmal diseases
- (4) Collection of fungal specimen & infected plant part from local region
- (6) Demonstration of Mushroom Cultivation Technology

III. BRYOPHYTES

Study of external and anatomy features of vegetative and reproductive parts of following genera – Marchantia, Anthoceros, Funaria, Polytrichum and Sphagnum

IV. PTERIDOPHYTES

Study of Pteridophyte external and anatomy features of vegetative and reproductive parts of following genera –Lycopodium,

Equisetum, Osmunda, Selaginella, Adiantum, Marsilea and any one fossil specimen

Note:

1. Omit the details of development of sex organs and sporophyte.
2. Botanical excursion (Two local and one outside the state is compulsory)
3. Common algal, fungal, pathological, bryophytic and pteridophytic collection and excursion report must be submitted at the time of practical examination.

BOOKS RECOMMENDED

1. Dube, H. C. (1990). An Introduction to Fungi. Vikas Pub. House Ltd. New Delhi.
2. Gangulee, H. C. and Kar, A.K. (2001). College Botany Vol. II. Books and Allied Press Ltd. Kolkata.
3. Krushnamurthy, K. V. (2007). An advanced Text Book on Biodiversity: Principles and Practice. Oxford and IBH Publishing Kumar, H.D. (1988). Introductory Phycology. Affiliated East-West Pres Ltd. New Delhi.
4. Kumar, H. D. and Singh, H.N. (1976). A Text Book of Algae. Affiliated East-West Pres Ltd. New Delhi.
5. Mehrotra, R. S. and Aneja, C.R. (1990). An Introduction To Mycology, Wiley Eastern Ltd. NewDelhi.
6. Pandey, B.P. (1994). A Text Book of Botany-Algae. S.Chand and Co. Ltd. New Delhi.
7. Pandey, S.N. and Trivedi, P.S. (1997). A Text Book of Botany Vol. II , Vikas Publishing House (P.) Ltd. New Delhi.
8. Pandey, S.N. and Trivedi, P.S. (1997). A Text Book of Botany Vol. I , Vikas Publishing House (P.) Ltd. New Delhi.
9. Pandey, S.N., Trivedi, P.S. and Mishra, S.P. (1995). A Text Book of Alage, Vikas Publishing House (P.) Ltd. New Delhi.
10. Parihar, N.S. (1977). Biology and Morphology of Pteridophytes. Central Book Depot, Allahabad.
11. Parihar, N.S. (1984). An Introduction To Embryophyta Vol. I Bryophyta. Central Book Depot, Allahabad
12. Rashid, A. (1996). An Introduction To Bryophyta. Vikas Publishing House Ltd. New Delhi.
13. Saxena, A.K. and Sarbhai, R.M.(1992). A Text Book of Botany Vol.II Embryophyta. Ratan Prakashan Mandir, Agra.
14. Sharma, O.P. (1989). A Text Book of Fungi. Tata Mc Graw-hill Publishing Company Limited, New Delhi.
15. Sharma, O.P. (1990). A Text Book of Algae. Tata Mc Graw-hill Publishing Company Limited, New Delhi.
16. Smith, G.M. (1995). Cryptogamic Botany. Vol. II (Bryophytes and Pteridophytes). Mc Graw-Hill Book Company, New York and London.
17. Sporne, K.R. (1995). The Morphology of Pteridophyta. The Hutchinson University Library, London, U.K.
18. Varma, P. S. and Agrawal, V. K. (2000). Cell Biology, Genetics, Molecular Biology, Evolution and Ecology. S. Chand and Company (P.) Ltd. New Delhi.
19. Vashistha, B.R. (1997). Botany For Degree Students-Bryophyta. S. Chand and company (P.) Ltd. New Delhi.
20. Vashistha, P.C. (1984). Pteridophytes. S. Chand and company (P.) Ltd. New Delhi.
21. Sharma, P.D. (1998). The Fungi. Rastogi Publications, Merrut.
22. Smith, G.M. (1995). Cryptogamic Botany. Vol. I (Algae and Fungi). McGraw-Hill Book Company, New York and London.
23. Vashistha, B.R. (1995). Botany for Degree Students-Algae. S. Chand and Company (P.) Ltd. New Delhi.
24. Vashistha, B.R. (1995). Botany for Degree Students-Fungi (9th Ed.) S. Chand and company (P.) Ltd. New Delhi. 7
25. Pandey Dr.B.P., Botany for Degree Students, S.Chand & Co. Ltd. New Delhi.
26. Modern Practical Botany Volume-I, Dr.P.B.Pandey, S.Chand Pub., N. D.
27. Modern Practical Botany Volume-II, Dr.P.B.Pandey, S.Chand Pub., N. D.
28. Modern Practical Botany Volume-III, Dr.P.B.Pandey,S.Chand Pub., N. D.

B. Sc. I : Semester – I**Practical Schedule**

Time : 4 hours	Marks : 50
Q1: Temporary mount and identification of given algal form (any two)	10
Q2: Temporary mount and identification of given fungal form (any two)	10
Q3: Salient features and identification of bryophytic material	05
Q4: Salient features and identification of pteridophytic material	05
Q5: Spotting (Algae, Fungi, Bryophyte, Pteridophyte, Pathology)	10
Q6: Viva-voce and Practical Record	05
Q7: Excursion Report	05

14. ENVIRONMENTAL SCIENCE**1S Environmental Science****(CONCEPTS OF ENVIRONMENTAL SCIENCE)**

- UNIT - I. Fundamentals of Environmental Science – Definition, scope, principles and environmental ethics.
Components of Environment: Atmosphere - Definition, structure and composition.
Hydrosphere – Definition, distribution of water, hydrological cycle, and global water balance.
Lithosphere - Definition, internal structure of earth. Rocks - types and their formation.
Biosphere - Definition, boundaries of biosphere.
(Lectures-14)
- UNIT – II. A. Natural Resources- Definition, classification.
a). Water Resources (Freshwater) - types, availability, demand utilization and conservation.
b). Forest resources - Distribution, Indian types, utilization and conservation.
c). Mineral resources – types, availability, distribution, utilization and conservation.
B. Soil - Definition, composition, formation, soil profile. Humus – significance and role.
(Lectures-14)
- UNIT – III. Environmental meteorology-I.
Solar radiation - concept of insolation and heat budget.
Temperature – Horizontal distribution, lapse rate, temperature inversion. Humidity -definition and types.
Wind - origin and Earth's surface wind system (doldrums, trade wind belt, prevailing westerlies, and polar easterlies).
(Lectures-14)
- UNIT – IV. Environmental meteorology-II.
Atmospheric pressure, Vapor pressure, saturated vapor pressure, concept of fog.
Clouds- definition, formation and types.
Precipitation- types (orographic, convectional, cyclonic), forms of precipitation (rain, drizzle, sleet, hail, snow).
Monsoon- Meaning origin, Indian monsoon (Bay of Bengal branch and Arabian Sea branch) and significance.

El-Nino- concept and mechanism.

(Lectures-14)

- UNIT – V. Environmental Geosciences.
a. Climatic types and their distribution - Tropical Rainforest, Savanna, Taiga and Tundra with respect to their temperature, wind pattern, precipitation and vegetation.
b. Geological hazards- Earth quakes, Floods, Volcano's, Cyclones (causes, distribution types and effects).
(Lectures-14)
- UNIT – VI Marine Environment
a. Introduction to Marine Environment- zonation in the sea, physic-chemical properties, (viscosity, temperature, light penetration, salinity, CO₂, O₂).
b. Oceanic movements- waves, tides, oceanic currents (origin and types). Tsunami- origin and effects.
c. Marine Resources – Food, medicinal, mineral, ornamental, petroleum deposits.
(Lectures-14)

Note-

Visit to:

1. Meteorological Station
2. Ecosystem- Forest / pond / River.
3. Land slide/ Rock fall/ Flood affected areas.

BOOKS FOR REFERENCE:

1. Physical geography by Savendra Singh
2. Climatology by S.K. Lal
3. Climatology by Savendra Singh.
4. Environmental Geology by K.S. Waldia.
5. Engineering and general Geology by Parbin Singh
6. Physical Geology by P.K. Mukharji.
7. Fundamentals of Ecology by E.P. Odum.
8. A Text book of Ecology and Environment by P.C. Joshi and Namita Joshi, Himalaya.
9. Environmental Science, Danial Botkin and Edward Keller. John Wiley and Sons, New York (1997).
10. Environmental Geography by Savendra Singh.
11. A Text Book of Marine Ecology by Balkrushnan Nair .

12. Environmental Biology by Verma and Agrawal.

PRACTICAL - I

PRACTICAL COURSE FOR B.Sc. PART- I, SEMESTER-I

(Environmental Science)

- A) Experiments on water analysis.
1. Measurement of pH. Determination of
 2. Measurement of electrical conductivity.
 3. Determination of total Hardness.
 4. Determination of dissolved Oxygen.
 5. Determination of alkalinity.
 6. Determination of free CO₂.
 7. Determination of turbidity.
- B) Experiments on Soil and rocks and minerals.
1. Determination of soil temperature.
 2. Determination of soil moisture by tensiometer.
 3. Determination of soil bulk density.
 4. Determination of soil texture by sieve method.
 5. Determination of soil electrical conductivity.
 6. Determination of soil pH.
 7. Determination of soil acidity
 8. Determination of soil organic content.
 9. Determination of soil calcium carbonate.
 10. To study the properties of rocks and minerals (Streak, lusture, texture hardness, color etc.).
- C) Experiments on meteorology.
1. Measurement of humidity and relative humidity.
 2. Measurement of light intensity at different time.
 3. To monitor wind speed and direction.
 4. Measurement of rain fall.
 5. Observation of clouds.
- D) Spottings.
1. Rocks and minerals.
 2. Observations and comments on meteorological instruments.
 3. Economically important plants of forest origin (medicinal, timber yielding, fiber yielding, resinous and other).

EQUIPMENTS:

1. pH meter
2. Conductivity meter.
3. Anemometer & wind vane.
4. Sieves.
5. Psychrometer (Dry-wet bulb thermometer).
6. Rain gauge.
7. Hygrometer.
8. Turbidimeter.
9. Lux meter.
10. Soil thermometer
11. Tensiometer

DISTRIBUTION PF PRACTICAL MARKS

Time : 4 hrs.

Q.1	Experiment on water analysis-----	10
Q.2	Experiment on soil analysis-----	10
Q.3	Experiment on meteorology-----	08
Q.4	Spotting (any four)-----	08
Q.5	Tour Diary-----	04
Q.6	Practical record-----	05
Q.7	Viva-voce-----	05

TOTAL 50

15. SEED TECHNOLOGY (VOCATIONAL)

There shall be one theory paper of 80 marks and practical examination of 50 marks for each semester. Duration of theory paper shall be 3 hours and practical examination shall be of 4 hours .

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

One on job training of one month duration shall be compulsory for each semester.

IS-Seed Technology

SEED DEVELOPMENT, SEED PHYSIOLOGY AND INTRODUCTION TO PLANT BREEDING

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 Harvestable maturity.
 Peroxidase test , GA3 test , RFLP
 Classification of fruits
 Use and limitation of laboratory techniques .
 Biochemical methods , elctrophoresis , phenol colour
 Sequential approach in testing .
- UNIT II 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 III Respiratory pathways during germination.
 Enzymatic activities during germination.
 Germination stimulators and inhibitors .
 Dormancy and ecological implications.
 Organic dormancy , Hardseededness.
 Causes of dormancy and its breakage.
 Seedling establishment and role of endosperm and embryo size on seedling establishment.
 Seed deterioration during storage , factors affecting physiological changes , its implications on seed quality
- UNIT IV Seed vigour ,its measurements and crop productivity .
 Invigoration treatment to improve seedling establishment and its effect planting value .
 Treatments to minimize 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 , scop and limitations.
 Seed pelleting and coating artificial seed production (synthetic seeds)
- UNIT V Major families of dicotyledons and monocotyledons
 Flower structure , megasporangium , female gametophyte development .
 Microsporangium , male gametophyte development .
 Pollination , Autogamy , Allogamy
 Polyembriony .
 Apomixis
 Testing for cultivar genuineness ; Objectives , General principles and methods .
 Morphology of seeds for varity identification .
 Varity descriptors ; importance in varity release System, DUS system .
 Grow out test in cotton .
 General Introduction to plant breeding
 Definition , history , nature , scope , objectives .
- UNIT VI 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 sterlity,
 Types of sterlity cytoplasmic , genetic, cytoplasmic genetic .
 Utility of male sterlity in hybrid seed production .
 Definition of incompatibility ,Morphological, enetic and biochemical basis of self incompatibility
 Utility of self incompatibility
 Use of chemical hybridising agents .

PRACTICALS

SEED DEVELOPMENT, SEED PHYSIOLOGY AND INTRODUCTION TO PLANT BREEDING.

1. Morphology of dicot seeds .
2. Morphology of monocot seeds
3. Seedling morphology and adult plant morphology in some major crops for identification in green house expt .
4. Phenol test in wheat and paddy .
5. Peroxidase test ,2-4D test .
6. GA test in wheat and other crops
7. Electrophoresis NaOH Test .
8. Factors affecting germination Temperature , Moisture Substratum light pattern of water absorption (starchy /protein and oil)
9. Dormancy behaviour and its release Hardseededness .
10. Seed leachate conductivity test .
11. Quick viability test .
12. Accelerated ageing test .
13. Invigoration treatments .
14. Meristem culture .
15. Cytological techniques for the study of chromosomes in plants.
16. Hybridization techniques .

PRACTICALEXAMINATION

Distribution of marks

1. Identification and classification of seeds (monocot and dicot seeds)	7
2. Phenol test in wheat .	7
3. Seed test (Peroxidase test , GA test) any one .	7
4. Identify describe specimen A , B ,C , and D giving reasons . (Flower ,Pollination, Embryology slides or models) .	8
5. Submission of visit reports .	7
6. Specimen collection and viva voce .	7
7. Record book .	7
Total Marks	50

Books Recommended

1. The embryology of angiosperms , Bhojwani ,S .S. and Bhatnagar, S. P.Physiology of seeds Crocker,W and Barton, L .V.
2. Principles of seed science and Technology LO Copeland Business publishing Co .,USA
3. Viability of seeds EH Roberts .
4. Germination of seeds Mayer and Poljakoff Mayber .

5. Seed biology Vol. I and 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 .1960Principles of plant breeding John Willey and Sons INC, Newyork .
9. Chandrasekharan S N and Partha sarthy , S V.1960 Cytogenetics and plant breeding P. Vardachary andCo. Madras .
10. Choudhary H K 1971 Elementary principles of pant breeding. Oxford and IBH . Publishing Co New Delhi
11. Choudhary R C .1982. Introduction to plant breeding Oxford and IBH Publishing Co. New Delhi .

16.ZOOLOGY

There shall be following paper and practical for B.Sc.Part-I Semester One examination. The syllabus is based on 6 theory periods and six practical periods per week (Total 75-80 theory Sessions and 25 practical sessions during the complete semester). There shall be one compulsory paper of 3 hours duration, in theory as stated below and practical examination extending for four hours. Every examinee shall offer the following paper of 100 marks, (Out of which 80 marks will be for written examination and 20 marks for internal assessments) and practical examination of 50 marks. Candidates are required to pass separately in theory and practical examination.

		Marks
1)	Paper-I: Life and diversity of Non-Chordata...	
	Theory (Written)	..... 80
	Internal assessments	..... 20
2)	Practical:	..... 50
Total :		150 Marks

1S-ZOOLOGY

LIFEAND DIVERSITY OFNON-CHORDATA

- UNIT-I : 1. Classification of Non-Chordata.
2. Phylum Protozoa: General characters.
 3. Type study: Plasmodium vivax: Structure, Life-cycle.
 4. Parasitic protozoan and human diseases': Malaria, Amoebiasis, Trypanosomiasis, Leishmaniasis .

- UNIT-II: 1. Phylum Porifera: General Characters.
 2. Type study: Scypha: Habits and habitat, External features, cell types, spicules & Structure and significances of canal system.
 3. Phylum Coelenterata: General Characters,
 4. Type study: Metridium: Habits and habitat, External features, Gastro-vascular cavity, Mesenteries, Reproduction.
- UNIT-III: 1. Phylum Platyhelminthes: General Characters.
 2. Type study: Fasciola hepatica: Habits and habitat, External features, Digestive, Excretory, Reproductive system and Life cycle.
 3. Phylum Aschelminthes: General Characters.
 4. Type study, Ascaris lumbricoides: Habits and habitat, External features, Digestive, Excretory, Reproductive system and Life cycle.
- UNIT-IV: 1. Phylum Annelida: General Characters.
 2. Type study: Leech: External features, Digestive, Excretory and Reproductive system.
 3. Phylum Arthropoda: General Characters
 4. Type study: Cockroach: Habits and habitat, External features, Digestive system, Respiratory system, Reproductive system.
- UNIT-V 1. Phylum Mollusca: General Characters.
 2. Type study: Pila globosa: Habits and habitat, External features (Shell and Body), Digestive, Respiratory and Reproductive system.
 3. Phylum Echinodermata: General Characters.
 4. Type study: Asterias: Habits and habitat, External features, Digestive system, Water vascular system,
- UNIT-VI 1. Phylum Hemichordata: General Characters, Body organization of Balanoglossus, Affinities of Balanoglossus, with non-Chordata, and Chordata.
 2. Corals, coral-reefs.
 3. Parasitic adaptations in Helminthes: Morphological and physiological
 4. Larval forms and their significance: Amphiblastula, Planula, Trochophore, Bipinnaria, Brachiolaria,

Two practical per week each of 3 period's duration. The Examination shall be of 4 hrs duration and of 50 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: Fasciola, Taenia, Ascaris (male & female).
 - Phylum Annelida: Nereis, Earthworm, Leech, Aphrodite
 - 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 and fasciola through gonads, T.S.Leech through crop, T.S.Cockroach gizzard, Compound eye of insect, T.S.Arm of Asterias, T.S.Balanoglossus through different body regions. Larval forms; Amphiblastula, Planula, Trochophore, Bipinnaria, Brachiolaria
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, nerve ring, spermatheca, ovary.
 - Pila: Radula, osphradium, and gill lamella.
 - Cockroach: Mouth parts, Salivary gland, trachea. Spiracle, gizzard.

Distribution of Marks during Practical Examination:

Time : 4 hrs.

- | | | | |
|------|---|-------|----------|
| i) | Identification and comments on spots
(1-8) - 4 specimens, 4 slides | | 12 Marks |
| ii) | Dissection | ..... | 10 Marks |
| iii) | Permanent stained micro preparation. | ..... | 8 Marks |

iv)	Study tour diary -	4 Marks
v)	Permanent stained micro preparation Submitted by examinee -	4 Marks
vi)	Certified class record and animal collection -	5Marks
vii)	Check-list of (20) locally available invertebrate fauna	2Marks
vii)	Viva-voce-	5 Marks

Total :- 50 Marks

Note:

- One or two short excursion / study tours are compulsory for the collection and observation of animals in their natural habitat.
- 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 bonafiede work of the Candidate.
 - Ten permanent stained micro preparations.
 - Study tour report or field diary duly signed by the teacher.
 - Check list of locally available faunal diversity.

Reference Books Recommended (All latest editions):

- Hickman, C.P. Jr.F.M. Hickman and L.S.Roberts, Integrated principles of Zoology Mosby College publication St.Louis.
- Ayyar, E.K. and T.N.Ananthkrishnan, Manual of Zoology Vol.I (Invertebrata), Part-I & II S. Viswanathan (Printers and Publishes) Pvt. Ltd. Madras.
- Jordan, E.L. and P.S.Verma Invertebrate Zoology, S.Chand and Co., Ltd. Ram Nagar, New Delhi.
- Parker and Haswell, Text book of Zoology, Vol. I (Invertebrata), A.Z.T.B.S. Publishers and Distributors, New Delhi – 110051.
- Waterman, Allyn J. etal., Chordate structure and Function, Mac Millan and Co Newyork.
- S.N.Prasad : Text Book of Invertebrate Zoology.
- Vishwanathan : Invertebrate Zoology.
- Majpuria : Invertebrate Zoology.
- Dhami and Dhami : Non-chordate Zoology.
- Baini Prasad: Indian Zoological memoir. Pila.
- R.L.Kotpal : Modern Text Book of Invertebrate Zoology.

- Malviya M.K. Invertebrate Zoology, by Rajdhool publications.
- S.S.Lal, Practical Zoology, Invertebrate.
- Bhamrah H.S.and Kavita Juneja A text book of Invertebrate Zoology, Anmol Publication Pvt. Ltd., New Delhi.
- Verma and Agarwal Practical Zoology, Invertebrate
- Barnes R.D. Invertebrate Zoology -(W.B. Saunders Co.)
- P.G.Puranik and Thakur, Invertebrate Zoology.

17. INDUSTRIAL FISH AND FISHERIES

(vocational)

There shall be a following paper and practical for B.Sc.Part-I Semester One examination. The syllabus is based on 6 theory periods and six practical periods per week (Total 75-80 theory periods and 25 practical during the complete semester). There shall be one compulsory paper of 3 hours duration, in theory as stated below and practical examination extending for four hours. Every examinee shall offer the following paper of 100 marks, (Out of which 80 marks will be for written examination and 20 marks for internal assessments) and practical examination of 50 marks. Candidates are required to pass separately in theory and practical examination.

		Marks
1)	Paper-I: FISH BIOLOGY	
	Theory (Written)	80
	Internal assessments	20
2)	Practical:	50
Total :		150 Marks

1S- INDUSTRIAL FISH AND FISHERIES

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, prawn, crab, lobster, bivalve, gastropod and cephalopods of India. |
| UNIT II | 1. External morphology of commercially important species of Elasmobranch, Teleost of India , |
| | 2. Anatomy of Digestive system and associated structures. |
| | 3. Anatomy of Respiratory system |

- 4 Accessory Respiratory organs.
- UNIT III 1 Anatomy of circulatory system..
2. Anatomy of excretory system..
3 Excretion & osmoregulation in marine & freshwater fish
- UNIT IV 1. Anatomy of nervous system and sense organs.
2. Lateral line receptors, Electric organs
3. Sound Producing organ.
4. Food and feeding habits of F.W.fish, Marine fish, prawn,crab, lobster, bivalve, gastropod and cephalopods.
- UNIT V 1.. Sexual dimorphism.
2. Anatomy of Reproductive system.
3. Fecundity and its estimation; Fecundity in relation to length, weight, age and food supply.
4. Spawning and factors affecting spawning.
5. Types of eggs, pre-embryonic and post embryonic development in major carps.
- UNIT VI 1. Qualitative and quantitative estimation of food consumption: Experimental estimation of food consumption: Experimental studies and stomach content analysis.
2. Nutrition in fishes and utilization of food, seasonal changes in food, availability of food, food preference, feeding intensity.
3. Fish migration.
4. Social behavior of fish aggregation and shoaling.

PRACTICALS

- External morphology and morphometrical study of a fish, prawn, crab, Lobster, bivalve and Cephalopod.
- Methods of collections, handling, identification and preservation of above animals for taxonomic purposes.
- Identification of commercially important F.W. and Marine fishes, prawns, crabs, bivalves and cephalopods of India.
- Preparations of wet and dry mounts, wax and plaster castings of fish. Aizarine Preparations and study of skeleton of Teleosts.
- * 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.

- Permanent stained mounting of statocysts in prawn, scales, and intestinal parasite of fishes.
- Sexual dimorphism in fishes.

Note: Study tour will be compulsory for observation and collection of fishes, prawns, crabs, mollusks during first semester which will be treated as a part of “on the job training” Collection and field dairy are to be submitted at the time of practical examination.

PRACTICALS EXAMINATION

Distribution of Marks.

- | | |
|---|-------------|
| 1. Identification and comments on given specimens 1 to 5 | — 10 Marks |
| 2. Identification of a given species of fish by morphometric study. | — 10 Marks. |
| 3. Dissection | — 10 Marks. |
| 4. Permanent stained micro-preparation | — 5 Marks |
| 5. (a) Viva voce | — 5 Marks |
| (b) Record book and Permanent slide submitted | — 5 Marks |
| (c) Field dairy | — 3 Marks |
| (d) Collection | — 2 Marks |
| Total : | 50 Marks |

18. BIOLOGICAL TECHNIQUES AND SPECIMEN PREPARATION (VOCATIONAL)

There shall be a following paper and practical for B.Sc. Part-I Semester one examination. The syllabus is based on 6 theory periods and six practical periods per week (Total 75-80 theory periods and 25 practical during the complete semester). There shall be one compulsory paper of 3 hours duration, in theory as stated below and practical examination extending for four hours. Every examinee shall offer the following paper of 100 marks, (Out of which 80 marks will be for written examination and 20 marks for internal assessments) and practical examination of 50 marks. Candidates are required to pass separately in theory and practical examination.

	Marks
1) Paper-I: CAPTURE FISHERIES	
Theory (Written)	..... 80
Internal assessments	..... 20

2) Practical:	..... 50
Total :	<hr/> 150 Marks

1S - Biological Techniques and Specimen Preparation

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, Focusing problems.
UNIT-II	Haemocytometer :Neubaur's chamber for RBC and WBC counting and other uses. Camera Lucida - Construction and functions. Collection and fixation of materials for permanent slides: Fixation, Types of fixatives. Culture of protozoan-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.
UNIT-III	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 balsm and DPX, sealing agents.
UNIT-IV	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-V	Organs and tissues commonly used in the classroom, Scales of fishes (Placoid, Rhomboid, Cycloid and Ctenoid), Ampulla of Lorenzini, Oral hood of Amphioxus, Pecten in birds, skin,. Preparation of Skeletons,, (Fish/Amphibian/Reptile/Bird/Mammal).

Preparation of liver, pancreas, tongue intestine, stomach, thyroid, kidney, gonads striated muscles, cartilage, squamous epithelium, Bone, of frog and rat.

UNIT-VI	Preparation of 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,. Special staining method- Giant chromosomes and their staining; Staining for glycogen, and proteins, Silver staining. Taxidermy-stuffing of animals (fish, Reptile, Bird and a mammal). Preparation of resin embedded specimens. Alizarine preparation. Preparation of charts. Preparation of transparencies slides.
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PRACTICALS

1. Use and maintenance of microscopes. Light compound and dissecting microscopes, Stereoscopic microscopes, Binocular microscopes.
2. Preparation of Stains: Eosin, 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. Microtomy: Preparation of Zoological permanent microslides (Histological)
6. Preparation of Sterile culture media : Solid/Liq. Cultures of some protozoans and their maintenance.
7. Counting of cells by Haemocytometer .growth curve.
8. Use of ocular and Stage micrometer scales for measurement of micro objects.
9. Preparation of zoological museum specimens: Including life cycles.
10. Preparation of Zoological whole mounts.
11. Collection and preservation of Zoological materials for anatomical & cytological studies.
12. Dissection and display of dissected specimen.

Practical Examination

Distribution of marks

(50 Marks)

- | | | |
|-----|---|-----------|
| Q1. | Dissection and its display with proper labeling. | 10 marks. |
|-----|---|-----------|

Q2.	Permanent stained micropreparation		
	Or		
	Double stained preparation	.....	8 marks
Q3.	blood smear by using nuclear stains.	.....	7 marks
Q4.	Counting of blood cells by haemocytometer	.....	10 marks
	Or		
	Measurement of micro-objects by coulometer		
Q5.	Submission of Zoological museum specimens, skeletons, Models, charts, (At least 3 different types) are to be Submitted at the time of examination.	.....	5 marks
Q6.	Practical record	.....	5 marks
Q7	viva voce	.....	5 marks
	Total :		50 Marks

19. STATISTICS

The examination in Statistics of First & Second semester will comprise of one theory paper each, internal assessment and practical examination. Theory paper will be of 3 Hrs. duration and carry 80 marks. The internal assessment will carry 20 marks. The practical examination will be of 4 hours duration and carry 50 marks.

The Distribution of marks for practical will be as follows :

1.	Practical record-----	08 Marks
2.	Practical Viva Voce-----	12 Marks
3.	Practical problems-----	30 Marks

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

The college imparting instructions in Statistics should provide 12 digit desk model electronic calculators to the every student for practical work.

1S STATISTICS

UNIT I: Introduction to Statistics:

- 1.1 Meaning of statistics as Science, its importance and limitations.
- 1.2 Scope of Statistics : In the field of Industry, Biological Sciences, Medical Sciences, Agricultural Sciences, Management Sciences, Education and Psychology.

- 1.3 Statistical Organizations in India and their functions : CSO, NSSO, IIPS, ISI.
- 1.4 Types of Data : Qualitative and Quantitative data, nominal and ordinal data, discrete and continuous data, frequency and non-frequency data.
- 1.5 Primary and Secondary Data and its major sources.
- 1.6 Types of Scales : Nominal, ordinal, ratio and interval.

UNIT II : Presentation of Data :

- 2.1 Classification : Rules of Classification and its types.
- 2.2 Tabulation : Meaning of Tabulation & its types, construction of tables with one or more factors.
- 2.3 Frequency Distribution : Discrete and continuous frequency distribution, cumulative frequency distribution, ogive curves.
- 2.4 Central Tendency : It's concept and its measures (A.M., weighted A.M., median, mode, G.M., H.M.) with its merits and demerits.
- 2.5 Properties of A.M., relation between mean, mode and median, relation between A.M., H.M., G.M.
- 2.6 Partition values : Quartiles, deciles and percentiles.

UNIT III : Measures of Dispersion, Skewness and Kurtosis :

- 3.1 Range, Quartile deviation, mean deviation and its coefficients.
- 3.2 Standard deviation, root mean square deviation, variance and various formulae for calculating variance, C.V.
- 3.3 Moments : Raw moments and central moments with its relationship, effect of change of origin and scale on moments.

UNIT IV : Theory of Probability :

- 4.1 Permutation and combination theory, Binomial theorem.
- 4.2 Algebra of Events.
- 4.3 Concept of probability, Definitions of – (i) Random experiment, (ii) Trial and Events, (iii) Exhaustive event, (iv) Favourable event, (v) Equally likely event, (vi) Mutually exclusive event, (vii) Independent event & complementary event.
- 4.4 Classical and Statistical Probability with its limits, simple numerical problems on probability.
- 4.5 Sample space, discrete sample space (finite & countably infinite), Axiomatic probability, simple theorems on probability with additive and multiplicative law of probability.
- 4.6 Conditional probability, Independent events and Bayes theorem.

UNIT V : Random Variables and Mathematical Expectations:

- 5.1 Concept of random variable & its illustration by examples. Discrete and Continuous random variables.
- 5.2 Probability distribution of a r.v., discrete and continuous distribution function, properties of distribution functions, simple numerical problems on probability distribution .
- 5.3 Mathematics expectations and its properties. Numerical problems on expectations.
- 5.4 Expectation of discrete and continuous r.v., expectation of a linear combination of r.v., variance of a r.v. covariance and its properties.

UNIT VI: Generating functions & Bivariate Distributions :

- 6.1 Probability generating function, moment generating function, relation between p.g.f. and m.g.f., properties of m.g.f.
- 6.2 Cumulant generating function and their properties.
- 6.3 Bivariate probability distributions (discrete and continuous), joint, marginal and conditional probability mass functions.
- 6.4 Marginal distribution functions, joint density function, marginal and conditional density functions.
- 6.5 Stochastic Independence, numerical problems on bivariate, marginal and conditional functions.
- 6.6 Addition and multiplication theorem of expectation.

List of Practicals : (1S Statistics)

1. Presentation of data by frequency table.
2. Calculation of arithmetic mean, median and mode for grouped and ungrouped frequency distributions.
3. Calculations of harmonic mean and geometric mean for grouped and ungrouped data.
4. Calculations of partition values as deciles, quartiles and percentiles.
5. Calculation of range, mean deviation and quartile deviation with its coefficients.
6. Calculation of standard deviation and coefficient of variation for grouped and ungrouped data.
7. Problems on calculations of moments (upto third order)
8. Problems on skewness and kurtosis.
9. Evaluation of probabilities using addition theorem.
10. Evaluation of probabilities using multiplication theorem.
11. Problems on conditional probability.
12. Determination of probability distribution of discrete random variables.

13. Determination of mathematical expectation and variance for discrete and continuous r.v.
14. Computation of covariance between two variables.

Note : The practicals numbered 2, 4 and 6 may be performed on MSEXCEL.

References for 1S and 2S (Statistics) :-

- (1) Brase and Brase : Understandable Statistics.
- (2) J.Medhi : Statistical methods, an introductory text.
- (3) S.C.Gupta and V.K.Kapoor : Fundamentals of mathematical statistics, Sultan Chand and Sons.
- (4) Bhat B.R., Srivenkatramana T. and Rao Madhava K.S. (1997) : Statistics-A beginners Text Vol.-II, New Age International Pvt. Ltd.
- (5) Goon A.M., Gupta M.K., Das Gupta B. (1999) : Fundamentals of Statistics, Vol.-I & II, World Press, Calcutta.
- (6) D.N.Elhance : Fundamentals of Statistics
- (7) Spiegel M.R. (1967) : Theory and Problems of Statistics, Schaum's Publishing Series.
- (8) Croxton F.E., Cowden D.J., and Kelin S. (1973) : Applied general Statistics, Prentice Hall of India.
- (9) S.C.Gupta : Fundamentals of Mathematical Statistics, S.Chand Publication.
- (10) B.L.Agarwal : Programmed Statistics, New Age International Pvt. Ltd., New Delhi.

List of Equipments and Instruments required for a Batch of Students in U.G. Statistics Laboratory :-

(1)	Twelve digit desk model electronic calculators	20
(2)	Biometrika tables Vol.-I & II	02
(3)	Seven figure logarithmic tables	10
(4)	Statistical tables (compiled)	10
(5)	Random Number Tables	10
(6)	Personal Computer with Printer	05
(7)	Statistical Poster and chart.	02

20. COMPUTER SCIENCE

OR

20. COMPUTER APPLICATION

OR

20. INFORMATION TECHNOLOGY

The examination in Computer Science will comprise One theory Paper and Practical examination for each semester. The theory paper will be of 3 Hours Duration and carry 80 marks. The Practical examination will be of 4 Hrs duration and carry 50 marks.

The distribution of marks in Practical examination is given as. :

- | | | |
|----|--|------------|
| 1) | Program writing / execution (on group A & B) | : 30 marks |
| 2) | Practical / Record | : 10 marks |
| 3) | Viva-voce | : 10 marks |

Total 50 marks

1S : Computer Science or Computer Application or Information Technology Paper-I Computer Fundamentals and C Programming

- UNIT-I: Introduction to Computers :
Characteristics, classification of Computers, block diagram of computer, memory and their types: Primary and secondary memory . Peripheral devices : Keyboard, mouse, scanner, printers : Impact, Non-impact, DMP, inkjet , Laser.
- UNIT-II: Introduction to OS :
DOS : Booting process, formatting, directory structure, FAT.
Internal DOS commands : REN, CD, MD, RD, DIR, DEL, COPY, TYPE, DATE, TIME, COPYCON, PROMPT External commands: FORMAT , XCOPY, CHKDSK, PATH, ATTRIB, AUTOEXEC. BAT, CONFIG.SYS Windows : Introduction, features, Windows Explorer Number system : Decimal, binary, octal, hexadecimal and their conversions, ASCII Code.
- UNIT-III: Introduction to Internet : Direct, Types of Internet connection: Direct dial-up, broadband, Internet protocol : TCP/IP, FTP, HTTP, Domain name e-mail address, WWW, web browser : Internet Explorer. Netscape navigator, search engines.
- UNIT-IV: Programming Concept : Algorithm flowcharting programming languages, assembler, interpreter, compiler programming process : program design, coding compilation, Execution, testing, debugging documentation structured programming : features and approaches.
- UNIT-V: 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 and decrement, precedence of operators.

- UNIT- VI: I/O Operations :
Formatted I/O : Printf (), Scanf (), Unformatted I/O : getch (), getche (), getchar (), putchar (), putche (), puts (), Controal structure : if , if... else, nested if, conditional operator , switch, goto, for, while, do..while, nesting of loops, break, continue.

Books Recommended :

- 1) Computer fundamental : B Ram, Nas Age publication
- 2) Fundamentals of Computer : V. Rajaraman, PHI Publication.
- 3) Computer Fundamentals : Preeti Sinha, BPB Publication.
- 4) Information Technology : Alexie and Mathews, Vijay Nikole Publication.
- 5) IT Tools and Applications : Alexie and Mathews, Vijay Nikole Publication.
- 6) Programming in C : E alurusamy, TMH. Publications.
- 7) C Programming With C : Ravichandran.
- 8) Program with C : Byron Gottfried, schaum series Publication.

Practicals : Minimum 16 practicals based on

- A. Unit-II, III and MS-WORD, MSEXCEL (Minimum 8 Practical)
- B. Unit-IV to Unit-VI (Minimum 8 Practical)

21. COMPUTER APPLICATION (VOCATIONAL)

The examinations in vocational subject Computer Application will comprise of one theory papers and practical examination for each semester. The theory paper will be of 3 hours duration and carry 80 marks. The practical examination will be of 4 hours duration and carry 50 marks.

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

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

Total 50 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.

1S : Computer Application (Vocational) : Paper-I
Fundamentals of Computer Applications

- UNIT-I: Introduction to Computer : Characteristics, types of computers: micro, mini, main and super, Block diagram of computer, types of memories : RAM, ROM, PROM, EPROM, EEPROM, Cache Memory, Secondary Storage Devices : hard disk, CD, DVD, Pen drives.
 I/O Devices : Keyboard, Mouse, Scanner, Touch Screen, 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.
 Operating System : Definition, Types and Functions of O.S(Memory, File, I/O and Processor Management), Booting process. Windows XP : Introduction, Features and taskbars, Desktop, Customising Desktop, Icons.
- UNIT-III: Internet : History, URL, Domain, Protocol(FTP,IPV4,IPV6), Wi-fi,, Internet Accounts : Dial up, direct access and broadband.
 Web browsers: Internet Explorer , Opera, Search Engines.
 E-mail: Using mail clients such as Microsoft Outlook & Web mail
- Unit-IV: Programming Concept : Algorithm, flowcharting, types programming languages, Programming process : Program design, coding, compilation & Execution, testing & debugging, documentation.
 Data Structure: Types of DS, operations on DS, Linear Array(Linear, Binary Search, Bubble Sort), STACK(Push,Pop), Introduction to QUEUE
- UNIT-V: Structured Programming : History and advantages of C language, 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, bitwise.
- UNIT-VI: I/O Operations : Formated I/O : printf(), scanf() Unformated I/O

: getch(), getche(), getchar(), putch(), putche(), putchar(), gets(), puts().

Control structures : Branching -simple if, if-else, Conditional operator(? :), nested if, switch.

Looping - while, do-while, for statements, comma operator, goto label, break, continue, nested loops: while, do-while, for.

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 Local Area Network - Keiser -TMH
- 4) I.T. tools and applications - Alexie & Mathews - Vijay Nikole
- 5) ABC of Internet - Christian Crumblish (BPB)

PRACTICALS :

Computer Lab.-I: Minimum 8 practical based on :

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

Computer Lab.-II: Minimum 8 practical based on Unit-IV,V and VI.

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

22. ELECTRONICS

The examination in Electronics of First semester shall comprise of one theory paper of 80 Marks of three hour duration and internal assessment of 20 mark .

The Practical examination of all semester shall be conducted annually and each semester practical examination is of 50 marks of Four hour duration.

At the time of practical examination every student has to perform one experiment.

Distribution of marks is as under :

- | | | |
|----|---|---------|
| 1. | Experiment (Construction, testing and performance) ----- | 30 Mark |
| 2. | Practical record ----- | 10 Mark |
| 3. | Viva Voce ----- | 10 Mark |

1S-Electronics
(Basic Electronics)

- UNIT I: Passive Components and Network theorems :
Introduction of Resistor, Capacitor, Inductor and Transformer.
Concept of ideal DC voltage and current source, Statements of KVL, KCL, Thevenin, Nortons, maximum power transfer, (proofs, simple numerical problem applicable for dc only).
- UNIT II: Measuring Instruments :
Principles of voltmeter, ammeter, ohmmeter, Multirange DC voltmeter ,ohm per volt rating, loading effect, Multirange DC Ammeter, Series & shunt type ohmmeter, Multimeter, (uses & drawback).CRO Block diagram & explanation, uses of CRO (measurement of frequency , amplitude& phase.)
- UNIT III: Semiconductor Diode and Regulated power supply :
Operation and characteristics of PN junction, avalanche and Zener breakdown mechanism. half wave and full wave rectifiers, ripple factor, efficiency, PIV ratings
C,L and π section filters .Concept of unregulated and regulated power supply, Zener diode voltage regulator.
- UNIT IV: Transistor:
NPN and PNP transistor, (construction and working)
CB, CE & CC configuration, leakage currents, Input and output characteristics of CE mode, relation between α and β , Load line and operating point
Amplification action of CE amplifier, biasing and stability.
- UNIT V: Binary arithmetic & Logic gates :Binary,octal & Hexadecimal number system and their inter- conversions, Binary arithmetic (addition, subtraction,- using 1's & 2's compliment), multiplication & division.

NOT, OR, AND, NAND, NOR gates (definition and truth table).
EXNOR & EXOR gates, Half adder, full adder. Binary codes :
8421,BCD,excess-3.

- UNIT VI: Boolean algebra & Logic families :, Classification of logic families, characteristics (Fan-in, Fan-out,Noise immunity, Propagation delay, Power dissipation),
DTL, TTL, CMOS logic and NAND Gate & CMOS logic. Boolean laws, De-morgans theorem, Simplification of Boolean equations using boolean algebra Fundamental products & Kmap(K-map upto 4 variable).

Practicals : Every student is expected to perform at least Ten experiments.(
At least one experiment from each Unit)

1. Identification of various electronic components.
2. Verification of Thevenin's theorem. (Determination of VTH,,RTH and IL)
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. Construction and Study of Multirange Ammeter.
8. Construction and Study of Multirange Voltmeter.
9. Construction and Study of series type Ohmmeter.
10. Construction and Study of shunt type Ohmmeter
11. Construction and Study of PN junction diode under forward bias mode.
12. Construction and Study of PN junction diode under reverse bias mode
13. Construction and Study of transistor under CB mode. Determination of α (alpha).
14. Construction and Study of transistor under CE mode. Determination of β (Beeta).
15. Identification and study of logic gates.
16. Construction and Study of Half adder and full adder circuit
17. Construction and Study of Half subtractor and full subtractor circuit.
18. Study of 7483 IC – 4 bit parallel adder.
19. Verification of De Morgan's Theorem.
20. Verification of truth Table for given Boolean expression.
21. Study of half wave rectifier.

22. Study of fullwave rectifier.
23. Study of filter circuits.
24. Study of Zener diode as voltage regulator.
25. Study of transistor series regulator.
26. Study of Transistor shunt regulator.
27. Study of three terminal IC voltage regulators.

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. Electrical and Electronic measurements and Instrumentation. A.K.Sawhney (Dhanpat Rai and sons)
6. A Text Book of Electrical Technology B.L.Theraja (S.Chand & Company Ltd.)
7. Functional Circuits in Electronics by SH.S.G. Pimple (Macmillan Publication, India)
8. Micro Electronic Circuits (Fourth Edition) By Sedra and Smith (Oxford publication)
9. Modern Digital Electronics, R.P.Jain (McGraw-Hill) ISBN: 0073404578
10. Digital And Analogue Techniques, Navneet / Kale / Gokhale,Kitab Mahal.

23. BIOCHEMISTRY

The examination shall comprise of two theory papers, one in each semester and one practical in each Semester. Each theory paper will be of 3 Hrs. duration and carry 80 marks. The internal assessment will carry 20 marks. The practical examination will be of 6 to 8 hours duration in one day and shall carry 50 marks.

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

The distribution of marks in practical shall be as follows:

A)	Any five tests for section –I	-	15 marks
B)	Any one experiment from sec-II	-	10 marks
C)	Any one Experiment from sec.-III	-	10 marks
D)	Viva Voce	-	8 marks
E)	Class Work & Practical Record	-	7 marks

	Total	-	50 marks
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1S Biochemistry

Biomolecules And Nutrition.

UNIT- I:	Carbohydrates: Defination,classification, asymmetric carbon, optical isomerism, D &L isomerism,Epimerism,ring structure of pentoses & hexoses,? β anomers, mutarotation Reactions of aldehyde, ketone groups & hydroxyl groups, amino sugars, deoxy sugars, types of glycosidic bonds, structure, occurence & biological importance of polysaccharides like starch,glycogen,cellulose & mucopolysaccharides like heparin,hyaluronic acids,chondratin sulphates.
UNIT-II:	Lipids: Defination & classification.Fatty acids: introduction, nomenclature, structure & properties of saturated & unsaturated fatty acids, cis & trans isomerism, positional isomerism, triacylglycerols; nomenclature, structure & characterization of fats(hydrolysis,saponification value,acid value,rancidity of fats,iodine number)biological significance of fats, structure & functions of lecithins,cephalins,phosphoinositides & spingomyelins,glycolipids-cerebrosides,gangliosides & steroids(properties & functions of ergosterol,cholesterol,bile acids)
UNIT- III:	Proteins: Defination,classification based on solubility, shape composition & function.Amino acids: classification, structure & isomers of standard amino acids, Zwitter ionic structure Physiochemical properties, glucogenic & ketogenic amino acids, non proteinous amino acids(ornithine,citrulline & β alanine)Peptides: structure oof peptide bonds, important peptides (structure & functions).

Protein structure: Levels of structure, forces stabilizing the tertiary & quaternary structure of proteins, Denaturation & renaturation of proteins, salting in and salting out of proteins, structure & biological functions of fibrous proteins (keratins, collagen, elastins), globular proteins (hemoglobin & myoglobin) catalytic proteins.

UNIT-IV: Nutrition, Balanced diet & Minerals:

- A) Energy value & nutritional importance of carbohydrates, lipids & proteins, essential amino acids, essential fatty acids, complete & incomplete proteins, calorie malnutrition, obesity and fatty liver.
- B) Balanced diet, dietary standards, infants diet, diet during pregnancy & diet for old persons, RQ, BMR & SDA.
- C) Importance of minerals like Na, K, Fe, Cu, Mg, Ca, P, Co, I, & Mn in nutrition.

UNIT-V: Nucleic Acids & Porphyrins:

- A) Nucleic acids: Structure of nitrogenous bases, nucleosides, nucleotides, structure of DNA & RNA. denaturation & annealing of DNA, evidence that DNA is genetic material, gene, genome, chromosomes.
- B) Chemistry of porphyrins nucleus: Classification, important, metalloporphyrins (hemoglobin, cytochromes, chlorophyll) Bile pigments: chemistry & physiological role.

UNIT-VI: Vitamins & Hormones:

- A) Vitamins: Chemistry, sources, daily allowances function & deficiency of water soluble & fat soluble vitamins.
- B) Hormones: Definition, classification, mode of action & target sites, chemistry & function of hormones of pituitary, thyroid, parathyroid, adrenal, pancreas, gonads & corpus luteum.

PRACTICAL

Section I: Qualitative Tests and Biochemical Preparations.

- a) Qualitative tests for carbohydrates.
- 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 value of fat.

- b) Determination of Saponification number of oil.
- c) Estimation of Glycine by Formal titration.
- d) 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 Protein by Lowry's method.

24. MICROBIOLOGY

The examination shall comprise of two theory papers, one in each semester and one practical in each Semester. Each theory paper will be of 3 Hrs. duration and carry 80 marks. The internal assessment will carry 20 marks. The practical examination will be of at least 4 hours duration in one day and shall carry 50 marks.

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

1S-Microbiology

Fundamentals of Microbiology and Microbial Physiology

UNIT I: A. History of Microbiology:

- a. Discovery of microscope- Leeuwenhoek, Robert Hook.
 - b. Controversy over Spontaneous, generation, Contributions of Aristotle, Redi, Needham, Schulze and Schwann, Schroder & Vandusch, Louis Pasteur, John Tyndall
 - c. Germ theory of diseases- Joseph Lister, Koch postulates, River postulates.
 - d. Pure culture concept- Joseph Lister, Koch, DeBarry.
- B. Scope of Microbiology as a modern Science.
- a. Industrial Microbiology, Environmental Microbiology, Medical microbiology, Food and Dairy Microbiology, Genetic engineering and Biotechnology.
 - b. Different types of Microorganisms (outline)
 - c. Distribution of Microorganisms in nature, and their beneficial and harmful activities.

UNIT II: A. Microscopy:

- i) Definitions- Magnification, Resolving power, numerical aperture,

focal length, Working Distance Aberrations,

- ii) Objectives- Functions, low and high power objectives, Oil Immersion objectives,
 - iii) Ocular- Functions, Huygenian, Ramsden, Hyperplane and compensating.
 - iv) Condensor- Functions, Abbe, parabolic
 - v) Iris diaphragm
- B. Principles, construction, ray diagram and applications:
- i) Compound Microscope,
 - ii) Darkfield Microscope,
 - iii) Phase Contrast microscope
 - iv) Fluorescent Microscope,
 - v) Electron Microscope.

C. Staining:

Dyes and Staining,- Definitions, auxochromes, Chromophore, mordants, chromogens, Leucostains, Principles and Methods of the following techniques:

- i. Simple staining
- ii. Differential- Gram, Acid fast,
- iii. Structural-Endospore, flagella.

UNIT III: Classification of Microorganisms:

A. Bacterial Classification:

- i. Definition- Taxonomy, Classification, Taxonomic rank, Identification, Nomenclature,
- ii. Bergy's manual of systematic Bacteriology, General characteristics enlisting all parts with major characters and examples(Vol.I to IV)
- iii. Methods of Classification: Intuitive, Numerical taxonomy, Genetic relatedness,

B. General characteristics of :

- i. Viruses,
- ii. Fungi (Including yeasts)
- iii. Actinomycetes,
- iv. Mycoplasma and Rickettsia
- v. Algae

UNIT IV: Structural Organization of Bacteria:

- a) Concept of prokaryotes and Eukaryotes; Comparison and Differences.
- b) Typical Bacterial cell

c) Shape, Size and Arrangement of Bacteria

d) Structure and functions of following:

- i. Capsule and slime layer
- ii. Cell wall- Gram positive and Gram negative bacteria.
- iii. Cytoplasmic membrane- fluid mosaic model
- iv. Flagella- Arrangement, Mechanism of flagellar movement.
- v. Pili- Arrangement and function
- vi. Ribosomes- Prokaryotic and Eucaryotic
- vii. Plasmid- Definition, General characters, classes
- viii. Bacterial chromosome
- ix. Endospores- Structure and arrangements.

UNIT V: A. Microbial Nutrition:

- i. Basic Nutritional Requirements: Sources of C, N, O, P, S, Energy, Macronutrients, Growth factors, water etc.
- ii. Media; Synthetic, Nonsynthetic, Liquid and Solid, Semisolid, Differential, Enriched, Selective media. Role of beef extract, yeast extract, peptone, agar and gelatin.
- iii. Determination of nutritional requirements: Auxanographic technique, Replica plating technique.
- iv. Nutritional classification; on the basis of source of carbon and energy

B. Pure Culture Techniques:

- i. Definition- Pure and Mixed culture:
- ii. Methods of Isolation of Pure culture, Serial dilution, Streak plate, pour plate, spread plate, Enrichment culture, and Single cell isolation method.
- iii. Methods of preservation of pure culture- Agar slants, Saline suspension, Overlaying with oil, Freeze drying.

UNIT VI: Reproduction and Growth of Bacteria:

- a) Reproduction: Binary fission, Budding, Fragmentation, Sporulation,
- b) Growth rate and generation time- Definition, mathematical expression.
- c) Bacterial growth curve
- d) Synchronous culture: Definition, methods of isolation (Helmstetter- Cummings Technique) and application.
- e) Continuous culture: Definition, method (chemostat, and Turbidostat Techniques) and Application.

- f) Measurement of Growth:
- i. Cell number measurement- Breed method, Colony count
 - ii. Cell mass measurement- Dry weight and Turbidity measurement.
 - iii. Cell activity measurement- Biochemical activity
 - iv. Factors influencing bacterial Growth- Temperature, pH, Gaseous.

Microbiology Practicals

1. Microscopy:
 - i. Different parts of compound microscope
 - ii. Use and Care of compound microscope
2. Construction, operation and utility of Laboratory equipments;
 - i. Autoclave
 - ii. Hot air oven
 - iii. Bacteriological Incubator
 - iv. pH meter
 - v. Centrifuge
 - vi. Colorimeter/ spectrophotometer
 - vii. Anaerobic Jar
 - viii. Bacteriological filters
 - ix. Laminar air flow
 - x. Air sampler
 - xi. BOD incubator
3. Preparation of Nutrient media:
 - i. Nutrient broth
 - ii. Nutrient agar
 - iii. PDA
4. Demonstration of bacteria from; Soil, Water, Air, Milk, Skin
5. Microscopic Examination of bacteria
 - i. Monochrome staining
 - ii. Gram's staining
 - iii. Acid fast staining
 - iv. Negative staining
 - v. Endospore staining
6. Hanging drop technique to demonstrate Bacterial motility
7. Measurement of size of bacteria
8. Cultivation and Demonstration of

- i. Yeast- Saccharomyces cereviceae, Candida albicans.
- ii. Molds- Mucor, Rhizopus, Penicillium, Aspergillus
9. Demonstration of
 - a) Protozoa- E. histolitica, Paramoecium
 - b) Algae – Anabena, Nostoc, Spirogyra
10. Isolation of Pure culture by
 - i) Streak plate ii) Pour plate iii) Spread plate .
11. Enumeration of bacteria in the given sample by standard plate count
12. Demonstration of Replica plate technique / auxanography.

Distribution of Marks

Ist Semester Microbiology Practicals

1. Major Experiment	-	15 Marks
2. Minor Experiment	-	10 Marks
3. Viva –Voce	-	10 Marks
4. Spotting	-	10 Marks
5. Laboratory Journal	-	05 Marks

Total 50 Marks

List of Books Recommended For 1S and 2S Microbiology

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 Microbiolgy	:	Volk
14) Chemical Microbiology	:	Rose

- 15) Microbiology : Paul A. Ketchum.
(Introduction to Health of Professional)
- 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 : Modi (Akta Prakashan)
Vol. I & II
- 20) Basic experimental : Ronald M., Atlas, & Alfred
Microbiology 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 : Satguru Prasad, Emkay
(Biometry) 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 Mannual of Microbiology : A.J. Salle.
Methods
- 3) Medical Microbiology Vol. II : R. Cruickshank
- 4) Microbiology Methods : Collins
- 5) Difco manual
- 6) Bacteriological Techniques : F.J.Baker
- 7) Introduction to Microbial : Gunasekaran
Techniques
- 8) Biochemical methods : Sadashivam & Manickam
- 9) Laboratory Fundamentals of : Alcamo, I.E., Jones and
Microbiology Bartlett Publishers.

25. FOOD SCIENCE

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

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

The distribution of marks in practical shall be as follows:

A) Two short experiment	-	20 marks (10 Each)
B) One long experiment	-	15 marks
C) Viva voce	-	10 marks
D) Practical Record	-	5 marks

Total	-	50 marks
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1S FOOD SCIENCE

BASIC CHEMISTRY OF FOODS

- UNIT - I Concept of Food Science :
Introduction and Definition of Food Science.
Unit Operation: Definition of SI Unit of length, Weight ,Volume.
Composition, formula and definition mole, atomic weight, equivalent weight and molecular weight.
Temperature (Conversion of Celsius Scale to Fahrenheit Scale).
pH and buffer :Definition, ionization of acid (weak and strong acid, measurement of pH, pH value of some common food substances)
Important Terminologies (Definition and Relevance, Melting point, Boiling point, Smoking point, Surface Tension, Sol, Gel, viscosity, Emulsion & foam.)
Physical and chemical properties Melting point, Boiling point, Smoking point, Surface Tension, Sol, Gel, viscosity, Emulsion & foam.
- UNIT - II Introduction and Terminology :

a) Food, Nutrition, Nutrients, Calories, Health, Malnutrition.
Balanced Diet, Basic food groups.
Recommended Dietary Allowances of All Age Group.
S.D.A. of Protein
Determination of Energy value of food stuff, calorimetry etc.
Concept of BMR
Factors affecting BMR : Age, body size, body composition and health.

UNIT – III Carbohydrates:
Definition, Composition, Classification, Food Sources, Functions of monosaccharide, disaccharides and polysaccharides.
Sugar: Sources of Sugar, Classification of Sugar, Properties of Sugar. Polysaccharides, Classification.
Starch: Structure, Amylose and Amylo Pectin.
Pectic Substances: Occurrences and Uses, biological importance.
Energy value and nutritional importance of carbohydrates.
Role of fiber in diet.

UNIT – IV Proteins :
Definition, Composition, Classification and Food Sources of Protein (good and poor sources).
Classification of Amino Acids, Essential and Non-Essential Amino Acids, Food Sources of Essential Amino Acids.
Function of Protein, Properties of Protein.
Denaturation of Protein, Factor Affecting Denaturation of Protein.

UNIT – V Fats and Lipids :
Definition and Formulas of Fats and Lipids.
Definition of Saturated and Unsaturated of Fatty Acids.
Food Sources of Fats, Oils, Saturated and Unsaturated Fatty Acids.
Properties of Fats and Lipids.

UNIT – VI Vitamins and Minerals:
History, Introduction, Definition of Vitamins and Minerals.
Formula and Food Sources of vitamins and minerals.
Classification of vitamins and minerals.
Requirement of vitamins and minerals in different age groups.

Practical

1. Preparation of Samples .

2. Preparation of Standard Solutions.
3. Identification of ash value of Food Stuff.
4. Moisture content of Food Stuff.
5. Determination of acidity and pH of Food.
6. Qualitative test for Carbohydrate
7. Qualitative test for Protein
8. Estimation of Total hardness of water using EDTA
9. Detection of presence of Starch by Iodine Test.
10. Estimation of Fat by Soxhelt Apparatus.

26. INDUSTRIAL MICROBIOLOGY

The examination in Industrial Microbiology of First semester shall comprise of one theory paper, internal assessment and practical examination. Theory paper will be of 3 Hrs. duration and carry 80 marks. The internal assessment will carry 20 marks. The practical examination will be of 5 hours duration in one day and carry 50 marks.

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

The distribution of marks in practical shall be as follows:

A)	Two short experiment	-20 marks (10 Each)
B)	One long experiment	-15 marks
C)	Viva voce	-10 marks
D)	Industrial Study Tour Report	-03 marks
D)	Practical Record	-02 marks

Total - 50 marks

1S INDUSTRIAL MICROBIOLOGY

Fundamentals of Industrial Microbiology

UNIT-I: Introduction to Industrial Microbiology

- a) Definition, basic concepts of Microbiology
 - (i) Discovery of Microorganism
 - (ii) Distribution of micro organisms in nature.
 - (iii) Beneficial and harmful activity of micro organisms.

- (iv) Basic and applied branches of microbiology.
- b) Development and scope of Industrial Microbiology
 - (i) Definition, basic concepts of fermentation
 - (ii) products-curd and yoghurt, pickles
 - (iii) Contemporary fermentations – organic acids-vinegar and citric acid, antibiotics, enzymes, vitamins.
- c) Study of Industrially Important Microorganisms
 - General characteristics, Structures, Modes of reproduction and industrial importance of : Yeast, Bacteria, Actinomycetes, Fungi, and Algae.

UNIT-II : Microbial Growth :

- a) Microbial growth characteristics and its significance in fermentation
 - i) Batch cultures - phases of growth and measurement of growth
 - ii) Continuous cultures – characteristics and maintenance
 - iii) Diauxic, synchronous and fed batch cultures
- b) Effect of environmental factors on growth of microorganisms: Temperature, osmotic pressure, hydrostatic pressure, surface tension, UV light, pH and heavy metals.

UNIT-III : Production strain in Industries :

1. Screening of industrial microorganisms
 - a) Primary Screening of - i. Antibiotic producers, ii. Organic Acid producers
 - b) Secondary screening
2. Methods of Stock pure culture isolation, Culture Maintenance

UNIT-IV : Fermentation media and Inoculum Preparation :

- a) Basic components – water, sources of energy, carbon, nitrogen, minerals
- b) Special ingredients – growth factors, buffers, precursors, inhibitors, inducers, antifoam agents, oxygen requirements, redox potential
- c) Types of media used- synthetic, natural–industrial and agricultural wastes
- d) Raw materials – Ideal characters and types of raw materials used in industry.

Inoculum Preparation : Inoculum build up technique.

UNIT-V: Types of Fermentation :

1. Concepts of axenic and mixed cultures in fermentations,
2. Types of Fermentations- Batch and continuous fermentations,

Dual and multiple fermentations

UNIT-VI: Industrial Sterilization :

- (a) Introduction
- (b) Principles of Sterilization
- (c) Sterilization of Equipments
- (d) Sterilization of Production Media
- (e) Sterilization of Air by Filtration

Practicals :- Semester-I

1. Study of laboratory equipments:
 - a) Optical compound microscope
 - b) Incubator
 - c) Hot air oven
 - d) Autoclave
 - e) Centrifuge
 - f) Membrane filter
 - g) Colorimeter
 - h) pH meter
2. Preparation and sterilization of media suitable for the growth of:
 - a) Bacteria – Nutrient agar/soil extract agar/soybean casein digest agar
 - b) Fungi – Potato dextrose agar/Czapek Dox agar
 - c) Yeasts – Glucose yeast extract agar/ Sabouraud's agar
 - d) Actinomycetes – Glycerol Asparagine agar/coconut water agar
 - e) Lactic acid bacteria – Neutral red chalk lactose (NRCL) agar atypical peptone tryptone (APT) agar
 - f) Algae – Geitler's medium
3. Isolation and cultivation of microorganisms from appropriate sources on the media described above and their microscopic examination.
 - a) Bacteria – From soil, monochrome and Gram staining
 - b) Fungi – Aspergillus and Penicillium from soil, lactophenol mounting
 - c) Yeasts – Saccharomyces cerevisiae, monochrome staining
 - d) Actinomycetes – from soil and cultivation using coverslip/slide/ agar cylinder methods and direct microscopic observation
 - e) Lactic acid bacteria – from curd or buttermilk, gram staining
 - f) Algae – from appropriate sources, direct microscopic observation
4. Effect of temperature, pH and osmotic pressure on growth of bacteria

27. BIOTECHNOLOGY (REGULAR/ VOCATIONAL)

The examination shall comprise of two theory papers, one in each semester and one practical in each Semester. Each theory paper will be of 3 Hrs. duration and carry 80 marks. The internal assessment will carry 20 marks. The practical examination will be of atleast 4 hours duration in one day and shall

carry 50 marks.

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

1S BIOTECHNOLOGY

Cell Biology & Biomolecules

- UNIT-I: Evolution of Cell & Introduction to Biotechnology
Cell as a Basic Unit of Living Systems, The cell theory and Exceptions to the cell theory.
Precellular evolution: Formation of first cell, properties, RNA world, Oparin Haldane concept, Miller experiment and Endosymbiont Theory.
Prokaryotic and Eukaryotic cells, Evolution of Multicellular Eukaryotes.
A detailed classification of cell types within organisms and Cell Diversity.
Biomolecules to Biotechnology : Definition, origin, historical background and scope.
- UNIT-II : Biomolecules –I Carbohydrates & Lipids
Scope and Importance of Biomolecules, Nature of Biological materials, General Properties of Organic and Inorganic compounds, Hydrophilic and Hydrophobic groups in Biomolecules.
Carbohydrates: Classification, Properties, Structure and Biological Importance.
Lipids: Classification, properties, structure and Biological Importance
- UNIT-III : Biomolecules –II Nucleic Acids and Proteins
Nucleic Acids: Nitrogenous bases, nucleosides, nucleotides, structure and function of DNA, mRNA, rRNA, tRNA.
Proteins: Classification of amino acids and proteins, Peptide Bond, Biological importance, Level of Organization of Protein Structure.
Enzymes: Nomenclature and Classification, Effect of Temperature, pH, Substrate concentration and enzyme concentration on

enzyme activity.

Applications of enzymes in Industries, Food processing, Medicines and Diagnostics.

- UNIT-IV: Structure and Function of Cell Organelles
Plant cell wall, Cell Membrane (Models of Membrane i.e. Danielli Davson, Robertson, Singer Nicholson), Mitochondria, Chloroplast, Lysosome, Golgi complex, Vacuoles, Endoplasmic reticulum (Types), Peroxisome, Ribosome, Nucleus.
- UNIT-V : Cell Transport and Fractionation
Cell Transport across membrane (Active, Passive, Diffusion, Osmosis, Transporters, Ion channels).
Density Gradient centrifugation, Differential Centrifugation, Cell lysis methods (enzymatic, Chemical, physical, Mechanical).
Identification of Sub-cellular fractions (Mitochondria, Chloroplast, Nucleus, Lysosome, Peroxisome).
- UNIT-VI: Cytoskeleton, Cell Division and Stem Cells
Cytoskeleton (Microtubules, microfilament and intermediate filament) and cell locomotion.
Cell Division, Cell cycle and Cancer.
Cell-cell signaling, Cell-cell adhesion, Cell junction.
Stem cells : Properties and applications.

Practicals.

1. Cell diversity in plant tissue and animal tissue.
2. Test for carbohydrates (Molisch, Fehling, Benedicts, Iodine, Barfoad, Osazone etc).
3. Test for fats/lipids (Saponification, Emulsification, Formaldehyde – H₂SO₄ test).
4. Test for proteins (Biurete, Ninhydrin, Millon, Xanthoprotic, Coagulation, Precipitation).
5. Quantitative determination of sugar in urine and blood sample.
6. Estimation of Proteins.
7. Estimation of RNA and DNA.
8. Chromatographic methods for separation of Biomolecules.
9. Demonstration of Osmosis.
10. Demonstration of Diffusion.
11. Cell lysis methods
12. Density gradient centrifugation.

13. Differential centrifugation.
14. Identification of sub cellular organelle (any one)
15. Mitosis.
16. Meiosis.

Distribution of Practical Marks :-

(1)	Major Experiment	12 Marks
(2)	Minor Experiment	08 Marks
(3)	Spotting	10 Marks
(4)	Viva	10 Marks
(5)	Practical Record	05 Marks
(6)	Study Tour/Visit	05 Marks

	Total	50 Marks
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Reference Books :- (Fir Sem-I)

- (1) Cell Biology – C.B.Powar, Himalaya Publishing House.
- (2) Cell and Molecular Biology – P.K.Gupta, Rastogi Publication Meerut.
- (3) Biochemistry - C.B.Powar.
- (4) Biochemistry – Lehninger
- (5) Essentials of Biochemistry – Dr.U.Satyanarayana, Books and Allied Pvt. Ltd.
- (6) Cell & Molecular Biology – Loddish.
- (7) Cell Biology – Cooper.
- (8) Cell and Molecular Biology – D.Robertis.
- (9) Biochemistry – J.L.Jain.
- (10) An Introduction to Practical Biochemistry – David Plummer.
- (11) Laboratory Manual in Biochemistry – Jayraman.

28. BIOINFORMATICS

1S Bioinformatics

Elementary Mathematics & Statistics

UNIT I: Types of functions, d-neighbourhood of point, Limit of function, Continuity of function, Theorems on Limits and Continuity of functions.
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 II : 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 III: Differential equation, its Formation. Its general solution and particular solution. Order and degree of differential equation. First order differential equation. Variable separable method.

UNIT IV: Representation of data. Discrete data, continuous data, Histogram, PolyGram's Frequency curves, Mean, Variability of data- the standard deviation, Median, quartiles, percentile, Skewness, Box and Whisker diagrams.

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

UNIT V : 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 VI: 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.

Practical-I : Elementary Mathematics and Statistics :-

1. Measures of dispersion- Range, Quartile deviation and mean deviation.
2. Computation of rank correlation coefficient.
3. Simple problems on probability- Law of addition, Law of multiplication.
4. Large sample test.
5. Application of Chi-square distribution.
6. Random Sampling- SRSWOR and SRSWR.
7. Fitting of binomial distribution.
8. Fitting of normal distribution.
9. Problems on Mean and Mode.
10. Problems on order and degree of differential equation.
11. Standard deviation and coefficient of correlation.

12. Handling of different formula / function.

Distribution of Practical Marks :-

(1)	Two Major Experiments	40 Marks
(2)	Class Record	05 Marks
(3)	Viva-voce	05 Marks

Total	50 Marks
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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.
- 7) S.Dobbs and J.Miller, (2002), 'Statistics (Advanced Level Mathematics) : Cambridge.
- 8) Narayanan, S. and Manicavachaagam Pillai, T.S. (1993) "Calculus, Vol. I and II"; Vishwanathan Printers and Publishers.
- 9) Veerarajan, T. (2003) "Engineering mathematics"; Third Edition, Tata McGraw Hill Publishing Co. Ltd, New Delhi.
- 10) Veerarajan, T. (2003) "Trigonometry, Algebra and Calculus"; Third Edition, Tata McGraw Hill Publishing Co. Ltd, New Delhi.
- 11) Sharma, A.K. (2005) "Text Book of Integral Calculus", Discovery Publishing House.
- 12) Grewal, B.S. (2000) "Higher Engineering Mathematics"; Thirty seventh edition, Khanna Publishers, New Delhi.
- 13) E. Horowitz and S. Sahani, "Fundamentals of Data structures", Galgotia Booksources Pvt. Ltd., (1999)
- 14) Ellis Horwitz, Sartaz Sahani and Sanguthevar Rajasekaran, (1999), "Computer Algorithms", Galgotia Publications
- 15) T .H. Cormen, C. E. Leiserson, R .L. Rivest (2001) "Introduction to Algorithms", 3rd Ed PHI

**Syllabus Prescribed for B.Sc. Part-I
Semester-II**

Effective from Session 2010-2011

7. MATHEMATICS

2S-Mathematics-Paper III (Integration and Differential Equations)

- UNIT I: Integration of Irrational algebraic functions , Reduction formulae. Reduction formulae for $\int \tan^n x dx, \int \cot^n x dx, \int \sec^n x dx, \int \operatorname{cosec}^n x dx, \int \sin^m x \cos^n x dx$ (where m, n are positive integers).
- UNIT II: Quadrature, Rectification, Volume and Surfaces of Solid of Revolution.
- UNIT III: Degree and order of differential equation of first order and first degree. Equations in which the variables are separable. Homogeneous equations. Linear equations and equations reducible to linear form. Exact differential equations..Orthogonal trajectories.
- UNIT IV: Second order linear differential equations with constant coefficients. Homogeneous linear ordinary differential equations. Equations reducible to homogeneous differential equation.
- UNIT V: Transformation of the equation by changing the dependant variable and independent variable. Method of variation of parameters, Ordinary simultaneous differential equations.

Reference Books:

- 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. nd Rota G.C.:Ordinary Differtial Equations,John Wiley and Sons,1978.
- 4) Coddington E.A.:An Introduction to Ordinary Differtial Equations,Prentice Hall of India,1998.
- 5) Edwards J.:Integral Calculus for Bginners,AITBS,Publishers and Distributors,1994.
- 6) Forsynth A.R.:A Treatise on Differtial Equations,(Sixth Edition) MacMillan and Co.1956.
- 7) Greenspan D.:Introduction to Calculus,Harper and Row,1968.

- 8) Gorakh Prasad: Differtial Calculus, Pothishala Pvt.Ltd. Allahabad.
- 9) Gorakh Prasad: Integral Calculus, Pothishala Pvt.Ltd. Allahabad.
- 10) Karade T.M. and Bendre S.M.: Lecturers on Calculus and Differtial Equations, Sonu-Nilu, 5, Bandu, Soni Layout Gayatri Road Parsodi, Nagpur
- 11) Murray R. Spiegel: Theory and Problems on Advance Calculus, Schaum's Outline Series, Schaum Publishing Co., New York.
- 12) Murray D.A.: Introductory course in Differtial Equations, Orient Longman (India), 1967.
- 13) W.E. Boyce and Diprima P.C.: Elementary Differtial Equations and Boundary Value Problems, John Wiley, 1986.
- 14) Erwin, Kreyszig: Advance Engineering Mathematics, John Wiley and Sons, 1999.
- 15) Piaggio HTS: Differtial Equations, CBS Publishers and Distributors, Delhi, 1985.
- 16) Siminons G.F.: Differtial Equations, Tata Mcgraw Hill, 1972.
- 17) N. Piskunov: Differtial and Integral Calculus, Peace Publishers, Moscow.
- 18) Bhamra K.S., Ratna Bala : Ordinary Differential Equation and Introductory Treatment with Application, Allied Pub., New Delhi.
- 19) Raisinghaniya, M.D. : Ordinary and Differential Equations, S.Chand. & Co., New Delhi.

2S-Mathematics-Paper IV (Vector Analysis & Geometry)

- UNIT I: Scalar and Vector Product of three vectors. Product of four vectors, Vector differentiation and Vector integration.
- UNIT II : Space Curves. t , n , b vectors. Fundamental planes. Curvature, Torsion, Frenet-Serete's Formulae.
- UNIT III : Gradient, divergent and curl (definition & examples only), Line integral, existance and evaluation, work done. Greens Theorem.
- UNIT IV: Different forms of Plane. Conditions of parallelism and perpendicularity of two planes. Length of a perpendicular from a point to a plane. Plane through intersection of two planes. Line, Condition for a line to lie in a plane. Equation of a Line.
- UNIT V : Sphere, Different forms of sphere, Section of a sphere by a plane, Sphere through a given circle, Intersection of a sphere and a line, Orthogonal spheres and condition of orthogonality.
Cone, The equation of a cone with a guiding curve, cone with vertex at origin, Right circular cone.
Cylinder. Equation of right circular cylinder.

Reference Books :

- 1) T.M. Karade, Maya S. Bendre: Lectures on Vector Analysis and Geometry, Sonu Nilu Publication, Nagpur.
- 2) Murray R. Spiegel: Theory and Problems on Advance 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) Shanti Narayan: A Text Book of Vector Calculus, S.Chand and Company, New Delhi.
- 6) S.L. Loney: The Elements of Co-ordinate Geometry, MacMillan and Co., London.
- 7) Gorakh Prasad and H.C. Gupta: Text Book on Co-ordinate Geometry, Pothishala Pvt.Ltd. Allahabad.
- 8) R.J.T. Bell: Elementary Treatise on Co-ordinate Geometry of Three Dimensions, MacMillan India Ltd., 1994
- 9) P.K. Jain and Khalil Ahmad: A Text Book of Analytical Geometry of Two Dimensions, Wiley Eastern Ltd., 1994.
- 10) P.K. Jain and Khalil Ahmad: A Text Book of Analytical Geometry of Three Dimensions, Wiley Eastern Ltd., 1999.
- 11) N. Saran and R.S. Gupta: Analytical Geometry of three dimensions, Pothishala Pvt.Ltd. Allahabad.
- 12) H.D. Pande, H.D.K. Dubey, S.N. Pande : A Text Book of Vector Analysis and Geometry, Wisdom Press, New Delhi.
- 13) Raisinghaniya M.D., Saxena H.C., Das S.K. : Vector Calculus, S.Chand, New Delhi.

8. Physics

2S-Physics

(Kinetic theory, Thermodynamics and electric currents)

- 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; Estimation of Avagadro's number; degrees of freedom; equipartition of energy; specific heat of monatomic 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.
- Transport Phenomena in gases: Molecular Collision, mean free path, Brownian motion and collision cross section. Transport of mass, momentum and energy and interrelationship, dependence on temperature and pressure.
- Numericals

- UNIT II: 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. Numericals.
- UNIT III: 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
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-IV: Motion of Charged Particles in Electric and Magnetic fields :
(Note: The emphasis should be on Mechanical aspects, and not on the details of the apparatus mentioned which indicated as applications of principles involved.)
E as an accelerating field, electron gun, case of discharge tube, linear accelerator (linac), E as a deflecting field, Transverse magnetic field, Mass spectrograph, velocity selector, curvatures of tracks for energy determination of nuclear particles, Principle of cyclotron. Mutually perpendicular E and B fields, velocity selector, its resolution. Numericals
- UNIT-V: Network theorem: Thevenin's theorem, superposition theorem(mesh current analysis), Maximum power transfer theorem, some applications.
Ballistic galvanometer (theory, charge sensitivity, effect of damping), Application of B.G: Determination of capacitance and high resistance by method of leakage
Varying Currents: Steady currents, current density J, non steady current and continuity equation, Kirchoff's laws and analysis of

- multi-loop circuits, Rise and decay of currents in LR, Rise and decay & charge in CR circuits, and in LCR circuit, resonating frequency. Numericals
- UNIT-VI: Alternating Currents : A.C. currents, complex numbers and their applications in solving A.C. circuits using J operator, pure R, L, C and their combinations, reactance and impedance, series and parallel resonance, Q-factor, power consumed by A.C. circuit, power factor. Self and mutual inductance, theory of transformer and energy losses in transformer.
Numericals
- Practical: (Every student will have to perform at least 10 experiments from the following list. At the time of examination, each student will have to perform 1 (one) experiment.)
1. Heating efficiency of electrical Kettle with varying voltages.
 2. Determination of "J" by Callendar and Barne's method.
 3. Cp/Cv by Clement and Desorme's method.
 4. Thermal conductivity of an insulator by Lee's disc method.
 5. Determination of charge sensitivity of ballistic galvanometer.
 6. Measurement of low resistance by Carey-foster Bridge.
 7. Measurement of low resistance by potentiometer.
 8. Measurement of inductance by phasor diagram method.
 9. Measurement of capacitance by phasor diagram method.
 10. Study of frequency resonance of series LCR circuit and determination of Q-factor.
 11. To study behavior of R-C.circuit as a filter.
 12. To determine high resistance by leakage method.
 13. C1 / C2 by De-Sauty's method.
 14. Verification of laws of capacitances.
 15. Study of transformer.
 16. Verification of Kirchoff's law, using electrical network.
 17. Verification of Maximum power transfer theorem.
 18. Verification of Thevenin's theorem.
 19. Verification of Norton's theorem.
 20. Verification of Milliman's theorem.

Reference Books

Semester 2S-PHY

1. Heat and thermodynamics – D.S.Mathur

2. Text book of Heat – J.B.Rajam
3. Heat and thermodynamics – Rajam & Arora
4. Heat – Rajkumar & Sharma
5. Electricity & Magnetism – Chakraborty P.
6. Foundations of Physics Vol. I & Vol. II – Gambhir R.S.
7. Electromagnetics – Laud B.B.
8. Electromagnetic field & waves – Sarwate V.V.
9. Electricity and Magnetism Vol. II – Berkley Physics Course
10. Electricity and Magnetism – D.N. Vasudeva
11. Electricity and Magnetism – Brijlal & Subramaniam
12. Electrodynamics – S.L.Gupta & R.Singh
13. Electricity & Magnetism – Reitz & Millford
14. Electricity & Magnetism – A.S.Mahajan & A.A.Rangawala (TMH)
15. Principle of electricity & Magnetism – Panofsky & Philips
16. Electricity & Magnetism – S.S.Atwood
17. Electromagnetic waves & radiating systems – E.C. Jordan

9. CHEMISTRY

2S Chemistry

Total Lectures: 84

Marks: 80

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

- UNIT I: A] Polarisation-Definition, polarising power, polarizability, Effect of polarization on nature of bond. Fajan's rules of polarisation and its applications. [2]
- B] Covalent bonding-Directional nature of covalent bond. Hybridisation, types of hybridisation to explain geometries of NH_4^+ ion, PCl_5 , SF_6 and IF_7 . [2]
- C] Intermolecular forces-Dipole-dipole, dipole-induced-dipole, induced dipole-induced dipole interactions (Keesom, Debye and London dispersion forces). Ion - dipole interactions. [3]
- D] Acids and Bases-Theory of solvent systems and Lux-Flood concept of acids and bases. Hard and soft acids and bases. Pearson's HSAB or SHAB principle with important applications. [7]
- UNIT II: A] P-Block Elements-Comparative study of 16th and 17th group elements with reference to electronic configuration, ionisation energy and oxidation states. Oxidising properties of halogens with reference to oxidation potential. Basic properties of halogens

- with special reference to iodine. Interhalogen compounds, structure and bondings. Introduction to fluorocarbons. [6]
- B] Noble Gases-Inertness of noble gases. Compounds of noble gases-only structure and bonding in XeF_2 , XeF_4 , XeF_6 , XeOF_4 , XeO_2F_2 , XeO_3 and XeO_4 [2]
- C] Nonaqueous Solvents-Requirements of a good solvent. Water as an universal solvent. Physical properties of solvents namely liquid range, dielectric constant, dipole moment, heat of vaporisation and solubility behaviour. Classification of solvents. Reactions in liquid ammonia (acid base, precipitation, redox, solvolysis and complexation reactions), solutions of metals in liquid ammonia. Merits and demerits of liquid ammonia as a solvent [6]

UNIT III: Halogen Derivatives

- A] Alkyl Halides: Synthesis of ethyl bromide from ethane and ethylene. Reactions of ethyl bromide (Substitution and elimination). Mechanism of SN_1 , SN_2 and E_1 , E_2 reactions. Elimination versus substitution. [5]
- B] Alkenyl Halides: Synthesis and reactions of vinyl, allyl and benzyl chlorides. Comparison of reactivity of vinyl and allyl chloride. [5]
- C] Aryl Halides: Synthesis and reactions of Chloro benzenes, Mechanism of Nucleophilic (benzyne) substitution reaction, comparison of reactivity of chlorobenzene and benzyl chloride. [4]

UNIT IV: Alcohols, Phenols, Ethers and Epoxides:

- A] Alcohols: Synthesis and reactions of benzyl alcohol, Ethylene glycol and Glycerol. Mechanism of Pinacol-Pinacolone rearrangement. [5]
- B] Phenols: Classification and nomenclature of phenols. Methods of formation a) from Cumene, b) from benzene. Acidic character, Comparative acidic strength of alcohols and phenols. Reaction of Phenols. Electrophilic aromatic substitution. a) Acetylation, b) Carboxylation (Kolb's reaction), c) Fries Rearrangement (With mechanism), d) Claisen Rearrangement, e) Gatterman Synthesis, f) Hauben-Hoech reaction, g) Reimer – Tiemann reaction. [5]
- C] Ethers: Introduction, synthesis and reactions of diethyl ether. Relative reactivities of alcohols and ethers. [2]
- D] Epoxides: Synthesis of ethylene oxide and styrene oxide (one

method). Ring opening of styrene oxide catalysed by acid and alkali. [2]

UNIT V: Crystalline state [14]

Crystalline and amorphous solids, Law of constancy of interfacial angles, Symmetry in crystals, Plane of symmetry, axis of symmetry, and angle of symmetry, Elements of symmetry in cubic crystals, law of symmetry, Space lattice, Crystal lattice, Unit cell and Lattice planes, Law of rational indices, Weiss and Miller indices of a lattice planes, Calculation of inter planer distance (d_{hkl}) from Miller indices (hkl) in a cubic system.

Seven crystal systems and fourteen Bravais lattices, Bravais lattices of cubic system Simple cubic crystal (sc), body centered cubic (bcc) and face centred cubic (fcc) Calculation of number of constituent units in sc, bcc and fcc, Ratio of inter planer distances for 100, 110 and 111 lattice planes in sc, bcc, fcc (no geometrical derivation)

Derivation of Bragg's equation for X-ray diffraction, Bragg's X-ray spectrometer method for the determination of crystal structure of NaCl and KCl, Anomalous behaviour of KCl towards X-ray, Numericals

UNIT VI: Chemical Kinetics and Catalysis [14]

Explanation of terms like rate of reaction, order of reaction and molecularity. Definition with one example of zero, first and second order reactions, Half life period of a reaction

Derivation of the rate constant (k) of first and second reaction with equal initial concentration and different initial concentration of reactants, Characteristics of second order reactions. Determination of order of reaction – Method of integration, graphical method, equifractional change method, Ostwald's isolation method and vant Hoff differential method.

Effect of temperature on reaction rate, Arrhenius equation, Activation energy and its determination using Arrhenius equation.

Definition of catalyst, characteristics of catalysed reaction, Homogeneous and Heterogeneous catalysis with example of each. Explanation of heterogeneous catalysis on the basis of adsorption theory. Catalytic promoters, poisons & Numericals.

Semester II 2S Chemistry Practicals

Total Laboratory Sessions: 30 Marks: 50

UNIT I: Inorganic Chemistry Practicals: 10 Laboratory Sessions
Semimicro analysis of inorganic mixture containing two acidic radicals of different groups and two basic radicals of same group. (Other details same as given in practicals of semester I)

UNIT II: Organic Chemistry Practicals: 10 Laboratory Sessions
Organic Preparations (any Ten).

1. Preparation of p-bromo acetanilide. (Bromination)
2. Preparation of p-nitro acetanilide. (Nitration)
3. Preparation of Benzoic acid from benzaldehyde (Oxidation).
4. Preparation of m-nitro aniline from m-dinitrobenzene. (Reduction).
5. Preparation of phenylazo-β-naphthol dye (Diaazotisation).
6. Preparation of aspirine (Acetylation).
7. Preparation of phenyl thiourea.
8. Preparation of sulphanilic acid from aniline (Sulphonation).
9. Preparation of glucosazone
10. Preparation of 2, 4 - dinitro hydrazone.
11. Preparation of phenol-formaldehyde plastic (Bakelite).
Organic Preparations Using Green Chemistry Concept.
12. Acetylation of primary amine (Preparation of acetanilide).
13. Base catalysed Aldol Condensation (Synthesis of dibenzal propanone).
14. Halogen addition to C = C bond (Bromination of trans-stilbene).
15. [4+2] cycloaddition reaction (Diels-Alder reaction between furan and maleic acid.).
16. Rearrangement reaction III (Benzil-Benzilic acid rearrangement).

Note:-

- a) Student should perform the single stage preparation with the help of given procedure.
- b) Melting point and percentage yield should be reported.
- c) The sample should be submitted.
- d) Students should recrystallize the sample with suitable solvent.

- e) Students should know the reaction and its mechanism of given single stage preparation.

UNIT III: Physical Chemistry Practicals: 10 Laboratory Sessions
 Expt 1: To determine activation energy for the reaction between $K_2S_2O_8$ and KI
 Expt 2: To study hydrolysis of methyl acetate catalysed by acid (First order reaction)
 Expt 3: To study hydrolysis of ethyl acetate by NaOH (saponification, second order reaction)
 Expt 4: To determine transition temperature of $MnCl_2 \cdot 4H_2O$.
 Expt 5: To determine heat of solution of KNO_3 (determination of water equivalent must)
 Expt 6: To determine heat of dilution of H_2SO_4 acid and determine strength of given H_2SO_4 acid.

Distribution of Marks for Practical Examination.

Time: 6 – 8 hours	(One Day Examination)	Marks: 50
UNIT – I	: Inorganic Chemistry (Exercise)	..... 12
UNIT – II	: Organic Chemistry (Exercise)	..... 12
UNIT – III	: Physical Chemistry (Exercise)	..... 12
	Viva-Voce	..... 07
	Record	..... 07

	Total:	50

Books Recommended: (Common for Semester-I & Semester-II)

- Principles of Inorganic Chemistry by Puri, Sharma and Kalia- S. Naginchand & Co., Delhi.
- Text book of Inorganic Chemistry by A.K. De, Wiley East Ltd.
- Selected Topics in Inorganic Chemistry by Malik, Tuli and Madan- S. Chand & Co.
- Modern Inorganic Chemistry by R.C. Agrawal, Kitab Mahal.
- Instrumental Methods of analysis by Chatwal and Anand, Himalaya Publishing House.
- Concise Inorganic Chemistry by J.D. Lee, ELBS.
- Inorganic Chemistry by J.E. Huheey- Harper & Row.
- Fundamental concepts of Inorganic Chemistry by E.S. Gilreath, McGraw Hill book Co.

- Modern Inorganic Chemistry by W.L. Jolly, McGraw Hill Int.
- Chemistry Facts, Patterns & Principles by Kneen, Rogers and Simpson, ELBS.
- Theoretical Principles of Inorganic Chemistry by G.S. Manku, Tata McGraw Hill.
- Inorganic complex compounds by Murmann, Chapman & Hall.
- Text book of Inorganic Chemistry by K.N. Upadhyaya, Vikas Publishing House, Delhi.
- Advanced Practical Inorganic Chemistry by Gurdeep Raj, Goel Publishing House, Meerut.
- Co-ordination Chemistry by D. Banerjee, TMH Publication.
- Text book of Inorganic Chemistry by Marathe, Bhadange, Mopari and Kubade.
- Organic Chemistry by R.T. Morrison & R.T. Boyd, 6th edition, PHI.
- Organic Chemistry by Pine, 5th edition.
- Organic Chemistry Vol. I, II and III by Mukharjee, Singh and Kapoor- Wiley Eastern.
- Organic Chemistry by S.K. Ghosh.
- Reaction Mechanism in Organic Chemistry by S.M. Mukharjee and S.P. Singh.
- Spectroscopy of Organic Compounds by P.S. Kalsi.
- Stereochemistry and mechanism through solved problems by P.S. Kalsi.
- Organic Chemistry by TWG Solomons, 4th edition, John Wiley.
- Hand Book of Organic Analysis by H.J. Clarke, Arnold Heinmen.
- Text book of Practical Organic Chemistry by A. I. Vogel.
- Text book of Organic Chemistry by Jamode, Ganar, Makode, Waghmare, Mahajan, Toshniwal.
- Text book of Organic Chemistry by P.S. Kalsi published by Macmillan India Ltd., 1999, Delhi.
- Practical Organic Chemistry by F.G. Mann, B.C. Saunders, Orient Longman.
- Comparative Practical Organic Chemistry (Qualitative Analysis) by V.K. Ahluwalia and Sunita Dhingra, Orient Longman.
- Comprehensive Practical Organic Chemistry (Preparation and Qualitative Analysis) by V.K. Ahluwalia and Renu Agrawal, Orient Longman.
- Physical Chemistry: Walter, J. Moore, 5th edn., New Delhi.
- Physical Chemistry: G.M. Barrow, McGraw Hill, Indian Edn.

34. Principles of Physical Chemistry: Maron and Prutton.
35. Principles of Physical Chemistry: Puri and Sharma.
36. Physical Chemistry: P.W. Atkins, 4th Edn.
37. Text book of Physical Chemistry: P.L. Sony O.R. Dhurma.
38. Physical Chemistry: Levine.
39. Practical Physical Chemistry: Palit and De.
40. Practical Physical Chemistry: Yadao.
41. Practical Physical Chemistry: Khosla.
42. Laboratory Manual of Physical Chemistry: W.J. Popiel.
43. Practical Chemistry: Dr. S.B. Lohiya, Bajaj publ., Amravati.
44. Text book of Physical Chemistry: Satpute, Kabra, Raghuvanshi, Wankhade, Jumle and Murarka.
45. Chemistry for Degree Student, Dr. R.L.Madan, S.Chand & Co. New Delhi.

LIST OF EQUIPMENTS / APPARATUS REQUIRED FOR THE CHEMISTRY PRACTICALS FOR B.Sc.

1.	Abbe's Refractometer	02 nos./batch
2.	Viscometer	10 nos./batch
3.	Stalagmometer	10 nos./batch
4.	Melting Point Apparatus	10 nos./batch
5.	Thermometer 0-360oC	20 nos./batch
6.	Thermometer 0-110oC	20 nos./batch
7.	Analytical balance	15 nos./batch
8.	Weight box	15 nos./batch
9.	Density Bottles	20 nos./batch
10.	Kipp's Apparatus	02 nos./batch
11.	Quick fit Distillation Assembly/ Multipurpose assembly	10 nos./batch
12.	Sintered Glass Crucible	20 nos./batch
13.	Silica Crucible	20 nos./batch
14.	Vacuum Suction Pump	02 nos./Lab.
15.	Potentiometer	02 nos./batch
16.	Metzer Electronic one pan balance	01 nos./Lab.
17.	Filtration flask with Buckner Funnels	
	100ml	10 nos./batch
	250ml	05 nos./batch
	500ml	02 nos./batch

18.	Desiccators	10 nos./batch
19.	Magnetic Stirrer	10 nos./batch
20.	Water Suction	10 nos./batch
21.	Conductometer with Conductivity Cell	04 nos./batch
22.	Colorimeter	02 nos./batch
23.	pH Meter	02 nos./batch
24.	Chromatographic Jar	05 nos./batch
25.	Separating funnels 250ml, 500ml	05ECH/batch
26.	Hot Air Oven	02 nos./Lab.
27.	Hot-Cold Air Blower	01 no./Lab.
28.	Centrifuge machine (Electrically Operated)	02 nos./Lab.
29.	Deioniser/ Water Still (Electrically Operated)	01 no./Lab.
30.	Hot Plate/ Heating Mentle	05 nos./batch
31.	Models of Elements (Seven Cryst, types and their symmetry)	
32.	Flame Photometer	01 no./batch
33.	Spectrophotometer	02 nos./batch
34.	Shaking Machine	01 no./batch
35.	Polarimeter	02 nos./batch

10. INDUSTRIAL CHEMISTRY (REGULAR/VOCATIONAL)

2S Industrial Chemistry (Regular/Vocational)

Total Lectures: 84 Marks: 80

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

UNIT-I [14]

- A) Distillation: Introduction, Flash distillation, Differential distillation, Steam distillation, Azeotropic distillation, Continuous distillation with rectification and stripping, Plate column, Packed column, Overall material balance.
- B) Evaporation: Introduction, Single and multiple effect evaporation, Short tube evaporator, Long tube evaporator, Forced circulation evaporator, Falling film evaporator, Climbing film evaporator (Upward flow evaporator), Agitated film evaporator, Evaporator capacity. Evaporator economy, Boiling point elevation.

UNIT-II [14]

- A) Extraction: Introduction, Selection of solvent, Single stage and multistage extraction, Spray column, Packed column, Mixer settlers, Rotating disc column, Centrifugal extractor.

- B) Leaching: Introduction, Single stage leaching, Percolation tank, Counter current multiple contact (Shank's system), Continuous counter current decantation, Agitated vessels, Rotocel, Kennedy extractor.

UNIT-III [14]

- A) Crystallization: Introduction, Solubility, Saturation, Supersaturation, Nucleation, Crystal growth, Agitated tank crystallizer, Vacuum crystallizer, Swenson-Walker crystallizer, Oslo cooler crystallizer.
- B) Drying: Introduction, Free moisture, Bound moisture, Moisture content on wet and dry basis, Equilibrium moisture content, Critical moisture content, Constant rate period, Falling rate period, Drying Equipments- Tray dryer, Drum dryer, Fluid bed dryer, Spray dryer, Rotary dryer, Rate of drying, Heat transfer in dryers, Drying of porous solids.

UNIT-IV [14]

- A) Size Reduction: Necessity of size reduction, Energy and power for size reduction, Crushing efficiency, Rittenger's law, Kick's law, Bond's law, Types of size reduction equipments- Jaw crusher, Smooth roll crusher, Ball mill, Hammer mill.
- B) Mechanical Separation: Screening-Types of screening equipments, Grizzly's screens, Trammel's screens, Ideal and actual screens, Capacity and effectiveness of screens.
- Filtration-Types of filtration, Constant pressure filtration, Constant rate filtration, Filter media filter cake, Pressure filters, Plate and frame filter press, Rotary drum filter, Centrifugal filtration.

UNIT-V [14]

Mixing and Agitation: Mixing of liquid with liquid, Mixing of gases with liquids, Mixing of solids with liquids, Impellers, Propellers, Turbines, Paddles, Flow pattern in agitated vessels, Unbaffled tanks, Prevention of swirling and vortex formation, Baffling, Banbury mixer, Pung mill, Ribbon blenders, Tumbling mixer, Double arm kneader.

UNIT-VI [14]

- A) Surface Chemistry: Adsorption, Mechanism of adsorption, Types of adsorption, Adsorption isotherms, Langmuir, BET and Freundlich isotherm, Factors affecting adsorption, Applications of adsorption, Sols and their preparations, Coagulation, Emulsions, Gels, Miscelles, Surfactants.

- B) Catalysis: Introduction, Types of Catalysis-Homogeneous and heterogeneous, Mechanism, Characteristics of catalysts, Catalyst deactivation, Autocatalysis, Negative catalysis, Activation Energy, Enzyme Catalysis.

Books Recommended:

- 1) Unit Operation II – K.A.Gavane
- 2) Unit Operations of Chemical Engineering- McCabe and Smith
- 3) Mass Transfer Operations- Robert E. Treybal
- 4) Unit Operations- George Granger Brown, CBS Publications.
- 5) Catalysis: Heterogeneous and Homogeneous- Delmon and Janner
- 6) Catalysis Science and Technology- Anderson J.
- 7) Surface Chemistry- J.J. Bickermann, Academic Press
- 8) Physical Chemistry- Puri and Sharma

2S Industrial Chemistry Practical

List of Experiments

UNIT – I

1. Crystallization of Benzoic acid by using water as a solvent.
2. Determination of Benzoic acid by using mixture of water and alcohol as a solvent.
3. Determination of amount of oil in given oil seed sample.
4. To study the yield of crystallization with and without seeding for copper sulphate crystals.
5. Extraction and isolation of Nicotine from tobacco leaves.
6. To establish Freundlich and Langmuir isotherm for adsorption of Oxalic (or Acetic) acid on activated charcoal.
7. Separation of two-component mixture of miscible liquids by simple distillation.

UNIT – II

1. Separation of three-component mixture of miscible liquids by fractional distillation.
2. Preparation of charcoal.
3. Coagulation of suspended solid particles in a given water sample by using alum.
4. Decolourization of Raw Sugar by using Charcoal.
5. To determine critical moisture content of a given material.
6. To construct ternary diagram for acetic acid- Water- Benzene System.

7. Determination of total acid content in lemon juice.

Distribution of Marks for Practical Examination.

Time: 6 – 8 hours (One Day Examination) Marks: 50

UNIT – I:	Exercise No.1 (Numericals)	.....	06
	Exercise No.2 (Practical Expt.)	.....	12
UNIT – II:	Exercise No.2 (Practical Expt.)	.....	12
	Viva-Voce	.....	10
	Record	.....	10

	Total:		50

11. PETROCHEMICALSCIENCE

2S Petrochemical science

Total Lectures: 84 Marks: 80

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

UNIT I		(14)
	Overview of Petrochemical industry Definition of Petrochemical, World Petrochemical industry, History and Development of petrochemical industry in India, Role of MGCC, IPCL, HBJ gas line, TNC, Fertilizer in India.	
UNIT II		(14)
	Petrochemical feedstock Feed stock for petrochemical from Natural gas and Petroleum, Most common impurities present in gases, Water vapor, Mechanical, Chemical, and other suspended impurities, how to remove them.	
UNIT III		(14)
	Separation of gases (From Natural gas and Petroleum) in to individual constituents Various process:- Absorption Desorption, Compression Liquifaction, Low temperature fractionation, Adsorption, and special technique. Introduction to separation techniques of Aromatic:- azeotropic separation, Extractive Distillation, Crystallization.	
UNIT IV		(14)
	Steam reforming	

Definition of reforming, Types of reforming,(Thermal and catalytic only introduction)

Steam reforming, various steam reforming reaction, Reactivity of hydrocarbons, Role of steam hydrocarbon ratio

UNIT V (14)

Production of synthesis gas

Various processes:- Natural gas steam reforming, Naphtha steam reforming, Partial oxidation hydrocarbon process, Scheme for CO and H₂ production, Coal gasification process, Lurgi process

UNIT VI (14)

Uses of synthesis gas

Various uses of synthesis gas, Methanol production with physical properties, Chemical reaction, Process flow and uses.

Oxo synthesis process, Production of propionaldehyde and propanol, Chemicals based on carbon monoxide

Semester – II

2S Petrochemical Science Practical

List of Experiment

- Flash point and Fire point of petroleum sample by various method
- API gravity of given petroleum sample
- Smoke point of Given Petroleum sample
- Aniline point of given petroleum sample
- Diesel index of given petroleum sample
- Viscosity by redwood viscometer
- Melting point by melting point apparatus

Distribution of Marks for Practical Examination.

Time: 6 hours (One Day Examination) Marks: 50

Exercise No.1 (Practical Expt.)	.....	15
Exercise No.2 (Practical Expt.)	.....	15
Viva-Voce	.....	10
Record	.....	10

	Total:	50

List of book:-

- Petroleum Refining and Petrochemical. N.K. Sinha, Umesh Publication Delhi

- 2) Advance Petrochemical, Dr. G.N. Sarkar, Khanna Publication, Delhi
- 3) A text on Petrochemical, Dr.B.K. Bhaskararao, Khanna publication, Delhi
- 4) Introduction to petrochemical, Sukumar Maiti,
- 5) Fuels and Combustion, Samir Sarkar, Orient Longman Ltd. Hyderabad
- 6) Catalyst and Chemical Process, Ronald Pearce and William R. Patterson, Leonard Hill, Glasgow
- 7) Systematic Experimental Physical chemistry, S.W. Rajbhoj; Dr. T.K. Chondhekar; Anjali Pub. Aurangbad
- 8) Advance Petroleum Refining, G.N. Sarkar, Khanna pub. Delhi
- 9) Petroleum Refining Technology, Dr. Ram Prasad, Khanna pub. Delhi
- 10) Unit operation II, K.A. Gavhane, Nirali Prakashan, Pune
- 11) Modern Petroleum Refining Process, Dr. B.K. Bhaskararao
- 12) Basic Organic Chemistry, Part 5, Industrial product, J.M. Tedder, A.Nechvatal, & A.H. Jubb, John Wiley, London
- 13) Industrial Organic chemistry, K. Weissmehl & H.J. Arpe, Veriag, chemie, New York
- 14) Chemical from Petroleum, A.L. Waddams, Murray, London
- 15) An introduction to industrial organic chemistry, P. Wiseman, Applied Science, London
- 16) Modern Petroleum Technology, G.D. Hobson, John Wiley, Chichester
- 17) Chemical from Synthesis gas, R.A. Sheldon, B. Reidel publishing Company, Dordrecht

LIST OF APPARATUS AND EQUIPMENTS FOR A BATCH OF 20 STUDENTS FOR B.SC. I (Semester I & II) PETROCHEMICAL SCIENCE

- | | | |
|-----|---|--------------|
| 1. | Burette | 20 Nos. |
| 2. | Pipette 10ml, 25ml | 20 Nos. each |
| 3. | Mohr pipette 2ml, 5ml | 10 Nos. each |
| 4. | Conical flask with stopper | 50 Nos. |
| 5. | Standard volumetric flask | 20 Nos. |
| 6. | Density Bottle | 20 Nos. |
| 7. | Balance (Electronic/Digital) | 02 Nos. |
| 8. | Aniline Point Apparatus | 01 No |
| 9. | U-tube viscometer of different capillary size | 02 Nos. |
| 10. | Thermometer (0 to 110°C I P Grade) | 10 Nos. |
| 11. | Thermometer (0 to 360°C I P Grade) | 10 Nos. |
| 12. | Test tube (20 and 50 ml with rubber cork) | 50 Nos. |

- | | | |
|-----|--|----------------------|
| 13. | Smoke Point Apparatus (I P Grade) | 01 No. |
| 14. | Abel Flash Point apparatus (I P Grade) | 01 No. |
| 15. | Pensky Marten's Flash Point apparatus | 01 No. |
| 16. | Cleveland Open Cup Flash point Apparatus | 01 |
| 17. | Porcelaine dish | 10 Nos. |
| 18. | Constant Temperature bath | 02 Nos. |
| 19. | Hot Plate | 01 No. |
| 20. | Air condenser | 20 Nos. |
| 21. | Glass tubing 6mm, 10mm | 20ft. Each |
| 22. | Glass rod 4mm, 8mm | 20 ft. Each |
| 23. | Stop watches | 04 Nos. |
| 24. | LPG Cylinder with regulator | 01 No. |
| 25. | Refractometer | 01 No. |
| 26. | Refrigerator | 01 No. |
| 27. | Water Distillation Plant | 01 No. |
| 28. | Beaker 250 ml | 20 Nos. |
| 29. | Beaker 50, 100, 500, 1000 ml | 07 Nos. |
| 30. | Hot Air Oven | 01 No. |
| 31. | Heating Furnace | 01 No. |
| 32. | Karl Fisher Auto Titrator | 01 No. |
| 33. | Dean and Stark Apparatus | 01 No. |
| 34. | Flame Photometer | 01 No. |
| 35. | Colorimeter | 01 No. |
| 36. | Bomb Calorimeter | 01 No. |
| 37. | Spectrophotometer | 01 |
| 38. | Oxygen Cylinder with pressure regulating valve | 01 No. |
| 39. | Vacuum Pump | 01 No. |
| 40. | Air source | 01 No. |
| 41. | Air Flow meter | 01 No. |
| 42. | Dessicators | 06 Nos. |
| 43. | Water Suction | 04 Nos. |
| 44. | Filtration Flask with Buckner Funnel 100, 250ml, 500ml | 20 Nos. |
| 45. | Heating Mantle | 06 Nos. |
| 46. | ASTM Distillation apparatus | 01 No. |
| 47. | Viscometer and Constant temperature bath | 01 Set of viscometer |
| 48. | Apparatus for oil determination in given sample | 01 No. |

as per I P norm

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

12. GEOLOGY

2S–GEOLOGY

UNIT-I:	Optical Mineralogy – Nature of Light, Ordinary and plane polarized light, Reflection and Refraction, total internal reflection and critical angle, Double Refraction – Nicol prism. Petrological Microscope – Its parts & functioning, Optical properties under plane polarized light – Colour, Pleochorism. Relief, Refractive Index and Becke line, Twinkling, Form & Cleavage. Properties under crossed Nicol – Isotropism & Anisotropism, Extinction, Interference Colours and Colour chart, Twinning.
UNIT-II:	Mineralogy – Physical, Chemical, Optical Properties & Structure of following Mineral groups, Feldspar, Mica Pyroxene, Amphibole, Garnet & Olivine group
UNIT-III:	Igneous Petrology :- Classification a) Chemical, Silica based, Silica Saturation and CIPW. b) Mineralogical Classification – Colour Index. c) Tabular Classification ; Characteristic of Acidic, Alkaline & Basic Igneous Rock Bowens Reaction Series. Continuous & Discontinuous.
UNIT-IV:	Sedimentary Petrology - Structure, Texture and Classification of Sedimentary rocks. Metamorphic Petrology-Textures, Structure & Classification of metamorphic Rocks. Stress & Anti Stress minerals. Products of Cataclastic metamorphism.
UNIT-V:	Paleontology - Systematic Classification of organism, Morphological character, Classification, and geological history of Phylum Mollusca and Brachiopoda,
UNIT-VI:	Stratigraphy – Lithostratigraphic Classification of India. Classification, geographic distribution, lithological characteristic,

fossil content and economic importance of Archean Super group, Dharwar Super group, Vindhyan – Super group, and Cuddpah Super group. Stratigraphy of Maharashtra.

Practicals (about 20-25)

1. Megascopic Identification of Mineral from the families as listed in Theory.
2. Megascopic identification of 20—25 Igneous, Sedimentary & Metamorphic Rocks.
3. Study of about ten Minerals under thin section as listed in syllabus.
4. Study of about ten Rocks under thin section from Igneous / Sedimentary/ Metamorphic.
5. Identification of about ten fossils from families as listed in Theory.

Semester – II

The Practical Examination will be of 4 hours duration & carries 50 Marks.
The distribution of Marks for Practical will be as follows.

A)	I	Megascopic Identification of Minerals	10 Marks
	II	Megascopic Identification of Rocks	12 Marks
	III	Optical Minerals	04 Marks
	IV	Rocks in thin Section	06 Marks
	V	Fossil	08 Marks
B)		Record	05 Marks
C)		Viva-Voce	05 Marks

		Total	50 Marks.

Reference Books for Sem I & II :

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.Mahaptra- 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.
11. I. G.W.Tyrell (1998) Principles of Petrology B.I.Publications Pvt.Ltd., New Delhi.
12. H.F.Read: Rutley's Elements of Mineralogy.
13. Dana, E.S. and Ford, W.E.(1949) A Text Book of Mineralogy. Wiley Eastern Ltd.
14. Roger and Kerr: Optical Mineralogy.
15. Jensen, M.L.and Bateman, A.M.(1981) Economic Mineral Deposits. John Wiley and Sons, New York.
16. Deb, S. (1980) Industrial Minerals and Rocks of India. Allied Publishers, New Delhi.
17. Deshpande, G.G. (1998) Geology of Maharashtra. Geological Society of India, Bangalore.
18. Henry Woods (1985) Invertebrate Palaeontology. CBS Publishers.
19. R.M.Black (1970) The Elements of Invertebrate Palaeontology, Cambridge University Press.
20. M.A.Koregave (1998) Fundamentals of Invertebrate Palaeontology, Book World Enterprises, Mumbai
21. Ravindra Kumar (1985) Fundamentals of Historical Geology and Stratigraphy of India. Wiley Eastern Ltd., New Delhi.
22. M.S.Krishnan (1982) Geology of India and Burma. CBS Publishers.
23. D.N.Wadia (1998) Geology of India. Tata McGraw Hill, India.

List of Equipments & Materials For B.Sc.

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

Ore Minerals.

A set of 100 one Minerals for megascopic study. (Set should be made with one Minerals as listed in Practical and included in Indian Matallc deposit of Theory course).

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

- | | |
|--|---------|
| 1. Petrological slide, projector | 1.No. |
| (For Demonstration of this section) with screen | |
| 2. Magnifiers 10x or more | 20 Nos. |
| (Table/Hand model with large view for Magascopic Study) | |
| 3. Hand lens 10 x or 20 x | 20Nos. |
| 4. Pen knife | 20 Nos. |
| 5. Streak Plates | 20 Nos. |
| 6. Petrological polarizing microscope | 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 transparent, 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 phylum 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 scale covering entire, Vidarbha.
3. Rotarameter 5 Nos.
4. Planimeter 5 Nos.
5. Tracing table (large size) 1 Nos.

Photogeology

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 complex. In addition about 20-25 problems are to be taken on dip, strike, 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 far as possible maximum no of charts should be present for demonstration of symmetry elements, crystallographic system. Morphology of various phylum, structural diagram, geodynamics, geological works performed by natural agencies. Mineralogical,

petrological 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. Hammer Sack 20 Nos.
3. Field camera (Plintax) with zoomlens and flash guns 1 Nos.
4. Water bottle 2 Nos.
5. Steel tapes 5 Mtr., 10 & 50 Meters. 2 Each.
6. Clinometer compass 15 Nos.
7. Brunton 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 models 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 Museum should be separate.)

13. BOTANY

2S – BOTANY

Gymnosperm, Morphology of Angiosperms and Utilization of Plants

UNIT-I: Palaeobotany (15)

- 1.1. Process of plant fossilization and types of fossils
- 1.2. Geological Time Scale
- 1.3. Fossil Gymnosperms
 - 1.3.1. Pteridospermales: Lyginopteris oldhamia
 - 1.3.2. Bennettitales: Bennittites

UNIT-II : Gymnosperms (15)

- 2.1. Classification according to D. D. Pant
- 2.2. General account: morphology, anatomy, life cycle and taxonomic position of Pinus and Gnetum

- 2.3. Affinities with pteridophytes and angiosperms
 2.4. Economic importance of Gymnosperms
- UNIT-III: Morphology (15)
- 3.1. Diversity in Plants habits – Annual, biannual, perennials
 3.2. Roots – Types of root : tap and adventitious, modification of root : for food storage, respiration, and supports.
 3.3. Stem – Types of Stem, Characteristic features, branching, modification of Stem – Underground and aerial
 3.4. Leaf – Parts of leaf, types of leaves – simple and compound; Phyllotaxy; Venation; Stipule. Modification of leaves
- UNIT-IV: Morphology (15)
- 4.1. Inflorescences – Types: Racemose, Cymose and Special.
 4.2. Flower – Flower as modified shoot; Structure of flower – Calyx, Corolla, Androecium and Gynoecium. Placentation; Types of Pollination.
- UNIT-V : Morphology and Utilization of Plants (15)
- 5.1. Fruits – Morphological types
 5.2. Utilization of Plants
 5.2.1. Food Plants – Wheat, Potato – Morphology, varieties and economic importance.
 5.2.2. Fiber Plant – Morphology, varieties and economic importance of Cotton.
 5.2.3. Oil yielding Plant – Morphology, Varieties and economic importance of Ground nut.
- UNIT-VI: Utilization of Plants (15)
- 6.1. Spices – General account and economic importance of Black pepper, Clove, Cinnamon and Cardamom
 6.2. General account and sources of firewood, timber and Bamboos.
 6.3. Essential oils – General account, economic importance of Eucalyptus.
 6.4. Pharmacognosy and Phytochemistry with respect to following medicinal plants –
 6.4.1. Aloe vera
 6.4.2. Adathoda vasica
 6.4.3. Asparagus racemosa
 6.4.4. Azadirachta indica

- 6.4.5. Catharanthus roseus
 6.4.6. Chlorophytum borivillianum
 6.4.7. Emblica officinalis
 6.4.8. Ocimum sanctum
 6.4.9. Rauwolfia serpentina
 6.4.10. Vitex negundo
 6.4.11. Withania somnifera

LABORATORY EXERCISE

- I. Gymnosperms: Morphology and anatomy of the following members –
 a. Pinus
 b. Gnetum
- II. Preparation of double stained permanent mount of Pinus stem, needle and Gnetum stem and leaf.
- III. Study of fossil slides of Lyginopteris and Bennettites
- IV. Detailed morphological study of types of root, stem and leaf with its modifications
- V. Forms of corolla
- VI. Types of placentation
- VII. Morphology of fruits
- VIII. Morphology of plant parts used and medicinal plants prescribed in syllabi
- IX. Utilization of plants: Spices, fiber yielding plants and food plants prescribed in syllabi

BOOKS RECOMMENDED

- 1) A.C. Dutta : Text Book of Botany.
- 2) Andrews A.N. : Studies in Paleobotany.
- 3) Arnold C.A. : Introduction of Paleobotany.
- 4) Bhatnagar S.P. and Moitra A., 1996 : Gymnosperms, New Age International Limited, New Delhi.
- 5) Bhojwani & Bhatnagar : Embryology of Angiosperms.
- 6) Coulter M.J. & Chamberlain C.J. : Morphology of Gymnosperms.
- 7) Cutter E.G., 1971 : Plant Anatomy Experiment and Interpretation Part-II, Organs, Edward Arnold, London.
- 8) Cutter, E.G. 1969 : Part-I, Cells and tissues, Edward, Arnold, London.
- 9) Davis P.H., and Heywood V.H., 1993 : Principles of Angiosperm Taxonomy: Oliver and Boyd, London.

- 10) Eames E.J. : Morphology of vascular Plants.
- 11) Gangulee & Kar : College Botany Vol.II
- 12) Gangulee Das and Dutta : College Botany, Vol.I
- 13) Giford E.M. and Foster A.S., 1988 : Morphology and Evolution of Vascular Plants, W.H. Freeman & Company, New York.
- 14) Hartmann H.T. and Kestler D.E., 1976 : Plant Propagation Principles and practices, 3rd edition, prentice Hall of India Pvt.Ltd. New Delhi.
- 15) Heyhood V.H. and Moore D.M. (Eds) 1984 : Current concepts in plant Taxonomy. Academic Press, London.
- 16) Jeffrey C., 1982 : An introduction to Plant Taxonomy, Cambridge University Press, Cambridge, London.
- 17) Maheshwari P. : Introduction of Embryology of Angiosperms.
- 18) Pande B.P. : A Text Book of Angiosperms.
- 19) Proctor M. and Yeop, 1973 : The Pollination of Flowers, William Collins Sons, London.
- 20) Radford A.E., 1986 : Fundamentals of Plant Systematics, Harper and Row, New York.
- 21) Rendle A.B. : Classification of flowering plants, Vol.I & Vol.II.
- 22) S. Sundar Rajan : College Botany, Vol.II & Vol.III.
- 23) Saxena and Sarabhai : A Text Book of Botany, Vol.II
- 24) Sharma O.P. : Gymnosperms.
- 25) Shukla & Mishra : Paleobotany.
- 26) Singh and Jain : Taxonomy of Angiosperms.
- 27) Singh, 4. 1999, Plant Systematics - Theory and Practices, Oxford and IBH Pvt. Ltd., New Delhi.
- 28) Sporne K.R. : Morphology of Gymnosperms.
- 29) Sporne K.R., 1965: The Morphology of Gymnosperms, Hutchinson & Company, (Publisher) Ltd. London.
- 30) Stace C.A., 1989: Plant Taxonomy and Biosystematics (2nd Edition) Edward Arnold, London.
- 31) Stewart W.N., 1983 : Paleobotany and Evolution of Plants, Cambridge University Press, Cambridge.
- 32) Thomas P., 2000 : Trees - Their natural history, Cambridge University Press, Cambridge.
- 33) Trivedi B.S. & Sharma B.B. : Introductory Taxonomy.
- 34) Tyagi & Kshetrapal : Taxonomy of Angiosperms.
- 35) Vasistha P.C. : Gymnosperms.
- 36) Vasistha P.C. : Taxonomy of Angiosperms.

- 37) Vyas Purohit Garg : A Text Book of Gymnosperms.
- 38) Walton : An Introduction & Study of fossil.
- 39) Modern Practical Botany, Volume-I, Dr.P.B.Pande, S.Chand Pub., N.W.
- 40) Modern Practical Botany, Volume-II, Dr.P.B.Pande, S.Chand Pub., N.W.
- 41) Modern Practical Botany, Volume-III, Dr.P.B.Pande, S.Chand Pub., N.W.

Semester – II
Practical Schedule

Time : 4 hours	Marks : 50
Q1. Preparation of double stained permanent mount of given Gymnospermic material and identification with reasons	10
Q2. Comments on given Morphological specimens	12
i. Root	
ii. Stem	
iii. Leaf	
iv. Inflorescence	
v. Flower	
vi. Fruit	
Q3. Comment on given medicinal plant with reference to morphology, part used and medicinal importance (Any two)	10
Q4. Spotting (02 marks each)	08
a) Palaeobotany	
b) Gymnosperms	
c) Utilization of Plant (food, fibers, spices) (2 Materials)	
Q5. Practical record	5
Q6. Viva voce and Excursion report	5

14. ENVIRONMENTAL SCIENCE
2S-ENVIRONMENTAL SCIENCE
ECOLGY AND ENVIRONMENT

- UNIT I
- a) Introduction to Ecology- Definition, principles and scope of ecology. Ecological factors- climatic, biotic, topographic.
 - b) Biogeochemical cycles- Definition, types. Gaseous (carbon, oxygen, and nitrogen). Sedimentary (phosphorous and sulfur).
(Lectures-14)
- UNIT II
- a) Population Ecology- Definition, characteristic (natality, mortality, age structure, growth curve, dispersal, population size and density, biotic potential and life tables.
 - b) Interspecific relationship- Positive and negative.
Positive- mutualism and commensalism.

Negative – Parasitism and predation.

(Lectures-14)

UNIT III Community Ecology: Definition, characteristics – species diversity, growth form, structure and dominance.

Characters used in community structures-

Analytical-a) Qualitative- frequency, abundance, density, basal area, dominance. b) Quantitative – Physiognomic, phenology stratification abundance vitality, life form.

Synthetic- i) presence and Constancy, ii) fidelity iii) Dominance and other synthetic characters.

Methods of study of community- Quadrat. (Lectures-14)

UNIT IV a) Ecosystem- Definition, components and structure, food chain, food web, ecological pyramids, energy flow in ecosystem, energy flow model (Y-shaped).

b) Ecosystem types: Terrestrial- forest, grassland, desert and cropland; Aquatic- marine and fresh water. (Lectures-14)

UNIT V a) Productivity of ecosystem- Concept of productivity, types (primary, secondary), net productivity. Biomass- concept, definition and study methods.

Methods of measurement of productivity- Chlorophyll, O₂, CO₂ and radioactive.

b) Ecological succession – Definition, causes, types. General process of succession. Hydro sere, xerosere as a succession models. Ecological niche, Ecotone. (Lectures-14)

UNIT VI a) Biodiversity – Definition, types, Biodiversity loss, global diversity. India as mega diversity nation. Indian Biodiversity hot spots.

b) Bio-indicators - climatic, soil and pollution and their role in environment. (Lectures-14)

NOTE :- Should visit to different Environmental ecosystems for the study of various components, interactions and ecological indicators.

BOOKS FOR REFERENCE:

1. A Text book of Ecology and Environment by P.C. Joshi and Namita Joshi, Himalaya.
2. Fundamentals of Ecology by E.P. Odum.
3. Principles of Environmental Biology-P.K.G. Nair, Himalaya Publ.
4. Ecology and Environment- P.D. Sharma, Rastogi Publ.
5. Plant Ecology and Soil Science- R.S. Shukla, P.S. Chandel, S Chand &

company.

6. Fundamentals of Ecology- M.C. Dash, Tata McGraw Hill Pub.
7. Communities and Ecosystem- Witalkar.
8. Environmental Science - Van Cunningham, Tata McGraw Hill Pub.
9. Manual of Field Ecology- R. Mishra.
10. Concept of Ecology- E.J. Koromondy, Principal Hall.
11. Modern Concept of Ecology- H.D. Kumar.
12. Text book of Plant Ecology- R.S. Ambush.
13. Elements of Ecology- Brijgopal and Bharadwaj.
14. Elements of Ecology- P.L. Kochar.
15. Environmental Biology- K.C. Agrawal.

PRACTICAL II

PRACTICAL COURSE FOR B.Sc. PART-I, SEMESTER-II

(ENVIRONMENTAL SCIENCE)

- A) Experiments on vegetational community structure.
1. Determination of minimum size of quadrat by Species Area-Curve method.
 2. Determination of minimum number of quadrat to be laid down in the field under study.
 3. To study community characters – density, frequency, abundance by quadrat or line transect method.
 4. To study vegetation of given area by Physiognomic / Biological Spectrum Method.
 5. To compare the biomass of ungrazed and grazed grassland.
 6. To determine Importance value Index (IVI) of vegetation.
- B) Experiments on Ecosystems.
1. Measurement of Primary productivity in aquatic ecosystem by light and dark bottle method.
 2. To study abiotic components – pH, temperature, turbidity and light penetration in pond ecosystem.
 3. To study biotic components of pond ecosystem.
 4. To study biotic components of forest ecosystem.
 5. Qualitative and quantitative estimation of planktons in fresh water.
 6. To study the abiotic components of forest ecosystem.
 7. To study the ecological adaptations in Flora and Fauna.

- C) Spotting= Observation and comments on –
1. Mutualism- Lichens, Rhizobia, Mycorrhizae.
 2. Commensalism- Lianas, Epiphytes.
 3. Parasitism- Cuscuta, Orobranchie, Loranthus.
 4. Predation- Nepenthes, Drosera and Utricularia.

DISTRIBUTION OF PRACTICAL MARKS		Time : 4 hrs.
Q.1	Any two Experiments on community structure -----	20
Q.2	Experiments on Ecosystem -----	10
Q.3	Spotting (any four)-----	08
Q.4	Tour Diary -----	03
Q.5	Practical record-----	04
Q.6	Viva-voce -----	05

TOTAL		50

15. SEED TECHNOLOGY (VOCATIONAL)

2S-SEED TECHNOLOGY

PLANT BREEDING METHODS FOR CROP IMPROVEMENT AND SEED PRODUCTION.

- UNIT I Genetic basis of crop improvement –Mendelian principles of inheritance of characters (Segregation , independent assortment).
Laws of probability , Gene interactions . Gene 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 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 .
Achievement in field crops, flowers, fruits vegetables and other plants.

Pureline selection – Definition of pureline, Characters of pureline and its importance, Field techniques of pureline 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 limitations , Achievement through clonal selection in some crop spp.

UNIT II Mass selection Definition, Procedure of mass selection , Merits and demerits, Differences between pureline selection, clonal selection and mass selection.

Hybridization followed by selection in self pollinated crops - 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 backcross 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 and fruit crops.

Mutation in crop improvement—Definition of mutation, mutagen, mutant etc.

Classification of mutation (point mutation, chromosomal, somatic mutation, spontaneous and induced mutation macro and micro mutation).

Artificial induction of mutation, Mutagens (physical, chemical, radioactive isotopes) .

Mechanism of action of mutagens. Dosimetry.

Procedure for mutation breeding, Significance of induced mutation in crop improvement

Achievements through induced mutations.

UNIT III - 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. Advance 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.

UNIT IV - General introduction—Seed definition- differences 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. Characteristic of sowing quality seed. Mode of reproduction in relation to seed production-Classification of crop plant 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.

UNIT-V 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 pollination detaseling- male sterility, gametocides and self incompatibility.

Areas of seed production—Choice of area of seed production, Factors affecting the choice of area of seed production-soil type, climate ,nutrition and weed status, insect pest and disease incidence.

Compact area approach in seed production. Seed village concept generation system of multiplication.

UNIT-VI 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 .

Bivalent, monovalent effect 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 ,organizing and managing a seed production programme.

Seed production procedure—Detailed seed production procedure in following crops with reference to land and isolation requirement, special agronomic management, roguing , harvesting and threshing in wheat ,Rice, Sorghum, Bajara, Maize, Chick pea ,Lentils ,Cowpea, Mung , Urdbeans, Soybeans, Groundnut, Rapeseed, Mustard, Sasame , Sunflower, Forages, Potato, seed plot technique of potato multiplication, production of hybrid Potato seeds.

PRACTICALS.

PLANT BREEDING METHODS FOR CROP IMPROVEMENT AND SEED PRODUCTION.

- 1 Preparation of slides for the study of mitosis and meiosis.
- 2 Hybridization techniques.
- 3 Studies on segregation using mixture of coloured seeds

- 4 Studies on independent assortment.
- 5 Studies on gene interactions.
- 6 Embryo rescue and media preparation for cultures
- 7 Visit to research farms.
- 8 Preparation of agroclimatic maps (India and States) for soil, crops and climatic conditions
- 9 Identification of different crop seeds.
- 10 Seed production planning-for hybrid and varieties, Computation of area and seed requirements for seed production of certified class.
- 11 Study of inflorescence and flower structure of self and cross pollinated crops.
- 12 Study of pollination and fertilization, insect pollinators- their identification, management of insect pollinators especially honey bee isolation distance.
- 13 Study Of seed production practices of cereals, pulses, oilseed, and fibre crops in relation to planting, weed control, roguing, harvesting and threshing.
- 14 Visit of nucleus, breeder seed plots and study of maintenance of varieties.
- 15 Visit of foundation and certified seed plots and study of the techniques of seed production.
- 16 Seed planning—cost of seed production.

PRACTICAL EXAMINATION

	Marks
1	7
2	7
3	8
4	7
5	7
6	7
7	7
Total Marks	50

BOOKS RECOMMENDED

- 1 Seed Technology- R. L. Agrawal Oxford IBH.
- 2 Choudhary R. C. 1982 Introduction to plant breeding oxford and IBH, Publishing co, New Delhi.
- Singh, B. D. 1990, Plant breeding Principles and methods kalyni publisher, New Delhi.
- 3 Simmonds, N. W. 1979 , Principles of crop improvement Longman, Newyork.
- 4 Strickberger N W. 1985 Genetics, Mc Millan publishing co. Newyork.
- 5 Gupta , P. K. 1991, Genetics Rastogi Publication co ,Meerut.
- 6 Frankel, R. and Galun, E. 1977. Pollination mechanisms, Reproduction and plant Breeding, Springer-Veriag, Berlin.
- 7 Poehlman, J. M. and Borthakur, D 1972 Breeding Asian Field Crops. Oxford and IBH publishing co . NewDelhi.
- 8 Chopra, V. L. 3Year plant breeding theory and practice. Oxford and IBH publishing co . NewDelhi.
- 9 Agrawal , P. K. and Dadlani, M. 1990. Techniques in seed science and Technology. South Asian publisher Newdelhi.
- 10 Fertilizer, W. P. 1975 Ed cereal seed Technology. Food and Agriculture Organisation of United Nation,. Rome.
- 11 Fertilizer, W. P. (1982) , Ed Technical guidelines for maize seed technology. Food and Agriculture Organizatin of the United Nations , Rome.

16. ZOOLOGY

There shall be following paper and practical for B.Sc.Part-I Semester Two examination. The syllabus is based on 6 theory periods and six practical periods per week (Total 75-80 theory Sessions and 25 practical sessions during the complete semester). There shall be one compulsory paper of 3 hours duration, in theory as stated below and practical examination extending for four hours. Every examinee shall offer the following paper of 100 marks, (Out of which, 80 marks will be for written examination and 20 marks for internal assessments) and practical examination of 50 marks. Candidates are required to pass separately in theory and practical examination.

	Marks
1) Paper-II: Cell and Developmental Biology	
Theory (Written)	..... 80
Internal assessments	..... 20

2) Practical:	.....	.....	50

	Total :		150 Marks

2S-ZOOLOGY

CELL AND DEVELOPMENTAL BIOLOGY

- UNIT-I: 1. General organization of Prokaryote and Eukaryote Cell.
2. Ultra structure and functions of, Plasma membrane
3. Ultra structure types and functions of, Endoplasmic reticulum
- UNIT-II: 1. Ultra structure and functions of, Golgi complex
2. Ultra structure and functions of Ribosome
3. Ultra structure and functions of Mitochondria.
4. Ultra structure and functions of Lysosomes.
- UNIT-III: 1. Ultra structure and functions of nucleus and nucleolus.
2. Chromosome and its general organization.
3. Structure of Polytene and Lamp brush Chromosome.
- UNIT-IV: 1. Mitosis and its significance
2. Meiosis and its significance.
3. Gametogenesis: Spermatogenesis and oogenesis
4. Fertilization: Types of fertilization, Mechanism of fertilization,
- UNIT V: 1. Cleavage, and development up to coelome formation in amphioxus
2. Cleavage, Blastulation and gastrulation up to the formation of three germ layers in Frog, Fate map.
3. Cleavage, Blastulation and gastrulation up to the formation of three germ layers in chick.
4. Extra embryonic membranes in chick: Development and significance.
- UNIT-VI: 1. Placentation in mammals; Types and Functions of Placenta.
2. Parthenogenesis: Types and, Significance,
3. Regeneration in invertebrates and vertebrates.
4. Elementary idea of, sources, types and use of Stem cells.

Two practical per week each of 3 period's duration. The Examination shall be of 4 hrs duration and of 50 marks.

Practical :

I- Cell biology –

1. Use, care and maintenance of microscope.
2. Bacterial Culture, Gram staining.
3. Permeability tests using erythrocytes.
4. Stained preparations of different type of animal cells. (Epithelial, connective, muscular and nervous cells)
5. Study of stages of mitosis in permanent stained slides
6. Study of stages of meiosis in permanent stained slides
7. Preparation of Polytene chromosome in Chironomous or Drosophila larva
8. Preparation of various stages of mitosis in Onion root tip.
9. Preparation of various stages of meiosis in grasshopper testis.

II. Developmental Biology.

1. Study of stages of Gametogenesis in rat/frog, (Permanent Stained Slides)
2. Study of different of types of animal eggs.
3. Study of developmental stages (Life cycle) of cockroach, Housefly, Mosquito, Butterfly, Moth.
3. Collection and Observation of early developmental stages in limnea and frog.
4. Observation of 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(WM and Sections).
7. W.M. Slides of Chick embryos at 18, 24, 36, 48, 72 hrs.
8. Mounting of limnea and chick embryos.
9. Study of different types of placenta with suitable histological slides or visual diagram.

Distribution of Marks during Practical Examination:

Time: 4 hrs.

- | | | |
|------|--|----------|
| i) | Identification and comments on spots
(1-8) - 4 Cytological, 4 Embryological | 16 Marks |
| ii) | Cytological preparation | 10 Marks |
| iii) | Embryological Preparation/Life cycle comments..... | 10Marks |
| iv) | Certified class record | 5 Marks |
| v) | Collection of Developmental stages of insects, frog..... | 4 Marks |

v) Viva-voce- 5 Marks

Total: - 50 Marks

Note:

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.
- Collection of, eggs of different animal, cocoons, developmental stages of insects, frog or other locally available animals.

Reference Books Recommended (All latest editions):

- 1) C.B.Pawar ;Cell Biology :
- 2] Alberts Bray, Lewis, Raff, Roberts and Watman Molecular Biology of the cell (Garland)
- 3] Balinsky, An introduction to Embryology, (CBS College Publishers)
- 4] Grant: Biology of developing system (Halt, Reihart and Winston.)
- 5] Gilbert: Developmental Biology (Sinauer)
- 6] Puranik P. G., A Text Book of Embryology S. Chand & Co.
- 7] Browder L.W. Erickson C.A. & Williams Developmental Biology, 1992 3rd edition, R J. Saunders // . College, Publications, London
- 8] Tyagi, Verma and Agrawal: Chordate embryology.
- 9] Dr.R.A.Malu, et.al Text Book of Cell Biology and Developmental Biology - Shivneri Publishers, Amravati.
- 10] Korak Kanti Chaki, Gautam Kundu, and Supriti Sarkar: Introduction to General Zoology Vol. 1 and Vol.2
- 11] De Robertis Cell and Molecular biology

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

- | | | | |
|----|---------------------------|---|----|
| 1. | Compound Microscope | - | 16 |
| 2. | Dissecting Microscope | - | 16 |
| 3. | Dissection Box | - | 02 |
| 4. | Dissecting Trays | - | 25 |
| 6. | Phase contrast microscope | - | 01 |
| 7. | Computer set with LCD. | | |
| 8. | Glass aquarias | - | 3 |
| 9. | Dissection Accessories. | | |

- 10 Scale reader
- 11 Hot air oven.
- 12 Weighing Balance (Single Pan Balance)
13. Refrigerator

17. INDUSTRIAL FISH AND FISHERIES**(vocational)**

There shall be a following paper and practical for B.Sc. Part-I Semester Two examination. The syllabus is based on 6 theory periods and six practical periods per week (Total 75-80 theory periods and 25 practical during the complete semester). There shall be one compulsory paper of 3 hours duration, in theory as stated below and practical examination extending for four hours. Every examinee shall offer the following paper of 100 marks, (Out of which 80 marks will be for written examination and 20 marks for internal assessments) and practical examination of 50 marks. Candidates are required to pass separately in theory and practical examination.

		Marks
1)	Paper-II: CAPTURE FISHERIES	
	Theory (Written)	..... 80
	Internal assessments	..... 20
2)	Practical:	..... 50
Total :		150 Marks

2S- INDUSTRIAL FISH AND FISHERIES**CAPTURE FISHERIES**

- | | |
|-----------|---|
| UNIT I | <ol style="list-style-type: none"> 1. Capture fisheries. Potential, estimates and significance. 2. Biological aspects of fishery management. 3. Principles of conservation, Development and Management. 4. Population dynamics |
| UNIT II. | <ol style="list-style-type: none"> 1. Concept of recruitment and yield 2. Problem of overfishing MSY, MEY and OSY. 3. Important river systems of India and their fisheries. 4. Cold water fisheries: Resources Development and Management |
| UNIT III. | <ol style="list-style-type: none"> 1. Fisheries of trout, Mahaseer and other cold water species. 2. Lacustrine fisheries. |

3. Origin, distribution and classification of Lakes.
4. Salient physico-chemical features and fisheries of Kodaikanal lake, Yer caud Lake, Ooty lake, Logta Lake.
- UNITIV. 1. Reservoir fisheries in India.
2. Marine fishery Resources in India.
3. Problem of inshore fishery.
4. Sampling technique adapting for estimating marine fish landing.
5. Pattern and growth of marine fishery exploitation. Under exploited and unexploited resources of the Exclusive Economic Zone (EEZ).
- UNITV. 1. Pelagic fishery Resources of India.
2. Fishery of oil sardine and other sardines mackerel, ribbon fish, Tunnies, seer fishes carangids and cephalopods.
3. Midwater and dimersal fisheries.
4. Fishery of Elasmobranch, Bombay duck, Catfishes, Silver bellies, Pomprets, Prawn, Crab, Lobsters, mussels and Clams.
- UNITVI. 1. Estuarine fisheries; Definition, origin and classification of Estuarine fisheries.
2. Major Estuaries of India and their fisheries.
3. Brackish water lakes and their fishery
4. Chilka Lake and Pulicat Lake
5. Indian backwater and their fisheries.

Practicals:

- Study of food and feeding habits of fishes - Analysis of stomach content qualitative and quantitative methods.
- Estimation of growth rate and ageing by indirect methods- (Using scales and otoliths, length weight relationship & ponderal index.)
- Plankton analysis: qualitative and quantitative, permanent stained preparations of planktons.
- Estimation of relative conditions factors, gonad somatic index and fecundity.
- Study of spawning habits based on ova diameter polygons.
- Identification of egg hatching spawn, fry and fingerlings of Indian major carps.
- Study of larval stages of crustacean and molluscs.
- Study of various types of external and internal fish tags.
- Field visits - (1) Visit to fish catching, center to assess catch compositions species

- Study of crafts and gears in inland water
- Fish market statistical data.
- Visit to a polluted water body to assess its impact on fishery.
- Visit to fish farm.

PRACTICALSEXAMINATION

Distribution of Marks.

- | | | | |
|----|--|---|----------|
| 1. | Identification and comments on given spots, 1 to 5 | — | 15 Marks |
| 2. | Identification of a given species of fish by morphometric study. | — | 7 Marks. |
| 3. | Estimation experiment Plankton analysis or determination of/ Feeding habit of fish by stomach content analysis | — | 8 Marks. |
| 4. | Permanent stained micro preparation of Any planktonic organism. | — | 6 Marks. |
| 5. | (a) Viva voce | — | 5 Marks |
| | (b) Record book | — | 5 Marks |
| | (c) Field dairy | — | 4 Marks |
| | Total : | | 50 Marks |

List of Equipments

- Microscopes common and Inverted.
- Fish measuring Boards.
- Dissection sets.
- Scale reader
- Hot air oven.
- Weighing Balance (Single Pan Balance)
- Otolith cutter and grinder
- Bone cutters.
- Oculometer and stage micrometer
- Microtome
- Camera lucida
- Projection microscope
- Centrifuge (Electrically operated)
- Sedgwick Rafter Cells.
- Tissue homogenizer
- Catheters

- 17) Refrigerator
- 18) Water analysis kit (Digital), Spectrophotometer, Colorimeter
- 19) pH meter, Oxygen analyzer.
- 20) Autoclave
- 21) Phage-Contrast microscope
- 22) Aluminum 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) Petri dishes, test tubes etc.
- 32) Glass troughs
- 33) Earthen ponds.
- 34) Cement custemes
- 35) Millpore filters
- 36) Pressure cookers
- 37) Drilling Machines.

References for Fish Biology(Sem I and II)

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. Kvale, 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 Identifications 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 Fishcicule 9. Research on Fish stocks. Laevastu T. 1965 Food and Agriculture Organization 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.

18. Biological Techniques And Specimen Preparation (vocational)

There shall be a following paper and practical for B.Sc. Part-I Semester Two examination. The syllabus is based on 6 theory periods and six practical periods per week (Total 75-80 theory periods and 25 practical during the complete semester). There shall be one compulsory paper of 3 hours duration, in theory as stated below and practical examination extending for four hours. Every examinee shall offer the following paper of 100 marks, (Out of which 80 marks will be for written examination and 20 marks for internal assessments) and practical examination of 50 marks. Candidates are required to pass separately in theory and practical examination.

	Marks
1) Paper-II: BTSP (Plant)	
Theory (Written)	..... 80
Internal assessments	..... 20
2) Practical.....	..... 50
Total : 150 Marks	

2S- Biological Techniques and Specimen Preparation (Vocational)**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.
UNIT-II	Plants used as cereals, Pulses, Fruits, vegetables, fiber plants, species of medicinal value. Ethno botanical plants of nearby locality. 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,
UNIT-III	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. Preparations of permanent slides showing stages of cell division. Use of chemicals to arrest cell division. Special stains for chromosomes and their preparation.
UNIT-IV	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-V	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. Modeling materials-Plaster of Paris, epoxy resin and fiber glass. Characteristics of teaching models, preparations, durability, attractiveness, innovations.
UNIT-VI	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. Preparation of herbarium sheet: 20 sheets.
2. Preparation of botanical museum specimens: Including life cycles.
3. Preparation of display boxes of dry plant., & Plant products.
4. Preparation of Botanical whole mounts.
5. Collection and preservation of Botanical materials for anatomical & cytological studies.
6. Preparation of alizarine stained preparation.
7. Plate and colony counting. (Bacteria/fungi)..
8. Taxidermy.
9. Preparation of resin embedded specimen, preparation of teaching models of plaster of Paris, Epoxyresin and fiber glass.
10. Preserving materials for class work use.
11. Preparation of Sterile culture media: plants-Culture of bacteria, fungi, algae, and their maintenance.
12. Study and use of Camera Lucida.
13. Microtomy: Preparation of Botanical permanent micro slides (Histological)

Practical Examination

Distribution of mark

(50 Marks)

Q1.	Microchemical/Phytochemical test	10 marks
Q2.	Permanent stained micro preparation Or Double stained preparation	10 marks
Q3.	Squash/smear of root tip/anther	8 marks

Or

Mounting of bacteria/fungi/algae.

Q4.	Camera Lucida drawing of the given slide/material	7 marks
Q5.	Submission of herbarium, Botanical museum specimens 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	5 marks
Q7	Viva voce	5 marks
	Total :.....	50 Marks

Books recommended for Paper PAPER-1S and 2S-BTSP

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 (Chordates) : 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.

19. STATISTICS 2S-STATISTICS

The examination in Statistics of First & Second semester will comprise of one theory paper each, internal assessment and practical examination. Theory paper will be of 3 Hrs. duration and carry 80 marks. The internal assessment will carry 20 marks. The practical examination will be of 4 hours duration and carry 50 marks.

The Distribution of marks for practical will be as follows :

- | | | |
|----|--------------------------|----------|
| 1. | Practical record ----- | 08 Marks |
| 2. | Practical Viva Voce----- | 12 Marks |
| 3. | Practical problems----- | 30 Marks |

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

The college imparting instructions in Statistics should provide 12 digit desk model electronic calculators to the every student for practical work.

UNIT I : Correlation and Regression Analysis :

- 1.1 Concept of correlation, scatter diagram and positive and negative correlation.
- 1.2 Karl Pearson's coefficient of correlation and its derivation, properties of correlation coefficient, coefficient of determination.
- 1.3 Concept of regression, lines of regression, two lines of regressions.
- 1.4 Coefficient of regression and its derivation, properties of regression coefficients.
- 1.5 Principle of least square, fitting of linear regression, polynomial and exponential curve.
- 1.6 Rank correlation – Spearman's and Kendall's rank correlation coefficient.

UNIT II : Multiple Regression and Correlation :

- 2.1 Concept of multiple regression, concept of regression and its properties, Yule's notations.
- 2.2 Equation of plane of regression of three variables, variance of residuals.
- 2.3 Concept of multiple correlation (3 variables) and derivation of multiple correlation coefficient, properties of multiple correlation coefficient.
- 2.4 Concept of partial correlation and derivation of partial correlation coefficient, properties of partial correlation coefficient.

UNIT III : Theory of Attributes :

- 3.1 Definition of attribute, notations, classes and class frequencies, order of class and class frequencies.
- 3.2 Consistency of data, conditions for consistency of data, simple numerical problems.
- 3.3 Independence of attributes, criteria for independence.
- 3.4 Association of attributes, Yule's coefficient of association, coefficient of colligation, relation between coefficient of association and colligation.

UNIT IV : Discrete Probability Distributions-I :

- 4.1 Discrete uniform distribution – its definition, mean, variance.
- 4.2 Bernoulli distribution – its definition, mean variance.
- 4.3 Binomial Distribution - its definition and derivation, mean variance, coefficient of skewness and kurtosis, moments and m.g.f., fitting of binomial distribution.
- 4.4 Negative Binomial Distribution – Its definition, derivation, mean,

variance, moments and m.g.f.

UNIT V: Discrete, Probability Distributions-II :

- 5.1 Poisson Distribution - its definition and derivation, mean variance, coefficient of skewness and kurtosis, moments and m.g.f., fitting Poisson distribution.
- 5.2 Hyper geometric Distribution - its definition and derivation, mean variance.
- 5.3 Geometric Distribution - its definition, mean variance, coefficient of skewness and kurtosis, moments and m.g.f.

UNIT VI: Continuous Probability Distribution :

- 6.1 Continuous Uniform Distribution - its definition, mean variance, moments and moment generating function.
- 6.2 Exponential Distribution - its definition, mean & variance through moment generating function.
- 6.3 Normal Distribution - its definition, mean, variance, median, mode & m.g.f., area property, chief characteristics and importance of normal distribution.
- 6.4 Beta & Gamma Distributions :- Definition, mean, variance.

List of Practicals : (2S – Statistics)

1. Problems on Correlation Coefficient.
2. Problems on Rank Correlation by Spearman's and Kendall's formulae.
3. Fitting of straight line and second degree parabola by least square method.
4. Fitting of exponential curve.
5. Problems on regression of two variables.
6. Problems on multiple and partial correlation coefficients in three variables.
7. Testing association of attributes by all four methods.
8. Calculation of mean, variance, coefficient of Skewness and Kurtosis for Binomial distribution.
9. Calculation of mean, variance, coefficient of Skewness and Kurtosis for Poisson distribution.
10. Calculation of mean, variance, coefficient of Skewness and Kurtosis for Geometric distribution.
11. Fitting of Binomial Distribution.
12. Fitting of Poisson Distribution.
13. Fitting of Normal Distribution.
14. Problems on Area property of normal distribution.

Note : The practicals numbered 1, 3 and 6 may be performed on MSEXCEL.

References for 1S and 2S (Statistics) :-

- (1) Brase and Brase : Understandable Statistics.
- (2) J.Medhi : Statistical methods, an introductory text.
- (3) S.C.Gupta and V.K.Kapoor : Fundamentals of mathematical statistics, Sultan Chand and Sons.
- (4) Bhat B.R., Srivenkatramana T. and Rao Madhava K.S. (1997) : Statistics- A beginners Text Vol.-II, New Age International Pvt. Ltd.
- (5) Goon A.M., Gupta M.K., Das Gupta B. (1999) : Fundamentals of Statistics, Vol.-I & II, World Press, Calcutta.
- (6) D.N.Elhance : Fundamentals of Statistics
- (7) Spiegel M.R. (1967) : Theory and Problems of Statistics, Schaum's Publishing Series.
- (8) Croxton F.E., Cowden D.J., and Kelin S. (1973) : Applied general Statistics, Prentice Hall of India.
- (9) S.C.Gupta : Fundamentals of Mathematical Statistics, S.Chand Publication.
- (10) B.L.Agarwal : Programmed Statistics, New Age International Pvt. Ltd., New Delhi.

List of Equipments and Instruments required for a Batch of Students in U.G. Statistics Laboratory :-

(1) Twelve digit desk model electronic calculators	20
(2) Biometrica tables Vol.-I & II	02
(3) Seven figure logarithmic tables	10
(4) Statistical tables (compiled)	10
(5) Random Number Tables	10
(6) Personal Computer with Printer	05
(7) Statistical Poster and chart.	02

20. COMPUTERSCIENCE**OR****20. COMPUTERAPPLICATION****OR****20. INFORMATION TECHNOLOGY**

The examination in Computer Science will comprise One theory Paper and Practical examination for each semester. The theory paper will be of 3 Hours Duration and carry 80 marks. The Practical examination will be of 4 Hrs duration and carry 50 marks.

The distribution of marks in Practical examination is given as. :

1) Program writing / execution (on group A & B)	: 30 marks
2) Practical / Record	: 10 marks
3) Viva-voce	: 10 marks

Total 50 marks

**2S : Computer Science or Computer Application or Information Technology
Data Structure and Advance C**

- UNIT-I: Introduction to Data structure, type of data structures, list, array, stack and Queue; Algorithms of traversing, insertion and deletion operation on it.
- UNIT-II: Linked list & its implementation, traversing, insertion, deletion algorithms, circular Queue.
- UNIT-III: Tree : Binary, Binary search tree, tree Traversing : inorder, preorder and postorder, sorting and searching Techniques : Bubble sort, insertion sort and selection sort, linear search, Binary search.
- UNIT-IV: Function : Definition, prototype, local & global variable, function parameter, function calling and return, return values and their types, function recursion Arrays : Declaration and initialization of one and two dimensional arrays, function with array.
- UNIT-V: String Handling : Declaring and initialization of string variable , operations on string : String copy comparison, concatenation. Pointers : Declaration and initialization, pointer and address arithmetic , Pointer comparison, Pointer and array.
- UNIT-VI: Structure : Definition 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(), fputs(), fgets(), fscanf(), fprintf(), fread(), fwrite().

Practical : Minimum 16 Practical based on

- A. Data structure using C Language
- B. C language covering aspectus of syllabus .

Study Tour : Study tour may be arranged to computer industry or software development organisation or software technology Park Or IT park

Hardware:

- I) List of Equipment : a) No. of Computers 10 Nos. Desirable configuration

- b) Printer - Minimum 2 Nos.
- II) Accessories
- 1) Pen. Drives 2 Nos.
 - 2) Printer Ribbon / Tonner
 - 3) Stabilizer / UPS
 - 4) Internet facility
- Legal Software for the syllabus .
 - List of books.
- 1) Introduction to Data structure : Tremble, Sorenson.
 - 2) Introduction to Data structure : Bhagat Singh , Mops.
 - 3) Fundamentals of Comp Algorithm : Horowitz & Sahani.
 - 4) Introduction to Data Structure in C : Pearson.
 - 5) Programming in C : E Balguruswami : TMH Publication.
 - 6) Programming with C : Venugopal K.R. TMH, Publication.
 - 7) Programming in ANSIC : Ramkumar and Rakesh Agrwal
 - 8) Programming with C : Byson Gottfried , Schaum Series Publication.

21. COMPUTER APPLICATION (VOCATIONAL)

The examinations in vocational subject Computer Application will comprise of one theory papers and practical examination for each semester. The theory paper will be of 3 hours duration and carry 80 marks. The practical examination will be of 4 hours duration and carry 50 marks.

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

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

Total	50 Marks
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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.

2S -Computer Application (Vocational)

Html and 'C' Programming.

UNIT-I: Introduction to HTML: HTML History, Hypertext and Hypertext Markup Language, Microsoft Front Page, HTML tags and

attributes : Adding tags, include attributes <HTML>, <HEAD>, <TITLE>, <BODY>, <P>,
, <HR>, Heading tags, table tags, <A>, <LINK>, , <ROWSPAN>, <COLSPAN>, <MARQUEE>, <BLOCKQUOTE>, list tag, Attributes : alignment, background colour, text colour.

UNIT-II: Basic text: paragraphs, line breaks, headings, strong and emphasized text. Typography: changing the font size, colour. Lists: numbered lists, bulleted lists, and definition lists.

UNIT-III: Images: using graphics on Web pages, uploading graphics, adding photos, making them small. Links: creating and using links, both internal (bookmarks) and external. Plus image maps and how to create them.

UNIT-IV: Arrays & Strings : Arrays - Declaration and initialisation of one and two dimensional array. String - String functions, string operations
Structure - Definition, declaration, initialisation, array of structure, nested structure, union.

Pointers - Declaration, initialisation, pointers and address arithmetic.

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

UNIT-VI: File Handling : Prototype of file, opening and closing of file, I/O operations on file: fgetc(), fputc(), fgets(), fputs(), fscanf(), fprintf(), fread(), fwrite() and simple programs on these function.

Random Access : fseek(), ftell(), rewind() Error Handling : feof(), ferror().

Books Recommended :

- 1) HTML 4 for Dummies Mastering by Ed Tittel, IDG Publications.
- 2) HTML 4 Unleashed, Professional Reference Edition by Rick Darnell
- 3) Instant HTML Programmer's Reference, 2nd Edition, HTML 4.0 version by Steve Wright
- 4) XML unleashed, BPB Publications.
- 5) Teach yourself XML in 24 hours, BPB Publications.
- 6) C Programming - Byron Gottfried - Schaum Outline Series

- 7) Let Us C - Y.P. Kanetkar - BPB
- 8) Programming in C - E.Balagurusami
- 9) C-Dennis Ritchie
- 10) Programming in C - V.Rajaraman
- 11) Programming in ANSIC - Ramkumar and Rakesh Agrawal - TMH

PRACTICALS

Computer Lab.-I : Minimum 8 practical based on Unit-I,II and III

Computer Lab.-II : Minimum 8 practical based on Unit-IV,V and VI.

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/Laptop -10 Nos.
Desirable configurations: Pentium-V, 128MB RAM, 40GB HDD, colour monitor, KBD, modem
 - b) Printer -2nos.
 - c) Inkjet Printer -1no.
 - d) Multimedia kit -1no.
- II. Accessories:-
 - 1) Pen Drives, CD,DVD
 - 2) Printer ribbon(Cartridge)
 - 3) Printer stationary-5000sheet
 - 4) Stabilizer/UPS
 - 5) Internet facility
- III. Legal Software required as per syllabus.
- IV. Other accessories be available based on syllabus.

22. ELECTRONICS

The examination in Electronics of Second semester shall comprise of one theory paper of 80 Marks of three hour duration and internal assessment of 20 mark .

The Practical examination of 50 marks will be held at the end of second semester of four hours duration.

At the time of practical examination every student has to perform one experiment.

Distribution of marks is as under :

1. Experiment (Construction, testing and performance) ----- 30 Mark
2. Practical record ----- 10 Mark
3. Viva Voce----- 10 Mark

2S-ELECTRONICS

(Electronic Devices and Digital Techniques)

UNIT I: 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).

UNIT II : 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 III : Hybrid-parameters & Power Amplifier:

Hybrid-parameters, transistor equivalent circuit of CE, Analysis of small signal CE amplifiers. Class A, Class B, Class C and Class AB amplifiers, Class A - transformer coupled amplifier, Class-B push-pull amplifier (Construction, working and efficiency of each). Crossover distortion, complementary symmetry Class-B push-pullamplifier.

UNIT IV : Switching & Optoelectronic devices :

Construction, working and characteristics of FET, MOSFET ,UJT ,SCR, Diac & Triac relation of FET parameters, , UJT as relaxation oscillator .,

Construction, working and & characteristics of LDR, LED, photodiode, Phototransistor, photovoltaic cell(Solar cell).

UNIT V: Flip Flops & Counters:

Construction & working of Astable, monostable and Bistable transistorised multivibrators, RS, CLK RS, D, JK, JKMS Flip Flops (Logic diagram, Truth table, construction & working), Concept

of edge trigger Flip-Flop, Concept of preset & clear terminal.

Asynchronous & synchronous Counter , Up-down counters(up to 4-bits), modified asynchronous counter,

UNIT VI: Shift registers :

Types of shift registers, SISO, SIPO, PISO & PIPO shift registers (Construction & working), left shift-right shift registers, IC version of shift register – 7495, Application of shift register. Ring counter, Johnson's counter.

Practicals : Every student is expected to perform at least Ten experiments (At least one experiment from each Unit)

15. Study of FET characteristics (Determination of FET parameters)
16. Study of MOSFET
17. Study of SCR.(To plot V-I Characteristics)
18. Study of LDR.(To plot V-I characteristics)
19. Study of photovoltaic cell.
20. Study of UJT characteristics.
21. To plot V-I characteristics of solar cell.
22. Measurement of displacement using Potentiometer.
23. Measurement of displacement using LVDT.
24. Measurement of displacement using capacitive transducer.
25. construction and Study of transistorized Astable Multivibrator.
26. construction and Study of transistorized Monostable Multivibrator
27. construction and Study of RS flip flop.
28. construction and Study of D flip flop.
29. construction and Study of JK flip flop
30. construction and Study of JKMS flip flop
31. construction and study of synchronous counter.
32. construction and study of Asynchronous counter.
33. construction and study of modified counter.
34. construction and study of SISO Shift register.
35. construction and study of SIPO Shift Register
36. construction and study of PISO. Shift Register
37. construction and study of PIPO shift register.
38. construction and study of Ring counter.
39. construction and study of Johnson's counter.
40. construction and study of Class B push pull Amplifier .
41. Design of PCB.

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.Thereja (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)
11. Modern digital electronics, R.P.Jain (McGraw-Hill) ISBN: 0073404578
12. Digital And Analogue Techniques, Navneet / Kale / Gokhale,Kitab Mahal.

List of optimum apparatus required to perform the practicals for a batch of 16 students for the subject electronics for B.Sc. –Semester I/II/III/IV/V/VI/VII/ VIII.

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 - 1A	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	07 for 78xx series.
	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

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	

23. BIOCHEMISTRY**2S BIOCHEMISTRY****Biophysical and Biochemical techniques.**

UNIT- I:	Concept of Bioenergetics: Principles of thermodynamics & their applications in biochemistry, introduction, thermodynamic systems, Laws of thermodynamics, concept of free energy, standard free energy, determination of ΔG of reaction, relation between equilibrium constant & standard free energy changes, standard free energy change in coupled reactions. Biological oxidation-reduction reactions-introduction, redox potentials, relation between standard redox potentials & free energy change (derivation & numericals involved).
UNIT- II:	Acids, bases, buffers & biomembranes:

- A) Acids, bases & buffers: Concept of water as biological solvent, weak acids & bases, pH, buffers, Henderson-Hasselbalch equation, Physiological buffers, Principles of glass & reference electrodes, measurement of pH by indicators (liquid & pH papers) & pH meter.
- B) Biomembranes: Structure & characteristics of biological membranes, active & passive transport, Donnan membrane equilibrium, Dialysis & osmosis, Sedimentation velocity, preparative & analytical ultra centrifugation.

UNIT III: Chromatography:

General Principles & applications of

1. Adsorption chromatography.
2. Ion Exchange chromatography.
3. Thin layer chromatography.
4. Molecular sieve
5. Gas liquid chromatography.
6. HPLC
7. Affinity chromatography.
8. Paper chromatography.

UNIT-IV: Electrophoresis:

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

UNIT-V: Spectroscopic techniques:

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

UNIT- VI : Immunological techniques & other analytical techniques:

- A) Immunological techniques: Immunodiffusions, immunoelectrophoresis, RIA, ELISA, Immunofluorescence.
- B) Isotopic tracer techniques, autoradiography, biological hazards of radiations, PCR.

2S PRACTICAL (SEMESTER-II) :

SECTION-I: COLORIMETRY

- a) Estimation of Carbohydrate by Anthron method.
- b) Estimation of RNA by Orcinol method.
- c) Estimation of DNA by Diphenylamine method.

Section II: 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.

Section III: Demonstration of Analytical Techniques.

- a) Amino acid separation by Paper Chromatography.
- b) Separation of Sugars by Paper/Thin Layer Chromatography.
- c) Flame photometry for estimation of Na & K.
- d) Separation of serum proteins by Paper Electrophoresis.

Distribution of Marks for Practical Examination :-

A) Any one experiment from Section-I	10
B) Isolation of any one compound from Section-II	10
C) Performance of any one Technique from Section-III	15
D) Viva voce	08
E) Class work and practical record	07

Total

50 Marks

BOOKS RECOMMENDED : (Common for Semester-I & II)

- 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, Bruening, 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.

24. MICROBIOLOGY

2S MICROBIOLOGY

Microbiology, Biochemistry, Biostatistics & Computers

UNIT-I VIRUSES

- i) Discovery of viruses
- ii) Structure of viruses
- iii) Classification of viruses (LHT System)
- iv) Replication of viruses – Lytic cycle (T4), Lysogeny (Lambda phage)
- v) Cultivation of viruses – Embryo culture, Tissue culture method .
- vi) Interferon

UNIT-II MICROBIAL CONTROL

- i) Definition and Terms- Sterilization, disinfection, Antiseptic, Sanitizer, Germicide, Microbiostatis, Antimicrobial agent.
- ii) Mechanism of cell Injury - Damage of cell wall, cell membrane, Inhibition of metabolic reactions.
- iii) Physical Control :- Temperature, osmotic pressure, Radiation, filtration.
- iv) Chemical Control – Chemistry and mode of action of halogens, heavy metals and their derivatives, Alcohols, Detergents and Gaseous Sterilization.

- v) Chemotherapeutic agents.- Definition and mode of action of penicillin , tetracycline, Norfloxacin

UNIT-III APPLIED ASPECTS OF MICROORGANISMS IN -

- i) Agriculture – Biofertilizers & Biopesticides.
- ii) Human and Animal Health – Antibiotics, Vaccines
- iii) Industry (Food, Chemical & Pharamaceutical) –List of Microbial products (and producing organisms)
- iv) Environmental – Biodegradation and Bioleaching.

UNIT-IV BASIC BIOCHEMISTRY –

- i) Carbohydrates – Classification, different types of Glycosidic linkages eg- Maltose sucrose, Lactose, starch
- ii) Lipids – Classification, concept of saturated and unsaturated fatty acids, outline of conjugated & derived lipids
- iii) Proteins – Classification of Amino acids, concept of peptide bond , elementary concept of protein structure.
- iv) Nucleic acid – Purine & pyrimidine bases, nucleotides , & nucleosides , structure of DNA, structure of RNA (mRNA , tRNA, rRNA)

UNIT-V BIostatISTICS

- i) Importance & application – Tabulation & Classification of data, Frequency distribution & graphical distribution of data.
- ii) Measures of central tendencies – Mean , Mode, Median & their Properties
- iii) Co relation & their Linear regression – Coefficient of correlation, linear least square Fit method of regression.
- iv) Hypothesis testing- (chi square test) x2 test, t-test
- v) Different models of data presentation with special reference to Biological samples.

UNIT-VI COMPUTER CONCEPTS :-

- i) Components of computer system – Hardware, input devices, CPU, output devices , Monitor, software.
- ii) Memory concept- Computer memory primary & secondary memory in computers
- iii) Window Operating systems :- Introduction graphical user interface systems, desktop menus, launching a program through start menu.
- iv) MS-Word- creating, saving operating editing, closing a document, entering & editing texts.

v) Using Internet explorer , MS power point, creating e-mails.

Microbiology Practicals

- 1) Demonstration of viruses – By plaque formation / chick embryo cultivation.
- 2) Effect of salt & sugar concentration , PH & Temperature on bacterial growth
- 3) Demonstration of oligodynamic action (copper, silver)
- 4) Anaerobic culture method – by Anaerobic Jar method / RCMM.
- 5) Slide culture techniques for fungi
- 6) Determination of antibiotic resistance of bacteria.
- 7) Industrial utilization of yeast for fermentation activity
- 8) Word processing
- 9) Use of MS- Excel
- 10) Creating e-mail
- 11) Use of Internet
- 12) Statistical data processing
- 13) Microbiological study tour to visit Research centre,/ Institutions / Industries

Distribution of Marks

IIInd Semester Microbiology Practicals

1.	Major Experiment	-	15 Marks
2.	Minor Experiment	-	10 Marks
3.	Viva –Voce	-	08 Marks
4.	Spotting	-	07 Marks
5.	Laboratory Journal	-	05 Marks
6.	Study Tour Report	-	05 Marks

Total 50 Marks

Note-List of books same as Semester-I.

25. FOOD SCIENCE

2S FOOD SCIENCE

NUTRITIONAL BIOCHEMISTRY OF FOODS

Maximum Marks 80

- UNIT – I
Nutritional Aspects of Protein.
Digestion and Absorption of Protein.
Biological Function of Protein.

Types of Protein.

Evaluation of Protein Quality.

Effects of Deficiency of Proteins.

Oxidation of amino acid.

Conversion of amino acid to carbohydrates and fat.

UNIT – II

Nutritional Aspect of Carbohydrates:

Utilization of Absorbed Carbohydrates in the body.

Oxidation of Carbohydrates (TCA cycle).

Effects of Deficiency and Excess Intake of Carbohydrates.

Study of Digestive System of Carbohydrates.

Energy yielding from Glycolysis.

Conversion of carbohydrates to fat and amino acids.

UNIT –III

Enzymes: Introduction of Enzymes,

Classification of Enzyme.

Characteristics of enzymes.

Enzymatic activity: name and functions.

Factor Affecting Enzymes Action.

Enzyme specificity.

Role of Enzymes in Digestion and Absorption of Nutrient.

Role of enzymes in various organs and digestive system: - digestion in mouth (salivary secretion, composition of saliva, function of saliva.), digestion in stomach (activity of gastric secretion- hydrochloric acid, hypo & hyper acidity), intestinal digestion(amylases).

UNIT-IV

Classification of Lipids

Function of Fats, Fatty Acids.

Nutritional Aspects of Lipids

Effect of Deficiency Fatty Acids.

Effect of Excess of Fats and Lipids in Digestion and Absorptions Process.

Role of Fat in the Body.

Oxidation of Fatty Acid.

UNIT-V

Vitamins and Minerals.

Functions and general function of Vitamins and Minerals.

Role of Vitamin and Minerals in Digestion and Absorption Process.

Deficiency Symptoms of Vitamins and Minerals.

Requirements of Vitamins and Minerals in all Age.
 UNIT-VI Water
 Importance of Water in body.
 Role of Water in body.
 Analytical Biochemistry: Homogenization, Chromatography,
 Calorimetry, Spectrophotometry, Electrophoresis, Elisa.

Practical

1. Estimation of Starch.
2. Estimation of Protein by Biuret methods.
3. Estimation of Protein by Kjeldhal's methods.
4. Chromatographic separation of Amino Acid in Food Stuff.
5. Estimation of Ascorbic Acids
6. Estimation of Iron.
7. Estimation of sugar by Layne Eynon method.
8. To determine Saponification value of Oil.
9. To determine Iodine value of Oil.
10. Estimation of Fiber.
11. Determination of Achronic point of salivary amylase.
12. Estimation of glycine by formal titration.

List of Books (Common for Semester-I & II)

1. Chemistry, 4th edition, John McMurry, Pearson Education
2. Food- Nutrition and Health, Vijaya Khader; Kalyani Publishers.
3. Food and Nutrition Volume I & II; Dr. M. Swaminathan; Bappco.
4. Nutrition Science; B. Srilakshmi; New Age International Publisher.
5. Fundamental of Biochemistry; Dr. A. C. Deb; Center Book Agency.
6. Fundamental of Biochemistry; J.L. jain, Sanjay Jain; C. Chand.
7. Textbook of Biochemistry; Dr. Mn Chatterjee, Dr. Rana Shinde; Jaypee Brothers.
8. Analytical Chemistry of Foods ; C. S. James; Blackie Academic & Professional.
9. Food Science; Sumati R. Mudambi, Shalini M. Rao; New Age Intertional (p) Limited .
10. Handbook of Analysis and Quality Control For Fruits and Vegetables 2nd Edition ; S. Ranganna.
11. Food Science & Nutrition; Sunetra Roday; Oxford University Press.
12. Food Facts & Principle; Shakuntala Manay, M. Shadaksharaswamy;

- New Age International (p) Limited.
13. Laboratory Techniques in Food Analysis; D. Pearson; Butterworths.
 14. Principle of Biochemistry; Lehninger.
 15. Textbook of Biochemistry; G. R. Agrawal.
 16. Food Chemistry; L. H. Meyer.
 17. Food Science; N. N. Potter.
 18. Nutrition & Dietetics 1st and 2nd Edition; Subhangini Joshi.
 19. Therapeutic Nutrition – Robinson Normal.
 20. Nutritive Value of Indian Food; Dr. C. Gopalan NIN Hyderabad.
 21. Basic principle of nutrition; Seema Yadav, pub. Anmol publication pvt New Delhi (1997)
 22. Introduction to biochemistry, second edition; John, W. Suttie, pub., Holt-Saunders publication.
 23. Biochemistry volume3 ; S. K. Dasgupta, The Macmillan company of India(1978)
 24. Elements of biochemistry; H.S. Shivastav, pub., Rastogi fourth edition (2001)
 25. Analytical Practical Biochemistry by Plummer, Academic Press.
 26. Practical Biochemistry by J.Narayan.

26. INDUSTRIAL MICROBIOLOGY

2S Industrial Microbiology

Fermentation Equipment and Techniques

- UNIT-I: 1. Basic Fermentor design:
 Parts and their functions of Conventional stirred tank fermentor
2. Fermentor Configurations
 (a) Tubular Fermentor
 (b) Fluidised bed fermentor
 (c) Bubble Cap fermentor
- UNIT-II: Instrumentation and control:
 a) Basic concepts of control systems
 b) Designs and working principles of instruments and systems for control of – temperature, pressure, foam, pH, redox potential, oxygen tension (DO), exit gas analysis, medium composition analysis
- UNIT-III: Instrumentation in Industrial Laboratory :
 (1) Principle , Working and Applications of Instruments in Industry:

- a. pH meter
 - b. Colorimeter/Spectrophotometer
 - c. Polarimeter
 - d. Chromatography
- (2) Computerisation in Industries-
- (i) Introduction
 - (ii) Applications of computers in fermentation technology – data logging, data analysis, process control
 - (iii) Practical implementation of basic computer control strategies for enzyme production.

UNIT-IV: Methods of recovery and purification of fermentation products

- a) Precipitation, filtration and centrifugation
- b) Cell disruption
- c) Liquid-liquid extraction and solvent recovery
- e) Chromatography – adsorption, ion exchange, gel, affinity.
- f) Distillation
- g) Crystallisation

UNIT-V : Detection and Assay of fermentation products-

- a) Physical and Chemical assays
- b) Biological assay of Vitamins and Antibiotics

UNIT-VI: Fermentation Economics-

Fermentation economics with respect to raw material, production process, recovery process and product economics, product patenting

Practicals :- Semester-II

1. Primary screening of:
 - a) Amylase producers
 - b) Protease producers
 - c) Antibiotic producers
2. Demonstration of antimicrobial activity of actinomycetes by the Giant Colony technique
3. Separation of amino acids, sugars, organic acids by paper and thin layer chromatography.
4. Demonstration of basic fermentation process :- Yoghurt, bread and idli.
5. Industrial Study tour.

The distribution of marks in practical shall be as follows :

- A) Two short experiment -20 marks (10 Each)
- B) One long experiment -15 marks

- C) Viva voce -10 marks
- D) Industrial Study Tour Report -03 marks
- E) Practical Record -02 marks

Total -50 marks

List of Reference Books :-

1. Quantitative Bioassay – D. Hancroft, T. Hector and F. Rowell. John Wiley & Sons for Analytical Chemistry by Opening Learning (ACOL) series.
2. Microbial Technology, Volumes I & II – H. J. Peppler. Academic Press
3. Isolation Methods for Microbiologists, Volumes I & II – Gibbs and Shapton, Academic Press.
4. Industrial Microbiology by A.H.Patel
5. Industrial Microbiology – L. E. Casida Jr. John Wiley and Sons.
6. Experimental Microbiology – R. J. Patel and K. R. Patel, Aditya Publishers, Ahmedabad
7. A Compendium of Good Practices in Biotechnology – Biotol Series
8. Principles of Fermentation Technology – Stanbury and Whitaker. Pergamon Press.
9. General Microbiology – R. Y. Stanier and others. Macmillan Press Ltd.

27. BIOTECHNOLOGY (Regular/Vocational)

2S-BIOTECHNOLOGY

(Microbiology)

- UNIT I:** Scope and importance of Microbiology:-
Size, shape and arrangement of bacteria, Typical bacterial cell.
Microscopy : Resolving power, Numerical aperture, Optical, TEM and SEM.
Staining techniques : Simple, Gram, Negative, Acid fast and Endospore staining.
Sterilization methods : Physical and chemical.
- UNIT II:** Microbial cell Structure:
Cell wall, Cytoplasmic membrane, and flagella.
Nutritional classification of microorganisms on the basis of carbon and energy source (Autotrophs, Heterotrophs, Phototrophs and chemotrophs)

Classification of bacteria according to Bergey's Manual of Systematic Bacteriology

Microbes in extreme environment (Thermophiles, Halophiles, and Methanogens)

UNIT III: Microbial Metabolism:

Energy production by aerobic and anaerobic processes, (Glycolysis, Krebs's cycle, Electron transport chain, Fermentation, and Photosynthesis)

Microbial Associations: Symbiosis (Rhizobium, Mycorrhiza), and Antibiosis,

Nitrogen fixing microorganisms in agriculture : (Azotobacter, Rhizobium, Cyanobacteria)

UNIT IV: Industrially useful Microorganisms:

Fermentation industry : (Saccharomyces cereviceae, and Lactobacillus)

Antibiotic Industry : (Penicillum and Streptomyces)

Enzyme Industry : (Aspergillus)

Food Industry: Cheese production (Penicillun roquefortii)

Biofertilizers : (Azotobacter, Rhizobium, and PSB)

Single cell protein : (spirullina)

UNIT V: Pathogenic microorganisms:-

Elementary knowledge of diseases caused by bacteria (Typhoid, Tuberculosis, Cholera), viruses (AIDS, Polio, Hepatitis) and fungi (Dermatophytes)

Mycoplasma: structure, pathogenicity and laboratory diagnosis.

Host parasite relationship.

Host defense mechanisms against microorganisms (Non specific and specific)

UNIT VI: Basic techniques in Microbiology:-

Spectroscopy (Beer Lambert's law, Components, working and applications of Colorimeter, and UV- VIS Spectrophotometer)

Chromatography; (Paper, and Thin layer)

Electrophoresis; (Paper and Gel)

Role of Radioactive isotopes in Biotechnology

Practicals

1. Cleaning of glasswares, preparation of media, cotton plugging & sterilization.
2. Isolation of microbes from different environments (water, soil, air, human

body and plants)

3. Enumeration of microorganisms by Standard plate count.
4. Identification of isolated bacteria : (Simple, Gram , Endospore, and Negative staining)
5. Biochemical characterization of micro organisms (Sugar fermentation and IMViC test)
6. Growth curve of microorganisms.
7. Antibiotic sensitivity of microbes by disc diffusion method.
8. One step growth of bacteriophage.
9. Alcoholic & mixed-acid fermentation.
10. Isolation of microorganisms from leaf.
11. Isolation of Rhizobium from root nodules.
12. Study tour / Visit to laboratories /Industries

Distribution of Practical Marks :-

(1)	Major Experiment	12 Marks
(2)	Minor Experiment	08 Marks
(3)	Spotting	10 Marks
(4)	Viva	10 Marks
(5)	Practical Record	05 Marks
(6)	Study Tour/Visit	05 Marks

Total 50 Marks

Reference Books (For Sem-II)

- 1) Microbiology-Pelczar
- 2) General Microbiology – Stanier
- 3) General Microbiology, Vol.I and II-Powar and Dagainawala
- 4) General Microbiology- Sulia
- 5) Textbook of Microbiology-Ananthanarayan
- 6) Text book of Microbiology- Dubey and Maheshwari
- 7) Elementary Microbiology Vol. I and II – H.A. Modi
- 8) Stains and staining Procedures-Desai and Desai
- 9) Experimental Microbiology-Rakesh Patel
- 10) Experimental Microbiology-Dubey and Maheshwari

28. BIOINFORMATICS

2S-BIOINFORMATICS

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, grammar, 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.

- UNIT VI: Networking : Needs and objectives, LAN- Introduction, classification, topology.
Topologies – Bus, Tree, Ring, Star, Hybrid, WAN, MAN.
Communication Protocols – Purpose, OSI model, Client Server Architecture.

Practical-II : Computer Fundamentals and Operating Systems :-

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. Using function wizard.
7. Calculate regression and correlation use excel.
8. Using different distribution.
9. Creation of presentation.
10. Practicals on Unix basic commands.
11. Practicals based on internet.

Distribution of Practical Marks :-

(1)	Two Program Writing/Execution	30 Marks
(2)	Practical Record	10 Marks
(3)	Viva-voce	10 Marks

Total	50 Marks
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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.
10. ABC of LAN – Michel Doprtch (BPB)
11. Local Area Network – Keiser - TMH

List of Equipments : (For Sem I & Sem II)	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

29.APICULTURE

The examination in Apiculture will comprise of one theory paper to each semester of 100 marks each which include 80 marks for theory and 20 marks for internal assessment and practical of 50 marks. Each theory paper shall be of 3 hours duration and practical of 6 hours duration. The syllabi is based on 6 theory periods and 6 practical periods per week.

1S-APICULTURE

(Fundamentals of Bee Keeping)

UNIT-I: A)	Fundamental requirement of bee keeping, knowledge of bees, bee plants, equipment and products.
B)	Apis, species, identification of Apis, A florea, A dorsata, A. mellifera, A Cerena, subspecies, varieties and races.
UNIT-II:	Estimation of stocking capacity and estimation of yield per hive, migration routes of colonies, native residents, reception to beekeeping – tribal population, collecting information of cultivated crop.
UNIT-III:	Beekeeping Equipment :- Types of hives, its components, dimension, equipment for protection, feeding. Bee management equipments, was extraction & honey extraction equipment & manufacturing of comb foundation sheet.
UNIT-IV:	Apiary Management – Method of handling recognition of queen, its age, health, egg laying behaviour. Brood food condition. Drone breeding, queen cells formation, laying workers, feeding, uniting, dividing, closure of queen gates etc. Sanitation, Routine forage and other activities, cleaning.
UNIT-V:	Establishment of Apiary :- Choice of site, climatic condition, topography, availability of water, flora. Optimum number of hive

UNIT-VI:	in relation to available of flora within foraging range over stocking. Individual Colony Records :- Colony number, strength, food storage, honey yield. Pollen income.
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2S-APICULTURE

(Bee Botany, Pollination, & Melato Palynology)

UNIT-I:	Introduction to Bee Botany :- Plant kingdom; morphology of flowering plant pollination & fertilization development of embryo & fruits. Floral structure & floral biology, elementary physiology of nectar, nectar secretion, nature, composition. Elements of classification & identification of important plant.
UNIT-II:	Bee Plants :- Functional Classification of local bee, plants flora, wild, cultivated, annuals, permanent agricultural, horticultural, crops ornamental, road side avenue trees relative evaluation of bee plants, major & minor species, nectar & pollen species.
UNIT-III:	Floral Calender :- Flowering sequence, succession, formulation of local floral calender, period of major honey flow, floral gaps during annual cycles, plant poison toxic to bee, poison honey, important bee plants of India.
UNIT-IV:	Mellitto Palynology :- Pollen basket of florage, bees comb cells used for pollen storage, preparation of pollen side, pollen morphology, morphological characteristic of pollen types, Identification of floral source, types of pollination, pollinating agents, importance of honey bee among other pollinating bees.
UNIT-V:	Bee Pollination :- Definition, Self and cross pollination, pollinating agents.
UNIT-VI:	(A) Methods of collecting bee pollination, migration of honey bee colonies for pollination, placement in farm & orchids, management of colonies during pollination, farmer bee keeper relationship. Effect of insecticide on honey bee, preventive measures to be taken. Economics of planed pollination by honey bees. Wild bees used for pollination. (B) Nector to Honey :- How bees make honey, general compotion of honey.

**Semester-I
Practical-I**

Practicals :-

- (1) Study of Identification features of honey bees :-
A. melifera, A.Carana, A.Dorsata, A.Florea, A. Trigona.
- (2) Study of mouth parts of Bees.
- (3) Study of bee string.
- (4) Study of bee hives (Carana, Melifera)
- (5) Study of hive tools.
- (6) Study of Castes of honey bees.
- (7) Study of honey extraction machine.
- (8) Study of wax extraction machine.
- (9) Manufacturing of comb foundation sheet.

Field Study :-

1. Inspection of bee colonies.
2. Counting of pollen load.

Distribution of Marks :-

	Duration : 4 Hours
1. Identification and comments on honey bee types (Any four)	16
2. Mounting of bees mouth parts	09
3. Bee hives & bee equipments.	10
4. Practical Record	05
5. Field diary	05
6. Viva-voce	05
Total	50

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

Practicals :-

1. To study the structure of flower.
2. Study of selected bee plants.
3. Study of pollen grains.
4. Preparation of pollen slides.
5. Study of nector.
6. Study of plant toxic to bees.

Field Study :-

1. Preparation of floral calender.

Distribution of Marks :-**Duration : 4 Hours**

1. Identification and comments on important bee plants (four)	16
2. Study of structure of flower	10
3. Pollen slide preparation.	05
4. Floral Calender	05
5. Field Diary	05
6. Practical Record	05
7. Viva-voce	04

Total 50

List of Reference Books :- Semester-I & II

- 1 First lesson in Beekeeping- Dadant C.D. Malliton, Illinois.
- 2 Honey a Comprehensive survey Pub.- Heinemann (London) & International Bee Research Association England.
- 3 Value added products for Beekeeping- Food and Agriculture Organisation United Nationa Bulletin No.124.
- 4 Studies in Chemistry of Indian Honey & Bee Waxes. Thesis for M.Sc. degree submitted to Botany Uni. Phadke R.P.
- 5 Investigation on Indian Honey bee products
- 6 Beekeeping in Integrated Mountain Development-Economic & Scientific perspective Publication.
- 7 Beekeeping-Teach yourself Books, By-Vernon F. (1984)
- 8 The Chemistry and Technology of Waxes Reinhold publication Corpn. N.Y.
- 9 मधुमख्खीपालन प्रशिक्षण पुस्तिका UNDP-KVIC, Mumbai
- 10 भारतीय मधमाशा आणि मधमाशा पालन -डॉ.र.पु.फडके प्रकाशन, किर्ती फडके यशोदा, पुणे
- 11 A.B.C. & X Y Z of Bee culture 39 edition A.Y.Root & Co America
- 12 The hive & the Honey Bee- 1975, 4th Edition, Dadant Publication, America
- 13 Bees their vision, chemical senses & language-1950, Cornel University Press – By – Fon frish, & Karl.
- 14 Honey bee Biology 1982-By Free & Johnson & Central Association of Bee Keepers England

- 15 The social Behaviour of the Bees 1974-By Missioner C.D.
- 16 Beekeeping in India 1962, 82 Sardar Singh- ICAR, New Delhi
- 17 Technical Bulletins- C.B.R.T.I. Pune
- 18 Beekeeping By-E.F.Phillips. Agrobios (India) Publication
- 19 Hand Book of Beekeeping- By Dharamsingh, Devendra Pratap Singh- Agrobios.
- 20 Technology & Value addition & Honey-Dr.D.M.Wankhale & K.D.Kamble, C.B.R.T.I. KVIC Pune
- 21 Extracted Honey-speciafication (Second Rev.) I S 4941; 1994, BIS New Delhi
- 22 Technology & Honey Bull- R.Borneeke & Gronnet
- 23 Anatomy of Honey bee R.E.Snodgrass.
- 24 Beekeeping in India Sardar Singh

Required Equipments :- Semester-I & II

1. Bee hives (Cerana Malifera)
2. Bee specimens
3. Hive tools
4. Honey extraction unit
5. Wax extraction unit
6. Microspace

I N D E X
B.Sc.Part-I (Semester-I & II)
(Prospectus No.2013121)

Sr. No.	Subject Sr.No.	Subject	Page Nos.	
			Semester-I	Semester-II
1.	-	Special Note	1	-
2.	-	Direction No.16 of 2010	2	-
3.	-	Direction No.37 of 2011	20	
4.	-	Direction No.1 of 2012	21	
3.	1	Compulsory English	1	2
4.	2	Compulsory Marathi	3	4
5.	3	Compulsory Hindi	5	6
6.	4	Compulsory Urdu	7	8
7.	5	Compulsory Sanskrit	9	9
8.	6	Supplementary English	10	11
9.	7	Mathematics	13	82
10.	8	Physics	15	84
11.	9	Chemistry	20	87
12.	10	Industrial Chemistry (Regular/Vocational)	25	94
13.	11	Petrochemical Science	28	97
14.	12	Geology	30	101
15.	13	Botany	32	106
16.	14	Environmental Science	37	110
17.	15	Seed Technology (Vocational)	40	113
18.	16	Zoology	44	118
19.	17	Industrial Fish & Fisheries(Vocational)	48	122
20.	18	Biological Techniques & Specimen Preparation.(Vocational)	50	126
21.	19	Statistics	53	130
22.	20	Computer Science/Computer Application/Information Tech.	56	133
23.	21	Computer Application (Vocational)	58	135
24.	22	Electronics	61	137
25.	23	Biochemistry	63	142
26.	24	Microbiology	66	145
27.	25	Food Science	72	147
28.	26	Industrial Microbiology	74	150
29.	27	Biotechnology (Regular/Vocational)	77	152
30.	28	Bioinformatics	79	155
31.	29	Apiculture	157	158

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

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

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

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

Ordinance No. 19	:	Admission Candidates to Degrees
Ordinance No.109	:	Recording of a change of name of a University Student in the records of the University
Ordinance No. 6/2008	:	For improvement of Division
Ordinance No.19/2001	:	An Ordinance for Central Assessment Programme, Scheme of Evaluation and Moderation of answerbooks and preparation of results of the examinations, conducted by the University, Ordinance 2001.

Dineshkumar Joshi

Registrar

Sant Gadge Baba Amravati University