

B.Sc. Part-I (Sem-I & II)  
Exam. 2016-17

Prospectus No. 2017121

संत गाडगे बाबा अमरावती विद्यापीठ  
SANT GADGE BABA AMRAVATI UNIVERSITY

विज्ञान विद्याशाखा  
(FACULTY OF SCIENCE)

अभ्यासक्रमिका  
विज्ञान स्नातक भाग-१  
सत्र-१, परीक्षा हिवाळी-२०१६  
सत्र-२, परीक्षा उन्हाळी-२०१७

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OF  
B.Sc. Part-I  
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**B.Sc.Part-I (Semester-I & II)**  
**(Prospectus No.2016121)**

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

- (1) Notwithstanding anything to the contrary, it is notified for general information and guidance of all concerned that a person, who has passed the qualifying examination and is eligible for admission only to the corresponding next higher examination as an ex-student or an external candidate, shall be examined in accordance with the syllabus of such next higher examination in force at the time of such examination in such subjects, papers or combination of papers in which students from University Departments or Colleges are to be examined by the University.
- (2) Be it known to all the students desirous to take examination/s for which this prospectus has been prescribed should, if found necessary for any other information regarding examinations etc. refer the University OrdinanceBooklet 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. 138	:	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.

**Dr. Ajay P. Deshmukh**  
 Registrar

Sant Gadge Baba Amravati University

**SANT GADGE BABA AMRAVATI UNIVERSITY, AMRAVATI  
DIRECTION**

No. : 16/2010

Date : 11/06/2010

**Subject : Examinations leading to the Degree of विज्ञान स्नातक (Bachelor of Science) (Three Year Degree Course-Semester Pattern), Direciton, 2010.**

Whereas, University Grants Commission, New Delhi vide D.O.No.F-2/2008/(XI Plan), Dtd.31 Jan.2008 regarding new initiatives under the 11<sup>th</sup> Plan ó Academic Reforms in the University has suggested for improving quality of higher education and to initiate the Academic Reform at the earliest.

**AND**

Whereas, the Academic Council while considering the above letter in its meeting held on 30.4.2008, vide item No.55 has resolved to refer the same to Dean's Committee, and the Dean's Committee in its meeting held on 19.07.2008 has decided to refer the matter to all Board of Studies.

**AND**

Whereas the recommendations of various Board of Studies in the faculty of Science regarding Upgradation and Revision of various syllabi and introduction and implementation of Semester Pattern Examination System at under graduate level was considered by the faculty of Science in its meeting held on 7.12.2009 and constituted a Committee of all Chairmen of Board of Studies and one member nominated by Chairmen of respective B.O.S. under the Chairmanship of Dean of faculty to decide the policy decision regarding semester pattern examination system.

**AND**

Whereas, the faculty of Science in its emergent meeting held on 11<sup>th</sup> May, 2010 vide item No.26, has considered, accepted and recommended to Academic Council, the policy decision regarding introduction of Semester pattern and the draft syllabi of B.Sc. Part-I (Semester-I & II) along with draft ordinance and other details. The recommendations of the faculty was approved by the Academic Council in its emergent meeting held on 28.5.2010, vide item No.35 D).

**AND**

Whereas, Ordinance No.143 in respect of Examinations leading to the Degree of विज्ञान स्नातक (Bachelor of Science) is in existence in the University as per annual pattern examination system.

**AND**

Whereas, new scheme of examination as per semester pattern is to be implemented from the Academic Session 2010-11 for Semester-I & onwards which is regulated by an Ordinance and framing of an Ordinance for the above examination is likely to take some time.

**AND**

Whereas, the admission of students in the semester pattern at B.Sc. Part-I (Semester-I) are to be made in the Academic Session 2010-11.

Now, therefore, I, Dr. Kamal Singh, Vice Chancellor of Sant Gadge Baba Amravati University, in exercise of powers conferred upon me under sub-section (8) of section 14 of the Maharashtra Universities Act., 1994, do hereby direct as under:

1. This Direction may be called, "Examinations leading to the Degree of विज्ञान स्नातक (Bachelor of Science) (Three Year Degree Course-Semester Pattern), Direciton, 2010".
2. This direction shall come into force with effect from the date of its issuance.
3. (i) The following shall be the examination leading to the Degree of विज्ञान स्नातक (Bachelor of Science) in the faculty of Science-
  - (1) The विज्ञान स्नातक भाग-१, सत्र-१ व २ (B.Sc. Part-I, Sem-I & II) Examination;
  - (2) The विज्ञान स्नातक भाग-२, सत्र-३ (B.Sc. Part-II, Semester-III) Examination;
  - (3) The विज्ञान स्नातक भाग-२, सत्र-४ (B.Sc. Part-II, Semester-IV) Examination;
  - (4) The विज्ञान स्नातक अन्त्य, सत्र-५ (B.Sc. Final, Semester-V) Examination; and
  - (5) The विज्ञान स्नातक अन्त्य, सत्र-६ (B.Sc. Final, Semester-VI) Examination.
- (ii) The period of Academic Session shall be such as may be notified by the University.
4. (i) The theory examination of Semester-I & II shall be simultaneously conducted by the University at the end of Semester-II in Summer.
- (ii) The examination of Semester-III, IV, V & VI shall be conducted by the University and shall held by the end of each semester separately.

- (iii) The main examination of Semester-III & V and that of Semester-IV & VI shall be held in Winter and Summer respectively.
- (iv) The supplementary examination for Semester-I & II shall be held in Winter and that of Semester-III & V and Semester-IV & VI in Summer and Winter respectively.

That means the theory examination of all the Semesters shall be conducted by the University and shall be held as per the schedule.

Sr.No.	Name of the Examination	Main Examination	Supplementary Examination
1	Semester-I & Semester-II	Summer (Simultaneously)	Winter (Simultaneously)
2	Semester-III & Semester-V	Winter	Summer
3	Semester-IV & Semester-VI	Summer	Winter

5. Subject to their compliance with the provisions of this Direction and of other Ordinances in force from time to time, the following persons shall be eligible for admission to the examinations, namely:-
- A student of a College who has prosecuted a regular course of study for not less than one academic year prior to that examination;
  - A teacher in a Educational Institution eligible under the provisions of Ordinance No.18, and
  - A women candidate who has not pursued a regular course of study.

Provided that in the case of the persons eligible under clauses (b) and (c) an applicant to the examination shall have attended a full course of laboratory instructions in a College in the subject in which laboratory work is prescribed. The candidate shall submit a Certificate to that effect signed by the Principal of the college.

6. **(I) The Students passing H.S.C. Examination with Physics, Chemistry and Mathematics shall offer following subjects at B.Sc. Part-I Examination.**
- English and any one of the following languages Marathi, Hindi, Urdu, Sanskrit, and Supplementary English.
  - Three optional subjects atleast one subject from the following groups be selected.

- Group A** :- Chemistry, Industrial Chemistry, Petro-Chemical Science, Electronics, Mathematics.
- Group B** :- Physics, Geology, Statistics, Computer Science, Computer Application, Information Technology and Geography.

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

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

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

**For Vocational subjects sanctioned by U.G.C. there shall be following scheme of Combination of subjects :-**

**Students with Mathematics at H.S.C. Examination shall select two subjects from Group D and one from Group F.**

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

**Group D** : Physics, Chemistry, Mathematics, Electronics, Statistics Computer Science, Computer Application, Information Technology and Geology.

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

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

**The students passing HSC examination with Physics, Chemistry, Biology and Mathematics shall**

have the option of opting **Bioinformatics** subject with any one subject from **Group-G** and any one subject from **Group-H**.

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

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

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

TABLE

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

		Biotechnology (Regular/Vocational), Geology, Geography, Environmental Science, Zoology, Bioinformatics, Apiculture.
4	<b>Engineering and Technology Group</b> <b>Electronics</b> <b>Technology Trade</b>	Physics, Computer Science, Geology, Geography, Statistics, Chemistry, Mathematics, Industrial Chemistry (Regular/Vocational), Computer Application (Vocational), Electronics, Information Technology.

- (III) In the case of विज्ञान स्नातक भाग-२ सत्र-३ व ४ (B.Sc. Part-II, Sem-III & IV) Examination:-

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

- (IV) In the case of the विज्ञान स्नातक अन्त्य, सत्र-५ व ६ (B.Sc. Final, Sem-V & VI) Examination:- have passed not less than one academic year previously the विज्ञान स्नातक भाग-२, सत्र-३ व ४ (B.Sc. Part-II, Sem-III & IV) Examination of the University or an examination recognised as equivalent thereto;

7. Subject to his/her compliance with the provisions of this Direction and other Ordinances (pertaining to Examination in General) in force from time to time, the applicant for admission, at the end of the course of study of a particular semester to an examination specified in column (1) of the table below, shall be eligible to appear at it, if,
- he/she satisfied the condition in the table and the provisions thereunder.
  - he/she has prosecuted a regular course of study in a college affiliated to the University.
  - he/she has in the opinion of the Principal shown the satisfactory progress in his/her studies.

TABLE

Name of the Exam to appear	The student should have completed the Session / term satisfactorily	The student should have passed
1	2	3
B.Sc. Part-I (Sem-I & II)	Sem-I & II	Qualifying examination.
B.Sc.-II Semester-III	Semester-I & II	One half of the total head prescribed for Sem-I & Sem-II examination
B.Sc.-II Semester-IV	Semester-III	One half of the total head prescribed for Sem-I & Sem-II examination
B.Sc.-III Semester-V	Semester-III & IV	(i) passed the Sem-I & II examination and (ii) One half of the total head prescribed for Sem-III & Sem-IV examination
B.Sc.-III Semester-VI	Semester-V	(i) passed the Sem-I & II examination and (ii) One half of the total head prescribed for Sem-III & Sem-IV examination

(Note : For Calculating the Heads, the theory and the practical shall be consider as a separate head and on calculation fraction if any shall be ignored.)

8. Without prejudice to the other provisions of Ordinance No. 6 relating to the Examination in General, the provisions of Paragraph 5, 8, 10 and 31 of the said ordinance shall apply to every collegiate candidate.
9. The fee for the examination shall be as prescribed by the University

from time to time.

10. Every examinee for the विज्ञान स्नातक भाग-२, सत्र-३ व सत्र-४ (B.Sc.Part-II, Sem-III & Sem-IV), Examination shall be examined in each of the three Science subjects in which he has been examined at the विज्ञान स्नातक भाग-१, सत्र-१ व २ (B.Sc. Part-I, Sem-I & II) Examination.
11. Every examinee for the विज्ञान स्नातक अन्त्य, सत्र-५ व ६ (B.Sc.Final, Sem-V & VI), Examination shall be examined in each of the three Science subjects in which he has been examined at the विज्ञान स्नातक भाग-२, सत्र-३ व सत्र-४ (B.Sc. Part-II, Sem-III & Sem-IV) Examination.
12. An examinee who is successful at the विज्ञान स्नातक भाग-१, सत्र-१ व २ (B.Sc. Part-I, Sem-I & II) Examination, may offer an additional subject mentioned in Para (6) (iii) not offered by him at the विज्ञान स्नातक भाग-१, सत्र-१ व २ (B.Sc. Part-I, Sem-I & II) Examination, on his prosecuting a regular course of study for one academic year in that subject. Such an examinee shall not be permitted to take any other examination simultaneously with the examination in the additional subjects. The fee for the additional subject shall be as prescribed by the University from time to time.
13. The Scope of the subjects of all semester opted by the students shall be as indicated in the respective syllabi from time to time. The medium of instruction and examination shall be English except for the courses in Languages.
14. The maximum marks allotted to each subject and paper and the minimum marks which an examinee must obtain in order to pass the examination shall be as per Appendices A, B, C, D, E and F appended to this Ordinance.
15. The practical examination of all semesters shall be conducted annually. That means the practical examination shall be conducted as per following schedule.

Sr.No.	Semester	Examination
1	Semester-I & II	Summer
2	Semester-III & IV	Summer
3	Semester-V & VI	Summer

16. The scheme of awarding internal marks shall be as per **Appendix-G** appended with this Direction.
17. Successful examinees at the विज्ञान स्नातक अन्त्य, सत्र-६ (B.Sc. Final, Sem-VI) Examination who obtain not less than 60% marks in

aggregate of Sem-I, II, III, IV, V & VI Examination taken together shall be placed in the First Division, those obtaining less than 60% but not less than 45% in the Second Division, and all other successful examinees in the pass Division.

**Explanation :**

Division at the विज्ञान स्नातक अन्त्य, सत्र-५ व ६ (B.Sc. Final, Sem-V & Sem-VI) Examination shall be declared on the basis of the marks obtained in the Science Subjects at the Sem-I, II, III, IV, V & VI Examination taken together.

18. There shall be no classification of successful examinees at the Sem-I to Sem-V Examinations.
19. An examinee successful in the minimum period prescribed for the examination, obtaining not less than 75% of the maximum marks prescribed in the subject shall be declared to have passed the examination with Distinction in the subject.

**Explanation :**

- (1) Distinction shall be awarded only in Science Subjects including Mathematics.
- (2) Distinction at the विज्ञान स्नातक अन्त्य (B.Sc. Final) Examination shall be awarded on the basis of the marks obtained at the विज्ञान स्नातक भाग-१, सत्र-१ व २; विज्ञान स्नातक भाग-२, सत्र-३ व ४; व विज्ञान स्नातक अन्त्य, सत्र ५ व ६ (B.Sc. Part-I, Sem-I & II; B.Sc. Part-II, Sem-III & IV, and B.Sc. Final-Sem-V & VI) Examination taken together.
- (3) Distinction shall not be awarded to an examinee availing of the provision of the exemptions and compartments at any of the examination.
20. Provisions of Ordinance No18/2001 in respect of 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 deficiency of marks in a subject in all the faculties prescribed by the Statute NO.18, Ordinance 2001 shall apply.
21. (A) The students who have passed B.Sc.Final examination of this University or any other statutory University shall be eligible to seek admission for studying practical of any other optional subjects offered for B.Sc. Degree for simultaneous study of complete three year course for that subject in one year and to appear simultaneously for all parts of examination leading to the degree of Bachelor of Science (additional) in that subject, subject to the following condition.

An examinee shall have attended full course of laboratory instructions in a College in the subject in which laboratory work is prescribed. An examinee shall submit a certificate to that effect signed by the Principal of the College.

- (B) On securing not less than minimum marks prescribed for the subject / subjects shall be issued a certificate of having passed the examination in the additional subject/subjects as the case may be.
- (C) The application for admission to the examination under (A) above shall be submitted to the Registrar not less than three months before the date of commencement of the examination.
22. As soon as possible after the examinations the Board of Examination shall publish a list of successful examinees at the B.Sc Part-I, Sem-I & II; B.Sc. Part-II, Sem-III & IV and B.Sc. Final Sem-V & VI Examinations. Such list at the विज्ञान स्नातक अन्त्य (B.Sc. Final) Examination shall be arranged in three Divisions. The names of the examinees passing the examination as a whole in the minimum prescribed period and obtaining the prescribed number of places in First or Second Division shall be arranged in Order of Merit as provided in the Examinations in General Ordinance No. 6.
23. No Person shall be admitted to B.Sc Part-I, Sem-I & II; B.Sc. Part-II, Sem-III & IV and B.Sc. Final Sem-V & VI Examinations, if he has already passed the corresponding or an equivalent examination of any other Statutory University.
24. Successful Examinees at the विज्ञान स्नातक भाग-१, सत्र-१ व २ (B.Sc. Part-I, Sem-I & II) and the विज्ञान स्नातक भाग-२, सत्र-३ व ४ (B.Sc. Part-II, Sem-III & IV) Examination shall be entitled to receive a Certificate signed by the Registrar and successful examinee at the end of विज्ञान स्नातक अन्त्य सत्र-६ (B.Sc. Final, Sem-VI) Examination, shall on payment of the prescribed fees, receive a Degree in the Prescribed form, signed by the Vice-Chancellor.



## Appendix-A

## Examination Scheme

विज्ञान स्नातक भाग-१

## (B.Sc. Part-I) (Semester-I)

Sr. No.	Subject	Examination Scheme						Total Theory, Pract. & Int.Ass.
		Theory			Practical			
		Max. Mar. Theory Papers	Max. Marks Int. Ass.	Total	Min. pass Marks	Max. Marks Practical	Min. Pass Mar.	
1	Compulsory English	40	10	50	18	0	0	50
2	Languages	40	10	50	18	0	0	50
3	Mathematics (Paper-I)	60	15	150	54	0	0	150
4	Mathematics (Paper -II)	60	15			0	0	
5	Science subjects excluding Mathematics	80	20	100	35	50	18	150

Grand Total of Semester-I : 450+100

## Appendix-B

विज्ञान स्नातक भाग-१

## (B.Sc. Part-I) (Semester-II)

Sr. No.	Subject	Examination Scheme						Total Theory, Pract. & Int.Ass.
		Theory			Practical			
		Max. Mar. Theory Papers	Max. Marks Int. Ass.	Total	Min. pass Marks	Max. Marks Practical	Min. Pass Mar.	
1	Compulsory English	40	10	50	18	0	0	50
2	Languages	40	10	50	18	0	0	50
3	Mathematics (Paper-III)	60	15	150	54	0	0	150
4	Mathematics (Paper -IV)	60	15			0	0	
5	Science subjects excluding Mathematics	80	20	100	35	50	18	150

Grand Total of Semester-I : 450+100

## Appendix-C

विज्ञान स्नातक भाग-२ . सत्र ३  
(B.Sc. Part-II) (Semester-III)

Sr. No.	Subject	Examination Scheme						Total Theory, Pract. & Int.Ass.
		Theory			Practical			
		Max. Mar. Theory Papers	Max. Marks Int. Ass.	Total	Min. Pass Marks	Max. Marks Practical	Min. Pass Mar.	
1	Mathematics (Paper-V)	60	15	150	60	0	0	150
2	Mathematics (Paper-VI)	60	15			0	0	
3	Science subjects excluding Mathematics	80	20	100	40	50	20	150

Grand Total of Semester-III : 450

## Appendix-D

विज्ञान स्नातक भाग-२ . सत्र ४  
(B.Sc. Part-II) (Semester-IV)

Sr. No.	Subject	Examination Scheme						Total Theory, Pract. & Int.Ass.
		Theory			Practical			
		Max. Mar. Theory Papers	Max. Marks Int. Ass.	Total	Min. Pass Marks	Max. Marks Practical	Min. Pass Mar.	
1	Mathematics (Paper-VII)	60	15	150	60	0	0	150
2	Mathematics (Paper-VIII)	60	15			0	0	
3	Science subjects excluding Mathematics	80	20	100	40	50	20	150

Grand Total of Semester-IV : 450

## Appendix-E

विज्ञान स्नातक अंत्य सत्र ५  
(B.Sc. Final) (Semester-V)

Sr. No.	Subject	Examination Scheme						Total
		Theory			Practical			
		Max. Mar. Theory Papers	Max. Marks Int. Ass.	Total	Min. Pass Marks	Max. Marks Practical	Min. Pass Mar.	Theory, Pract. & Int.Ass.
1	Mathematics (Paper-IX)	60	15	150	60	0	0	150
2	Mathematics (Paper-X)	60	15			0	0	
3	Science subjects excluding Mathematics	80	20	100	40	50	20	150

**Grand Total of Semester-V : 450**

## Appendix-F

विज्ञान स्नातक अंत्य सत्र ६  
(B.Sc. Final) (Semester-VI)

Sr. No.	Subject	Examination Scheme						Total
		Theory			Practical			
		Max. Mar. Theory Papers	Max. Marks Int. Ass.	Total	Min. Pass Marks	Max. Marks Practical	Min. Pass Mar.	Theory, Pract. & Int.Ass.
1	Mathematics (Paper-VII)	60	15	150	60	0	0	150
2	Mathematics (Paper-VIII)	60	15			0	0	
3	Science subjects excluding Mathematics	80	20	100	40	50	20	150

**Grand Total of Semester-VI : 450**

- Note :**
- 1 There shall be only one theory paper of each science subject other than Mathematics for every semester.
  - 2 Distribution of marks of practical within the limit of Max. Marks shall be as prescribed by the B.O.S. of the concerned subject.
  - 3 In absence of certificate for practical record book (Appendix-H), examinee shall not be allowed to appear for the practical examination.

## Appendix-G

The internal assessment marks assigned to each theory paper as mentioned in **Appendix-A to F** shall be awarded on the basis of assignment, class test, attendance, project assignments, Seminar, Study tour, Industrial visit, Visit to educational institutions and research organization, field work, group discussion or any other innovative practice/activity. The marking scheme for each of the practice/activity shall be as under :-

Sr. No.	Semester	Practice /Activity	Details of marking scheme	Total marks for		
				Languages	Mathe-matics	Other Science Subjects
1	2	3	4	5	6	7
1	Semester -I & II	Assignment	Two assignments per theory paper	04	05	08
2	Semester-I & II	Class Test	Two class test (on passing test)	06	10	12
<b>Total marks for Sem-I /II</b>				<b>10</b>	<b>15</b>	<b>20</b>
3	Sem-III, IV, V & VI	Project Assignment	On latest developments in the subject in 100-200 words	0	03	04
4	Sem-III, IV, V & VI	Class Test	Two class test (on passing test)	0	08	10

1	2	3	4	5	6	7
5	Sem-III, IV, V & VI	Seminar, Study tour, Industrial visit, Visit to educational institutions, research organization, field work, group discussion or any other innovative practice/ activity.	Any one of the activity with report of the activity.	6	04	06
<b>Total marks of Sem-III/ IV/V/ VI</b>				—	<b>15</b>	<b>20</b>

- Note :**
- The concerned teacher shall have to keep the record of all the above activities till the passing out of that batch.
  - At the beginning of each semester, every teacher shall inform his/her students unambiguously the method he/she proposes to adopt a scheme of marking for the internal assessment.
  - Teacher shall announce the schedule of activity for Internal Assessment in advance in consultation with HOD/ Principal.
  - Normally the teacher concerned may conduct three written tests spread periodically during the semester and award the marks on the test on passing of any two tests.
  - The internal marks shall be displayed on the notice board before three weeks of the commencement of the theory examination. Grievances if any, of the student regarding Internal Assessment marks shall be settled by the Principal at college level in consultation with the concerned teacher.
  - Final submission of internal marks to the University shall be before commencement of the theory examinations.

**CERTIFICATE**

Name of College / Institution :

\_\_\_\_\_

Name of the Department :- \_\_\_\_\_

This is to certify that this Book contains the bonafide record of the practical work of Shri/Kumari/Shrimati

of B.Sc.Part-\_\_\_\_ (Semester-\_\_\_\_) during the Academic year \_\_\_\_\_

Dated :    /    /20

Signature of the Teacher who taught the examinee

1. í í í í í í í í

2. í í í í í í í í

Head of the Department

(Note : In absence of certificate for practical record book (Appendix-H), examinee shall not be allowed to appear for the practical examination.)

Amravati  
Date : 11/6/2010

Sd/-  
(Dr.Kamal Singh)  
Vice-Chancellor

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**Sang Gadge Baba Amravati University, Amravati**

**DIRECTION**

No. : 37 / 2011

Date : 26.7.2011

**Subject : Corrigendum to Direction No.16/2010 in respect of Examinations leading to the Degree of (Bachelor of Science)(Three Year Degree Course – Semester Pattern)**

Whereas, the Direction No. 16 of 2010 regarding Examinations leading to the Degree of (Bachelor of Science) (Three Year Degree Course ó Semester Pattern), Direction-2010 is in existence.

AND

Whereas, the existing provision regarding theory examination of Semester-I & II shall be simultaneously conducted by the University at the end of Semester-II in Summer as well as the practical examinations shall be conducted annually for each semester.

AND

Whereas, the Committee constituted by the faculty of Science, under the Chairmanship of Dean of the faculty in its meeting held on 28.6.2011 and 14.7.2011 has considered the issues regarding conduction of theory and practical examination of B.Sc. Semester-I to VI at the end of each semester, from the Academic Session 2011-12.

AND

Whereas, making amendments in the Ordinance for above examination is a time consuming process.

AND

Whereas, it is necessary to carryout the corrections to Direction No.16 of 2010 issued earlier as stated in para No.1 above, urgently.

Now, therefore, I, Dr.Mohan K.Khedkar, Vice Chancellor of Sant Gadge Baba Amravati University, in exercise of powers conferred upon me under sub-section (8) of section 14 of the Maharashtra Universities Act., 1994, do hereby direct as under:

1. This Direction may be called õCorrigendum to Direction No.16/2010 in respect of Examinations leading to the Degree of (Bachelor of Science) (Three Year Degree Course ó Semester Pattern)õ.
2. This direction shall come into force from the date of its issuance.
3. From the Academic Session 2011-12, theory and practical examinations of each Semester shall be conducted separately at the end of each semester.

Sd/-

Amravati  
Date : 26/7/2011

(Dr.Mohan K.Khedkar)  
Vice-Chancellor

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**DIRECTION**

No. : 1 / 2012

Date : 23.1.2012

**Subject : Corrigendum to Direction No.16/2010 in respect of Examinations leading to the Degree of (Bachelor of Science)(Three Year Degree Course – Semester Pattern)**

Whereas, the Direction No.16 of 2010 in respect of Examinations leading to the Degree of (Bachelor of Science) (Three Year Degree Course ó Semester Pattern) in the faculty of Science is in existence.

AND

Whereas, corrigendum to Direction No.16 of 2010 in respect of Examinations leading to the Degree of (Bachelor of Science) (Three Year Degree Course ó Semester Pattern) was issued vide Direction No.37/2011 on dated 26.7.2011.

AND

Whereas, the Academic Council in its meeting held on 13.1.2012 vide item Nos.14 (5) (E) and 14 (5) (O) respectively has accepted to allow the students passing H.S.S.C. examination (M.C.V.C. stream) with Medical Laboratory Technician Trade for admission to B.Sc. Part-I under the group-õChemistry, Environmental Science, Industrial Microbiology,õ, and the recommendations of the Monitoring Committee under the Chairmanship of Dean, faculty of Science of its meeting dated 15.11.2011 regarding correction in marking scheme of Internal Assessment Marks at B.Sc. level.

AND

Whereas, as per decision of Academic Council, the above correction are to be carried out in Column No.3 against Sr.No. 1 under the table of sub-clause (II) of Para 6 and in Appendix-G of Direction No.16 of 2010 issued earlier for the Examinations leading to the Degree of (Bachelor of Science) (Three Year Degree Course ó Semester Pattern) in the faculty of Science for Summer-2012 examinations and onwards.

AND

Whereas, it is necessary to carry out the corrections in the above said Direction immediately.

Now, therefore, I, Dr.Mohan K.Khedkar, Vice Chancellor of Sant Gadge Baba Amravati University, in exercise of powers conferred upon me under sub-section (8) of section 14 of the Maharashtra Universities Act., 1994, do hereby direct as under:

1. This Direction may be called õCorrigendum to Direction No.16/2010 in respect of Examinations leading to the Degree of (Bachelor of Science)

(Three Year Degree Course ó Semester Pattern) in the faculty of Scienceö.

2. This direction shall come into force from the date of its issuance.
3. In Direction No.16/2010 in respect of Examinations leading to the Degree of (Bachelor of Science) (Three Year Degree Course ó Semester Pattern) in the faculty of Science-
  - A) the words öIndustrial Microbiologyö after the word öBioinformaticsö in column No.3 against Sr.No.1 under the table of Sub-clause (II) of para 6 of Direction No.16 of 2010 shall be added.
  - B) in Appendix-G following corrections be carried out :
    1. In column No.4, at Sr.No.1, the words öTwo assignmentsö be replaced by the words öOne assignmentö.
    2. In column No.4, at Sr.No.2, the words & signs öTwo Class Tests (On passing test)ö be replaced by the words öOne testö.
    3. In column No.4, at Sr.No.4, the words & signs öTwo Class Tests (On passing test)ö be replaced by the words öOne testö.
    4. In column No.4, at Sr.No.5, the words öAny one of the activityö be replaced by the words öAny one of the activitiesö.
    5. The Note No.4 be deleted and substituted by the following para. öThe test with maximum 30 marks be conducted for the students and the marks be allotted based on the performance of the students as under-ö

	Languages		Mathematics		Other Sci. subjects	
	Sem-I & II	Sem-I & II	Sem-III to VI	Sem-I & II	Sem-III to VI	Sem-III to VI
For the score 24 and above.	06	10	08	12	10	
From 18 to 23	05	08	06	10	07	
From 11 to 17	04	06	04	07	05	
From 0 to 10	00	00	00	00	00	

6. The following Note be added at Sr.No.7 -
 

öThe student who remain absent for internal assessment through out the semester, -Zeroömarks be given to him/her while posting the marks instead of writing öAbö before his/her name.ö

Sd/-

(Mohan K.Khedkar)

Vice-Chancellor

Amravati

Date : 23/1/2012

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**SANT GADGE BABA AMRAVATI UNIVERSITY, AMRAVATI**

## DIRECTION

No. : 5 of 2015

Date : 03/07/2015

**Subject : Corrigendum to Direction No. 16 of 2010 in respect of Examinations leading to the Degree of विज्ञान स्नातक (Bachelor of Science) (Three Year Degree Course – Semester Pattern), Direction, 2015.**

Whereas, Direction No.16/2010 in respect of Examinations leading to the Degree of विज्ञान स्नातक (Bachelor of Science) (Three Year Degree Course ó Semester Pattern), Direction 2010, in the Faculty of Science is in existence in the University.

AND

Whereas, Direction No. 16 of 2010 in respect of Examinations leading to the Degree of विज्ञान स्नातक (Bachelor of Science) (Three Year Degree Course ó Semester Pattern), Direction 2010 is already corrected by Direction Nos. 37/2011 & 1/2012.

AND

Whereas, the recommendation of the Committee appointed by Faculty of Science in respect of Government Resolution No. व्हीओसी-२०१२/५९१/प्र.क्र.२४५(अ)/व्यशि-४, दि.२८.९.२०१२ to decide equivalence for the +2 year courses of Vocational Education Examination Board for admission to higher education was accepted by the Honöble Vice-Chancellor u/s 14(7) of Maharashtra Universities Act, 1994 on behalf Faculty of Science and Academic Council.

AND

Whereas, Honöble Vice-Chancellor has accepted the recommendation of the Committee appointed by Faculty of Science for the students admitted to B.Sc.Part-I having passed 12<sup>th</sup> M.C.V.C. courses with trades öDairy Technologyö, öPoultry Productionö, öSeed Production Technologyö, öWatershed Managementö, öPost Harvest Technologyö and öWatershed Managementö u/s 14(7) of Maharashtra Universities Act, 1994 on behalf Faculty of Science and Academic Council.

AND

Whereas, the Department of Higher and Technical Education, Govt. of Maharashtra vide its Order No.एन.जी.सी.२०१४/(१०२/१४)/मशि-४, दि.14.6.2014, granted permission to start B.Sc. Part-I Forensic Science at Shri Shivaji Arts, Commerce and Science College, Akola; and the recommendations of Ad-hoc Committee of its meeting held on 9.4.2015 regarding draft syllabus

and other details for the subject Forensic Science at B.Sc. level were accepted by the Honorable Vice-Chancellor u/s 14(7) of the M.U.Act, 1994 on 15.4.2015 on behalf of Faculty of Science.

AND

Whereas, the Academic Council in its meeting held on 6.5.2015 while considering the above recommendations of Faculty of Science vide item No. 35) 2) G) has approved the Draft Syllabi and other details for the subject Forensic Science at B.Sc. level to be implemented from the Academic Session 2015-16.

AND

Whereas, the matter is required to be regulated by framing the Ordinance and making of an Ordinance may likely to take some time.

AND

Whereas, the Academic Session 2015-16 is commencing in June, 2015.

Now, therefore, I, Dr.M.K.Khedkar, Vice-Chancellor of Sant Gadge Baba Amravati University, Amravati in exercise of powers conferred upon me under sub-section (8) of section 14 of the Maharashtra Universities Act, 1994, do hereby direct as under:

- 1) Corrigendum to Direction No. 16 of 2010 in respect of Examinations leading to the Degree of विज्ञान स्नातक (Bachelor of Science) (Three Year Degree Course ó Semester Pattern), Direction, 2015.
- 2) This Direction shall come into force w.e.f. the date of its issuance.
- 3) As per Government Resolution No. व्हीओसी-२०१२/५९९/ प्र.क्र.२४५(अ)/ व्यशि-४, दि.२८.९.२०१२,
  - i) The students passing the Certificate Course Examination from Computer, Electronics, Electric and Chemical group shall be eligible for admission to B.Sc. Part-I under the Group-A, B, D & H.
  - ii) The students passing the Certificate Course Examination from Paramedical and Agriculture group shall be eligible for admission to B.Sc. Part-I under the Group-C, E, F & G.
- 4) For the admitted and hereinafter admitting students to B.Sc. Part-I, in Direction No.16/2010 in para 6(II), in Sr.No.2 of the table, in the column of óM.C.V.C. Group and Tradeö, the trades óDairy Technologyö, óPoultry Productionö, óSeed Production Technologyö, óWatershed Managementö, óPost Harvest Technologyö be added below the Trade óCrop Science Tradeö under Agriculture Groupö and the trade óWatershed Managementö be also added below the Trade óElectronics Technology Tradeö.

- 5) Forensic Science subject shall be started as an optional subject for B.Sc. Degree course in the University.
- 6) In Direction 16/2010, in Para 6. (I), the subject óForensic Scienceö shall be added in Group-C after the subject óApicultureö, in Group-E after the subject óBiochemistryö and in Group-G after the subject óBiotechnologyö.

Date : 03/07/2015

Sd/-

**(Dr.M.K.Khedkar)**

Vice-Chancellor

Sant Gadge Baba Amravati University

**DIRECTION****No. : 15 of 2015****Date : 24/09/2015**

**Subject : Corrigendum to Direction No. 16 of 2010 in respect of Examinations leading to the Degree of विज्ञान स्नातक (Bachelor of Science) (Three Year Degree Course - Semester Pattern), Direction, 2015.**

Whereas, Direction No.16/2010 in respect of Examinations leading to the Degree of विज्ञान स्नातक (Bachelor of Science) (Three Year Degree Course - Semester Pattern), Direction 2010, in the Faculty of Science is in existence in the University.

AND

Whereas, Direction No. 16 of 2010 in respect of Examinations leading to the Degree of विज्ञान स्नातक (Bachelor of Science) (Three Year Degree Course - Semester Pattern), Direction 2010 is already corrected by Direction Nos. 37/2011, 1/2012 & 5/2015.

AND

Whereas, the Department of Higher and Technical Education, Govt. of Maharashtra vide its Order No.एन.जी.सी.२०१४/(१०२/१४)/मशि-४, दि.14.6.2014, granted permission to start B.Sc. Part-I i) Renewable Energy & ii) Animation at Gayadevi Joshi Aryabhata Mahavidyalaya, Akola;

AND

Whereas, the Honb'le Vice-Chancellor has constituted the Ad-hoc Committees for the subjects Renewable Energy & Animation for preparation of draft syllabi and other details.

AND

Whereas, the recommendations of Ad-hoc Committee of its meeting held on 6.8.2015 for the subject "Renewable Energy" and 18.09.2015 for the subject "Animation" regarding draft syllabus and other details for the above subjects at B.Sc. level were accepted by the Hon'ble Vice-Chancellor u/s 14(7) of the Maharashtra Universities Act, 1994 on 24.9.2015 on behalf of Faculty of Science and Academic Council.

AND

Whereas, the above recommendations of the Draft Syllabi and other details for the subjects i) Renewable Energy & ii) Animation at B.Sc. level to be implemented for B.Sc.Part I from the Academic Session 2015-16.

AND

Whereas, the matter is required to be regulated by framing the Ordinance and making of an Ordinance may likely to take some time.

AND

Whereas, the Academic Session 2015-16 is already started.

Now, therefore, I, Dr.M.K.Khedkar, Vice-Chancellor of Sant Gadge Baba Amravati University, Amravati in exercise of powers conferred upon me under sub-section (8) of section 14 of the Maharashtra Universities Act, 1994, do hereby direct as under:

- 1) This Direction shall be called as "Corrigendum to Direction No. 16 of 2010 in respect of Examinations leading to the Degree of विज्ञान स्नातक (Bachelor of Science) (Three Year Degree Course - Semester Pattern), Direction, 2015".
- 2) This Direction shall come into force w.e.f. the date of its issuance.
- 3) The subjects i) Renewable Energy & ii) Animation shall be started as optional subjects for B.Sc. Degree course in the University.
- 4) In Direction 16/2010, in Para 6. (I), the subject "Renewable Energy" and "Animation" shall be added at the end of Group-A.

Date : 24/09/2015

Sd/-

(Dr.M.K.Khedkar)  
Vice-Chancellor

The Executive Council, dated 1/2-4-1977, 11-7-1977 has prescribed the Teaching periods in the various subject in the Faculty of Science as follows.

**Examination:****B. Sc. Part - I**

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

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

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

**Note :** 1) \* The strength of a batch of practical and Tutorials for Under-Graduate classes shall be 16 with an addition of 10% with the

permission of Vice-Chancellor.

\*(As amended by the Executive Council dated 27/28-4-1979).

- 2) A Period will be counted of 45 minutes duration at Under-graduate level.
- 3) For Tutorial class a batch will be of 16 students with an addition of 10% with the permission of the Vice-Chancellor per week.

\*\*\*\*

**SYLLABUS PRESCRIBED FOR B.Sc. PART-I  
SEMESTER-I**



**1. COMPULSORY ENGLISH****1S Compulsory English****Effective from Session 2010-2011****Text Book Prescribed : REALMS OF GOLD (SPACIAL EDITION)**

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

Publisher: Orient Blackswan Pvt. Ltd. Mumbai.

- Prose Passages:**
1. The Power of Prayer : Abdul Kalam
  2. Rising Tide of Urban Chaos : Colin Legum
  3. The Gold Frame : R.K.Laxman
  4. Vivekananda : The Great Journey to the West :  
Romain Rolland
  5. Good Manners : J.C.Hill

- Poems :**
1. The Village Schoolmaster ó Oliver Goldsmith
  2. Lucy ó William Wordsworth
  3. When I Set Out for Lyonesse ó Thomas Hardy
  4. All in June ó W. H. Davies.

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

**Communication Skills Everyday English – Part I****Preparing a CV and Writing Letters.****Pattern of Question Paper and Distribution of Marks.****Maximum Marks : 40****Time: Three Hours**

- Q.1 : Prose Passages No. 1 to 5  
There shall be five short answer questions í .05 marks
- Q. 2 : Prose Passages No. 1 to 5  
There shall be five long answer questions. Out of these, students will have to answer any two questions of five marks each  
í í 10 marks
- Q. 3 : Poems no. 1 to 4  
There shall be four long-answer questions. Out of these students will have to answer any two questions of five marks each  
í .10 marks
- Q. 4 : Grammar : Parts of Speech, Articles and Prepositions, Tenses, Transformation of Sentences.  
There shall be five questions based on the prescribed grammar and usage. í .05 marks
- [Note : The paper setter shall have his/her discretion as regards

selection]

- Q.5 : There shall be two questions based on Everyday English ó Part I. Out of these students will have to answer any one

í í 05 marks

- Q. 6 : There shall be one question on preparing a CV for seeking a job

í í 05 marks

-----  
Total 40 marks  
-----

**2S COMPULSORY ENGLISH****Text Book Prescribed : REALMS OF GOLD (SPACIAL EDITION)**

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

Publisher: Orient Blackswan Pvt. Ltd. Mumbai.

- Prose Lessons Prescribed:**
1. With the Photographer ó Stephen Leacock
  2. A Talk on Advertising ó Herman Wouk
  3. Making a Contract ó Philip Bingham
  4. The Scientific Point of View ó J. B. S. Haldane
  5. The Sun, the Planets and Stars ó C. Jones.

- Poems Prescribed:**
1. The Best of School ó D. H. Lawrence
  2. Ballad of the Landlord ó Langston Hughes
  3. To the Indians Who Died in Africa ó T. S. Eliot
  4. Ecology ó A. K. Ramanujan

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

**Communication Skills :** Note-making and Reporting, Paragraph Writing.

**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 passages  
í ....05 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 each  
...í 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 Sec-

tion-Parts of Speech, Use of articles and Prepositions, Tenses, Transformation of Sentences .....05 marks

Q. 5 : There shall be one question either on Note-making or on Reporting (Note: The paper setter shall have the discretion)í .. 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 topics í í 05 marks

-----  
**Total 40 marks**  
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## 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)	विद्यार्थ्याप्रत	-	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-१ घटक अ	-	दिर्घोत्तरी प्रश्न (कोणताही एक)	गुण - १०
प्रश्न-२ घटक अ	-	लघुत्तरी प्रश्न (कोणतेही दोन)	गुण - (५+५=१०)
प्रश्न-३ घटक ब	-	लघुत्तरी प्रश्न (कोणतेही दोन)	गुण - (५+५=१०)
प्रश्न-४ घटक क	-	व्यावहारिक मराठी- कार्यालयीन पत्रव्यवहार	गुण - (५+५=१०)

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-१ घटक अ	-	दिर्घोत्तरी प्रश्न (कोणताही एक)	गुण - १०
प्रश्न-२ घटक अ	-	लघुत्तरी प्रश्न (कोणतेही दोन)	गुण - (५+५=१०)
प्रश्न-३ घटक ब	-	लघुत्तरी प्रश्न (कोणतेही दोन)	गुण - (५+५=१०)

प्रश्न-४ घटक क - व्यावहारिक मराठी- प्रसारमाध्यमांसाठी लेखन गुण - (५+५=१०)  
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

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

### SEMESTER - I

#### URDU COMPULSORY

Time : 3 Hours )

( Marks : 40

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

Published by TAFSA Printers & Publishers, Amravati.

#### Unitwise Distribution of Marks

Unit - I	The Following Lessons from Text	8 Marks
	جزو "الف" حصہ ۱-۲ تاریخ ۲- دنیا کی پہلی تہذیبیں ۳- سائنس کا کرشمہ	
Unit - II	The following poems from Text	8 Marks
	جزو "ب" (حصہ نظم) ۱- دنیا ۲- گلزار وطن ۳- نوجوانوں سے	
Unit - III	The following lessons from Text	8 Marks
	جزو "ج" ۱- گھر کی تربیت ۲- مردہ بدست زندہ	
Unit - IV	The following lesson from text	8 Marks
	کالے خاں	
Unit - V	Communication Skill	8 Marks
	Reporting of any function, incidence, match excursion	

Q. 1. Two short answertype questions out of four based on Unit -I  
(Carrying four marks each ) 8Marks

Q. 2. Two short answertype questions out of four based on Unit -II  
(Carrying four marks each ) 8Marks

Q. 3. Two short answertype questions out of four based on Unit -III  
(Carrying four marks each ) 8 Marks

Q. 4. One long answertype question out of two based on Unit -IV  
(Carrying 8 marks ) 8 Marks

Q. 5. Reporting of any function, incidence, match excursion  
8 Marks

SEMESTER - II  
URDU COMPULSORY

Time : 3 Hours )

( Marks : 40

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

Published by TAFSA Printers & Publishers, Amravati.

Unitwise Distribution of Marks

Unit - I The Following Lessons from Text 8 Marks

جزو "الف" حصہ نثر

۱۔ اردو ادب اور قومی یکجہتی ۲۔ سلونو

- II The following poems from Text 8 Marks

جزو "ب" (حصہ نظم)

۱۔ ایضاً ۲۔ ایک خواب اور

Unit - III The following lessons from Text 8 Marks

جزو "ج"

۱۔ بلٹ ٹرین میں کبھی نہ بیٹھو

Unit - IV The following lesson from text 8 Marks

گذری کالال - نور خاں

Unit - V Communication Skill 8 Marks

a) Expansion of given idea 4 Marks

b) Idioms and Phrases 4 Marks

Q. 1. Two short answer type questions out of four based on Unit - I

(Carrying four marks each) 8 Marks

Q. 2. Two short answer type questions out of four based on Unit - II

(Carrying four marks each) 8 Marks

Q. 3. Two short answer type questions out of four based on Unit - III

(Carrying four marks each) 8 Marks

Q. 4. One long answer type question out of two based on Unit - IV

(Carrying 8 marks) 8 Marks

Q. 5. a) Expansion of given idea 4 Marks

b) Idioms and Phrases 4 Marks

या विषयाची एक प्रश्नपत्रिका राहिल.

सुक्ष्म वाचनाकरीता पाठ्यपुस्तक

कविकुलगुरु कालिदास विरचित रघुवंशम या महाकाव्याचा द्वितीय सर्ग वरील गुण ४०

पाठ्यपुस्तकाची पुढीलप्रमाणे चार गटात विभागणी करावी.

गट-१ : रघुवंशम (द्वितीय सर्ग) यातील श्लोक १ ते २४

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 : २ पैकी १	गुण-१०
प्रश्न-५:	गट ४ मधील टिपा : ३ पैकी २	गुण-१२

## 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 ó C. Jones
  2. Water : The Elixir of Life ó C. V. Raman
  3. Sir Isaac Newton ó Nathaniel Hawthorne
  4. Toasted English ó R. K. Narayan
  5. What is Courage ? ó William Slim

- Poetry Section :**
1. A Requiem ó William Shakespeare
  2. The Sun Rising ó John Donne
  3. From Paradise Lost ó John Milton
  4. The Chimney Sweeper ó 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. í ....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 í í 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 ...í .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) ...í .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. ..í ..05 marks

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Total 40 marks  
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### 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 ó R. K. Laxman
  2. My Financial Career ó Stephen Leacock
  3. The Power of Prayer ó A. P. J. Abdul Kalam
  4. Why is the Sea Blue ? ó G. Venkataraman
  5. The Myths of Artificial Intelligence ó Attila Narin

- Poetry Section :**
1. Ode to Autumn ó John Keats
  2. The Road not Taken ó Robert Frost
  3. Ballad of the Landlord ó Longston Hughes
  4. The Wind hover ó G. M. Hopkins

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

- Professional :**
- 1) Soft Skills
  - 2) Public Speaking
- Communication**
- 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.  
í .....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  
í í 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.  
í í 05 marks
- Total 40 marks  
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[Notes : 1. For additional knowledge & practice of Grammar the following books are suggested.  
English Grammar Practice by Raj N. Bakshi, Publisher ó 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	10 Marks
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

**Semester I**  
**1S Mathematics Paper-I**  
**(Algebra and Trigonometry)**  
**(Implemented from the A.S. 2015-16)**

- Unit-I : De Moivre'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 :** Trigonometric series: Gregory series, Euler's series, Machin's series, Rutherford's series, summation of series, series based upon  $\sin x$ ,  $\cos x$ ,  $\sinh x$ ,  $\cosh x$ , exponential series, logarithmic series and series based upon Gregory series.
- Unit-III:** Elements of quaternion: Definition. Equality and addition, multiplication, complex conjugate of a quaternion, norm, inverse, quaternion as a rotation operator, geometric interpretation, a special quaternion product, operator algorithm, quaternion to matrices.
- Unit-IV:** Theory of equations: Relations between the roots and coefficients, transformation of equations, cubic equations (Cardan method), Descartes' rule of signs, biquadratic equations.
- Unit-V :** **Matrices:** Rank of a matrix, row rank, column rank, eigenvalues, eigenvectors and the characteristic equation of a matrix. Cayley-Hamilton theorem and its application.

**References Books:**

- 1) K.B.Datta, Matrix and Linear Algebra, Prentice Hall of India Pvt.Ltd. New Delhi, 2000.
- 2) H.S.Hall and S.R.Knight, Higher Algebra, H.M.Publications, 1994.
- 3) Chandrika Prasad, Text Book on Algebra & Theory of Equations, Pothishala Private Ltd., Allahabad.
- 4) S.L.Loney, Plane Trigonometry Part-II, MacMillan & Co., London.
- 5) R.S.Verma & K.S.Shukla, Text Book on Trigonometry, Pothishala Pvt.Ltd. Allahabad.
- 6) Ayres Jr Frank : Matrices : Schaum's outline series, McGraw Hill Book Company, Singapore, 1983.

- 7) T M Karade, Maya S. Bendre, Lectures on Algebra and Trigonometry.
- 8) Hohn Franz E : Elementary Matrix Algebra, Amerind Publishing Co., Pvt.Ltd. 1964.
- 9) Spiegel M.R. : Complex Variables, Schaum's outline series, McGraw Hill, 1981.
- 10) Shanti Narayan : A Test Book of Matrices, S.Chand & Co. Delhi.
- 11) Jack B Kuipers: quaternion algebra of Quaternions and rotation sequences, Princeton University Press, Fifth printing, 2002.

### Semester I

#### 1S Mathematics Paper-II (Differential and Integral Calculus) (Implemented from the A.S. 2015-16)

- Unit-I** : Definition of the limit of a function, basic properties of limits, continuous functions and classification of discontinuities.
- Unit-II** : Differentiability, successive differentiation, Leibnitz theorem, indeterminate forms and L'Hospital rule.
- Unit-III** : Rolle's theorem, Lagrange's mean value theorem, Cauchy's mean value theorem, Maclaurin and Taylor series expansions.
- Unit-IV** : Partial derivatives and differentiation of real valued function of two variables, homogeneous functions, Euler's theorem on homogeneous functions.

**Unit-V:** Integration of the form  $\int \frac{P_n(x)}{\sqrt{Q}} dx$ , reduction formulae for

$$\int \sin^n x dx, \int \cos^n x dx \text{ and Wallis's formula, } \int \tan^n x dx,$$

$$\int \cot^n x dx, \int \sec^n x dx, \int \operatorname{cosec}^n x dx, \int \sin^n x \cdot \cos^m x dx,$$

quadrature, rectification,

#### References :

- 1) Ayres F Jr. : Differential equations, Schaum's outline series, McGraw Hill, 1981.
- 2) Ayres F Jr. : Calculus, Schaum's Outline series, McGraw Hill, 1981.
- 3) Karade T.M., J.N.Salunke, M.S.Bendre : Graduate level Calculus, Sonu-Nilu, 5, Bandu Soni layout, Gayatri Road Parsodi, Nagpur.
- 4) Karade T.M., Maya S. Bendre : Integration and Differential equations, Sonu-Nilu, 5, Bandu Soni layout, Gayatri Road Parsodi, Nagpur.
- 5) Edwards J : Differential Calculus for Beginners, MacMillan and Co.Ltd.,1963.
- 6) Edwards J : Integral Calculus for Beginners, AITBS, Publishers and Distributors, 1994.
- 7) Forsyth A.R.: A Treatise on Differential Equations, (Sixth Edition) MacMillan and Co.1956.
- 8) Greenspan D. : Introduction to Calculus, Harper and Row, 1968.

- 9] Gorakh Prasad: Differential Calculus, Pothishala Pvt. Ltd., Allahabad.
- 10] Gorakh Prasad : Integral Calculus, Pothishala Pvt. Ltd., Allahabad.
- 11] Erwin, Kreyszig : Advanced Engineering Mathematics, John Wiley & Sons, 1999.
- 12] N.Piskunov : Differential and Integral Calculus, Peace Publishers, Moscow.

### 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

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**Total** **50 marks**

- 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 in-charge 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

Date											
Sr. 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

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

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

## 9.CHEMISTRY

### 1S Chemistry

(Effective from session 2013-14)

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 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

**14L**

#### A] Periodic Properties:

Atomic and ionic radii. Types of atomic radii (only definitions - covalent radius, metallic radius, Van der Waals radius and ionic radius). Periodic trends in atomic and ionic radii. Ionization energy, electron affinity and electronegativity (definition and periodic trends). Effect of ionization energy and electronegativity on different properties of elements namely metallic and non-metallic character, relative reactivity, oxidizing and reducing properties., 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, 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 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****14L****A] S-Block element:**

Comparative study of 1<sup>st</sup> and 2<sup>nd</sup> group elements with reference to electronic configuration, ionisation energy, oxidation states, reactivity and flame colouration. Diagonal relationship between Li and Mg.

**[5]****B] P-Block element:**

Comparative study of 13<sup>th</sup>, 14<sup>th</sup> and 15<sup>th</sup> group elements with reference to electronic configuration, ionisation energy, oxidation states. Concept of inert pair effect. Diagonal relationship between Be and Al. Structure of diamond and graphite. Abnormal behaviour of nitrogen. Hydrides of boron- preparation (from BCl<sub>3</sub> and NaBH<sub>4</sub>), properties (action of heat, water, alkali and oxygen), structure and bonding in diborane. Carbides, types of carbides and fullerenes.

**[9]****Unit III****14L****A] Electronic Displacements:**

Inductive effect, Electromeric effect, Resonance and Hyperconjugation (definition, and applications of these effects). [3]

**B] Reactive Intermediates:**

Carbocations, Carbanions and free radicals: their generation stability and reactions. [2]

**C] Aliphatic Hydrocarbons:**

Alkanes: Methods of formation: i) Wurtz reaction and ii) Corey-House reaction, Reactions: i) Halogenation (With mechanism), ii) Aromatisation. [2]

Alkenes: Methods of formation (With mechanism): i) Dehydrohalogenation of alkyl halides (E<sub>1</sub> & E<sub>2</sub>) ii) Dehydration of alcohols, Reactions: Electrophilic and free radical addition of HX and X<sub>2</sub> (with mechanism). [3]

Alkynes: Preparation from vicinal and geminal dihalides, Reaction-Hydrogenation. [2]

Alkadienes: Classification, 1,3-Butadiene- Preparation from cyclohexene, Reactions- Addition of H<sub>2</sub>, Br<sub>2</sub> and HBr. [2]

**Unit IV- Aromatic Hydrocarbons****14L**

**A] Nomenclature and Isomerism of Aromatic Compounds. Structure of Benzene: Kekule structure and Molecular orbital structure. [4]**

**B] Aromaticity and Huckel's rule Aromatic, antiaromatic and non-aromatic systems. [4]**

**C] Mechanism of Electrophilic Aromatic Substitution: Nitration, Friedel Craft Alkylation and Acylation. Nuclear and Side Chain Halogenation, Birch Reduction. [4]**

**D] Orientation: Effect of substituent groups. Activating and deactivating groups. Theory of reactivity and orientation on the basis of inductive and resonance effects (-CH<sub>3</sub>, -OH, -NO<sub>2</sub> and  $\delta$ Cl groups). [2]**

**Unit V : Thermodynamics****14L**

Adiabatic and Isothermal processes. Work done in adiabatic and isothermal processes, Evaluation of different expressions showing relationship between pressure, volume and temperature. First law of Thermodynamics and its limitations, Need of Second law. Carnot's heat engine, derivation of expression for the work done and efficiency of Carnot's engine. Statements of Second law of thermodynamics. Concept of Entropy, Physical significance of Entropy, Derivation of expression for the Entropy change for an ideal gas in terms of pressure, temperature and volume. Entropy change for an ideal gas for isothermal, isobaric and isochoric processes, Entropy of fusion, sublimation, vapourization, transition and its calculations. Entropy change for reversible and irreversible processes. Entropy change as a criteria for spontaneity. Numericals. [14]

**Unit VI****14L**

**A] Gaseous State:** Postulates of Kinetic theory of gases, Derivation of Kinetic gas equation. RMS, Average and Most probable velocities and their relationship. Maxwell-Boltzmann distribution law of molecular velocities (only qualitative treatment), Mean free path, collision number and collision diameter. Deviation of real gases from ideal gas behaviour. Vanderwaal's equation of state and its derivation for real gases. Critical phenomenon, Andrew's experiment - isotherm of CO<sub>2</sub>. Critical state, critical constant, P<sub>c</sub>, V<sub>c</sub> and T<sub>c</sub> in terms of Vanderwaal's constants  $a$  and  $b$ . Reduced equation of state and its derivation. Law of corresponding state. Numericals. [10]

**B] Phase Rule:**

Statement of phase rule, explanation of phase, number of components and degree of freedom. Application of phase rule to water and sulfur system. [4]

**Semester I**  
**1S Chemistry Practicals**

**Total Laboratory Sessions: 26** **Marks: 50**

**Exercise 1: Inorganic Qualitative analysis**  
**12 Laboratory sessions**

Semimicro qualitative analysis of inorganic salt mixture containing two acidic radicals and two basic radicals of same or 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 and sulphate, silver(I), lead(II), copper(II), bismuth(III), 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).

**Exercise II: Organic Preparations** **14 Laboratory sessions**

1. Preparation of acetanilide (Acetylation).
2. Preparation of Benzanilide (Benzoylation).
3. Preparation of m-di-Nitrobenzene (Nitration).
4. Preparation of tri-Bromoaniline from Aniline (Bromination).
5. Preparation of Benzoic acid from Benzamide (Hydrolysis).
6. Preparation of Benzoic acid from benzaldehyde (Oxidation).
7. Preparation of phenylazo ó ß ó naphthol dye (Diazotisation).
8. Preparation of sulphanilic acid from aniline (Sulphonation).

**Organic Preparations Using Green Chemistry Concept**

9. Acetylation of primary amine (Preparation of acetanilide).
10. Base catalysed Aldol Condensation (Synthesis of dibenzal propanone).

**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.

**Distribution of Marks for Practical Examination**

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

<b>Exercise-I</b>	í í í ..	<b>18</b>
<b>Exercise-II</b>	í í í ..	<b>18</b>
<b>Viva-Voce</b>	.í í í .	<b>07</b>
<b>Record</b>	.í í í .	<b>07</b>
	ô ô ô ô ô ô ô ô	
	<b>Total:</b>	<b>50</b>

**Books Recommended:**

1. Principles of Inorganic Chemistry by Puri, Sharma and Kalia- S. Naginchand & Co., Delhi.
2. Text book of Inorganic Chemistry by A.K. De, Wiley East Ltd.
3. Selected Topics in Inorganic Chemistry by Malik, Tuli and Madan- S. Chand & Co.
4. Modern Inorganic Chemistry by R.C. Agrawal, Kitab Mahal.
5. Instrumental Methods of analysis by Chatwal and Anand, Himalaya Publishing House.
6. Concise Inorganic Chemistry by J.D. Lee, ELBS.
7. Inorganic Chemistry by J.E. Huheey- Harper & Row.
8. Fundamental concepts of Inorganic Chemistry by E.S. Gilreath, McGraw Hill book Co.
9. Modern Inorganic Chemistry by W.L. Jolly, McGraw Hill Int.
10. Chemistry Facts, Patterns & Principles by Kneen, Rogers and Simpson, ELBS.
11. Theoretical Principles of Inorganic Chemistry by G.S. Manku, Tata McGraw Hill.
12. Inorganic complex compounds by Murmann, Chapman & Hall.
13. Text book of Inorganic Chemistry by K.N. Upadhyaya, Vikas Publishing House, Delhi.
14. Advanced Practical Inorganic Chemistry by Gurdeep Raj, Goel Pulishing House, Meerut.
15. Co-ordination Chemistry by D. Banerjee, TMH Publication.
16. Text book of Inorganic Chemistry by Marathe, Bhadange, Mopari and Kubade.
17. Organic Chemistry by R. T. Morrison & R. T. Boyd, 6<sup>th</sup> edition, PHI.
18. Organic Chemistry by Pine, 5<sup>th</sup> edition.
19. Organic Chemistry Vol. I, II and III by Mukharjee, Singh and Kapoor- Wiley Eastern.
20. Organic Chemistry by S.K. Ghosh.

21. Reaction Mechanism in Organic Chemistry by S.M. Mukharjee and S.P. Singh.
22. Spectroscopy of Organic Compounds by P.S. Kalsi.
23. Stereochemistry and mechanism through solved problems by P.S. Kalsi.
24. Organic Chemistry by TWG Solomons, 4<sup>th</sup> edition, John Wiley.
25. Hand Book of Organic Analysis by H.J. Clarke, Arnold Heinmen.
26. Text book of Practical Organic Chemistry by A. I. Vogel.
27. Text book of Organic Chemistry by Jamode, Ganar, Makode, Waghmare, Mahajan, Toshniwal.
28. Text book of Organic Chemistry by P.S. Kalsi published by Macmillan India Ltd., 1999, Delhi.
29. Practical Organic Chemistry by F.G. Mann, B.C. Saunders, Orient Longman.
30. Comparative Practical Organic Chemistry (Qualitative Analysis) by V.K. Ahluwalia and Sunita Dhingra, Orient Longman.
31. Comprehensive Practical Organic Chemistry (Preparation and Qualitative Analysis) by V.K. Ahluwalia and Renu Agrawal, Orient Longman.
32. Physical Chemistry: Walter, J. Moore, 5<sup>th</sup> edn., New Delhi.
33. 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, 4<sup>th</sup> Edn.
37. Text book of Physical Chemistry: P.L. Sony O.R. Dhrma.
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. Text book of Chemistry, B.Sc.-I, First Semester, BokeyPrakashan, Amravati

### 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 óSolar 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, Cp, Cv, Molar heat capacity, Heat of reaction, formation, combustion, neutralisation, Heat of solution, Hessø 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, natu-

ral 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 : Fluid Mechanics:****[14]**

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, Reynolds'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 of 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.**

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

### 11. 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.**

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

**12. GEOLOGY**

**1S – Geology**

- UNIT-I :** General Geology ó Geology, Branches and scope. Origin of Earth ó Nebular, Planetesimal and Tidal Hypothesis. Age of Earth ó Radioactive Methods ó K/Ar, Rb/Sr., U/Pb and Carbon 14 Method. Constitution of Earth ó Crust, Mantle and Core.
- UNIT-II :** Mineralogy and Crystallography :- Definition of Mineral, Rock Forming & Ore Mineral, Physical Properties of Minerals ó Colour, Streak, Lustre Habit, Cleavage, Fracture, Hardness, Specific gravity and its determination by Spring balance, Walker's balance & Jolly's balance.  
Crystallography ó Definition crystal, Faces, edges & Solid angle. Crystallography axes, Parameters- Weiss and Millers. Symmetry elements in seven system.
- UNIT-III :** **Petrology** ó 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 ó Formation of Sedimentary- Weathering, Transportation and deposition, Diagenesis and Lithification. Metamorphic Rocks ó Agents and kinds of Metamorphism.
- UNIT-IV :** **Physical Geology – I :** Weathering ó 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 ó Elastic rebound Theory ó 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 ó 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 ó 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 Practical 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 ó Modes of Preservation	04 Marks
B)	Record	05 Marks
C)	Viva-Voce	05 Marks
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**Total**                      **50 Marks.**

**13. BOTANY**

There shall be following paper and practical for B. Sc. Part ó I Semester one examination. The syllabus is based on six theory periods and six practical periods per week (Total 75 ó 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 ó 1		Marks
	a. Theory	-	80
	b. Internal Assessment	-	20
2.	Practical	-	50

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**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 ó
  - 2.3.1. Chlorophyta - Oedogonium
  - 2.3.2. Charophyta ó Chara (Thallus structure and reproduction)
  - 2.3.3. Phaeophyta ó Sargassum (Thallus structure and reproduction)
  - 2.3.4. Rhodophyta ó 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 ó
  - 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 ofó
  - 1.2.1. Hepaticopsida ó Marchantia
  - 1.2.2. Bryopsida ó 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 ó
  - 5.3.1. Sphenopsida ó Equisetum
  - 5.3.2. Filicopsida ó 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 ó Types and Application
- 6.3. Role of Fungi in Industries, Medicine, Food & Agriculture
- 6.4. Plant Diseases ó
  - 6.4.1. Viral ó TMV
  - 6.4.2. Bacteria ó Black arm of cotton (Xanthomonos malvacearum)
  - 6.4.3. Fungal ó 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-  
edogonium, 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 Mycoplasma 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 ó Marchantia, Anthoceros, Funaria, Polytrichum and Sphagnum

**IV. PTERIDOPHYTES**

Study of Pteridophyte external and anatomy features of vegetative and reproductive parts of following genera ó 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. Affili-

- ated East-West Pres Ltd. New Delhi.
5. Mehrotra, R. S. and Aneja, C.R. (1990). An Introduction To Mycology, Wiley Eastern Ltd. New Delhi.
  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 Algae, 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.
29. A Text Book of Botany ó Diversity of Microbes and Cryptogams (2013), Dr.N.H.Shahare, Dr.A.U.Pachkhede, Dr.D.V.Hande, Dr.S.H.Kanherkar, Sh.R.S.Dhande, Dr.D.S.Talwankar, Published by Nabh Prakashan, Amravati.

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

<b>Time : 4 hours</b>	<b>Marks : 50</b>
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 ó Definition, scope, principles and environmental ethics.  
Components of Environment: Atmosphere - Definition, structure and composition.  
Hydrosphere ó 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 ó types, availability, distribution, utilization and conservation.

- B. Soil** - Definition, composition, formation, soil profile.  
Humus ó significance and role.

(Lectures-14)

**UNIT – III. Environmental meteorology-I.**

- Solar radiation - concept of insolation and heat budget.  
Temperature ó 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, Volcanoes, Cyclones (causes, distribution types and effects).

(Lectures-14)

**UNIT – VI Marine Environment**

- a. Introduction to Marine Environment- zonation in the sea, physico-chemical properties, (viscosity, temperature, light penetration, salinity, CO<sub>2</sub>, O<sub>2</sub> ).
- b. Oceanic movements- waves, tides, oceanic currents (origin and types). Tsunami- origin and effects.
- c. Marine Resources ó 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 CO<sub>2</sub>.
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

Polyembryony .

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 sterility,

Types of sterility cytoplasmic , genetic, cytoplasmic genetic .

Utility of male sterility in hybrid seed production .

Definition of incompatibility ,Morphological, enetic and bio-chemical 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 .

#### PRACTICAL EXAMINATION

##### 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
<b>Total Marks</b>	<b>50</b>

#### 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.

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

**1S-ZOOLOGY****LIFE AND DIVERSITY OF NON-CHORDATA**

- UNIT-I :**
1. Classification of Non-Chordata.
  2. Phylum Protozoa: General characters.
  3. Type study: *Plasmodium vivax*: Structure, Life-cycle.
  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,

**LIFE AND DIVERSITY OF NON-CHORDATA**

**Practical :** Two practical per week each of 3 periodø 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: *Taenia*, *Ascaris* (male & female).
  - Phylum Annelida: Nereis, Earthworm, Leech,
  - Phylum Arthropoda: Prawn, *Limulus*, *Aranea*, *Scolopendra*, *Julus*, Moth, Mosquito.
  - Phylum Mollusca: Chiton, Pila, Dentalium, Unio, Octopus.
  - Phylum Echinodermata: *Antedon*, *Holothuria*, *Echinus*, Sea star, Brittle star
  - Phylum Hemichordata: *Balanoglossus*
2. Study of Permanent slides:
 

L.S.Sycon, nematocyst, *Ascaris* egg, T.S. *Ascaris* through gonads, T.S.Leech through crop, Compound eye of insect, Radula, Gill lamella and Osphradium of *Pila*, Scolex and Gravid Proglottid of *Taenia*.
3. Anatomical Study through Computer Aided Techniques, Video Clipping Models, Photographs and other available resources :
  - a) Leech/Earthworm: Alimentary canal, Reproductive system, Nervous system,
  - b) Grasshopper/Cockroach: digestive system, Nervous system, Reproductive system
  - c) Culture of *Paramoecium* and *Volvox* (To be given to all students)
4. Mountings :
  - a) Mosquito (*Aedes*, *Culex* and *Anopheles*) : wings, legs, mouth parts
  - b) Housefly: Mouth parts, legs, wings
  - c) *Paramoecium* and *Volvox*

**Distribution of Marks during Practical Examination:** Time : 4 hrs.

i) Identification and comments on spots (1-8) - 4 specimens, 4 slides	12 Marks
ii) Labelling of Anatomical diagrams provided (Two)	10 Marks
iii) Permanent stained micro preparation	08 Marks
iv) Study tour diary - í í í í í	04 Marks
v) Permanent stained micro preparation Submitted by examinee í í í .	04 Marks
vi) Certified class record - í í í í	05 Marks
vii) Check list of 20 locally available invertebrate fauna í í í	02 Marks
viii) Viva- voce í í í í í ..	05 Marks
ô ô ô ô ô ô ô ô ô ô ô	
Total: - í í í 50 Marks	

**Note:**

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

**Reference Books Recommended (All latest editions):**

- 1) Hickman, C.P. Jr.F.M. Hickman and L.S.Roberts, Integrated principles of Zoology Mosby College publication St.Louis.
- 2) Ayyar, E.K. and T.N.Ananthakrishnan, Manual of Zoology Vol.I (Invertebrata), Part-I & II S. Viswanathan (Printers and Publishes) Pvt. Ltd. Madras.
- 3) Jordan, E.L. and P.S.Verma Invertebrate Zoology, S.Chand and Co., Ltd. Ram Nagar, New Delhi.
- 4) Parker and Haswell, Text book of Zoology, Vol. I (Invertebrata), A.Z.T.B.S. Publishers and Distributors, New Delhi ó 110051.
- 5) Waterman, Allyn J. etal., Chordate structure and Function, Mac Millan and Co Newyork.
- 6) S.N.Prasad : Text Book of Invertebrate Zoology.
- 7) Vishwanathan : Invertebrate Zoology.

- 8) Majpuria : Invertebrate Zoology.
- 9) Dhami and Dhami : Non-chordate Zoology.
- 10) Bains Prasad: Indian Zoological memoir. Pila.
- 11) R.L.Kotpal : Modern Text Book of Invertebrate Zoology.
- 12) Malviya M.K. Invertebrate Zoology, by Rajdhool publications.
- 13) S.S.Lal, Practical Zoology, Invertebrate.
- 14) Bhamrah H.S.and Kavita Juneja A text book of Invertebrate Zool-ogy, Anmol Publication Pvt. Ltd., New Delhi.
- 15) Verma and Agarwal Practical Zoology, Invertebrate
- 16) - Barnes R.D. Invertebrate Zoology -(W.B. Saunders Co.)
- 17) 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.

	<b>Marks</b>
1) Paper-I: FISH BIOLOGY	
Theory (Written)                    í í .	80
Internal assessments            ..í ...	20
2) Practical:                            í í ..	50
<hr/>	
<b>Total:</b>	<b>150 Marks</b>

**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**

1. External morphology and morphometrical study of a fish, prawn, crab, Lobster, bivalve and Cephalopod.
2. Methods of collections, handling, identification and preservation of above animals for taxonomic purposes.
3. Identification of commercially important F.W. and Marine fishes, prawns, crabs, bivalves and cephalopods of India.
4. Preparations of wet and dry mounts, wax and plaster castings of fish. Aizarine Preparations and study of skeleton of Teleosts.
5. \* Dissections of
  - \* Digestive, Nervous, Circulatory, Reproductive systems in type specimens of fish,
  - \* Accessory Respiratory organs and gas bladder of fish.
  - \* Dissections of prawn: - Digestive, Nervous system.
  - \* Dissections of Crab: - Digestive, Nervous.

6. Permanent stained mounting of statocysts in prawn, scales, and intestinal parasite of fishes.
7. 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 diary 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            | ô | 10 Marks |
| 2. Identification of a given species of fish by morphometric study. | ô | 10 Marks |
| 3. Dissection   | ô | 10 Marks |
| 4. Permanent stained micro-preparation                              | ô | 5 Marks  |
| 5. (a) Viva voce  | ô | 5 Marks  |
| (b) Record book and Permanent slide submitted                       | ô | 5 Marks  |
| (c) Field diary   | ô | 3 Marks  |
| (d) Collection  | ô | 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.

	<b>Marks</b>
1) Paper-I: CAPTURE FISHERIES	
Theory (Written)	1 .. 80
Internal assessments	1 .. 20
2) Practical:	1 .. 50

**Total: 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 eye piece, 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.

**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. Micortomy: 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
<b>Total :</b>		<b>50 Marks</b>

### 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 begineers 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 |

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**Total 50 marks**

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**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 ( ), putchar ( ), gets ( ), Puts ( ), Control 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 alaurusamy, 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

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<b>Total</b>	<b>50 Marks</b>
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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.

**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() Unformatted I/O : getch(), getche(), getchar(), putchar(), 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) 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

### General Provisions/Instructions

**Part A**

- (i) The Examination in Electronics of each semester shall comprise of one theory paper of 80 marks of three hours duration and internal assessment of 20 marks.
- (ii) Theory paper of each semester shall comprise of six units. Each unit shall be completed in maximum 15 teaching periods of 48 minutes duration.
- (iii) There shall six questions of twelve marks on each unit with alternate choice and One compulsory question (08 subquestions of 01 mark each) of 08 marks covering syllabi of all units (short answer type).

**Part B**

- (i) The Practical examination of each semester of the B. Sc. (Electronics subject) shall be of 50 marks of 4 hours duration and shall be held at the end of each semester at the places as decided by the university.
- (ii) Distribution of 50 marks assigned to practical for (Semester I to V) is as under-
- |  |            |
|--|------------|
| 1. Experiment<br>(Construction, testing and performance) | : 30 Marks |
| 2. Practical record                                      | : 10 Marks |
| 3. Viva-voce   | : 10 Marks |
- ô ô ô ô ô ô ô ô ô ô
- Total : 50 Marks**
- (iii) Project will be given to a group of not more than four students.
- (iv) Teacher may adopt any innovative practice for demonstration of practicals on the aspects given.
- (v) College/ Department may prepare laboratory manuals of experiments

**Semester I**  
**1S-Electronics**  
**Basics of Electronics**

**Unit I : Passive Components and Network theorems**

Introduction to Resistors, Capacitors, Inductors and Transformers, Concept of ideal dc voltage and current source, KVL, KCL, Thevenin $\phi$ , Norton $\phi$ , maximum power transfer, Millman $\phi$  theorem (statement, proof, simple numerical application 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, CRT construction & working, uses of CRO (measurement of frequency, amplitude & phase.)

**Unit III : Semiconductor Diode and Regulated power supply:**

Operation and characteristics of PN junction diode, Avalanche and Zener breakdown mechanism, Half wave and full wave rectifiers (ripple factor, efficiency, PIV ratings), C, L and  $\pi$  filters, Concept of unregulated and regulated power supply, Zener diode voltage regulator, Three terminal IC regulator.

**Unit IV : Bipolar Transistors:**

NPN and PNP transistor (construction and working) CB, CE & CC configuration, leakage currents, Input and output

characteristics of CE mode, relation between  $\alpha$  and  $\beta$  Load line and operating point, Amplification action of CE amplifier, biasing and stability, Self and fixed bias circuit.

**Unit V : Switching and Optoelectronic devices :**

Construction, working and characteristics of FET, MOSFET, UJT, SCR, relation of FET parameters, Construction, working & characteristics of LDR, LED, photodiode, photovoltaic cell (Solar cell).

**Unit VI : Integrated Circuits:**

Introduction to IC technology, advantages and disadvantages, Classification of ICs, Basic steps in fabrication of monolithic ICs, Fabrication of diode, resistor & transistor. Scale of integration upto V<sup>2</sup>LSI. Basic concept of Embedded systems.

**Books Recommended:**

- 1) Basic electronics by B.L. Thereja (S.Chand and Company)
- 2) Digital and Analog technique by Navneet, Kale and Gokhale
- 3) Element of electronics by Bagde and Singh (S.Chand and Company)
- 4) Principles of electronics by V.K.Mehta
- 5) Introduction to digital electronics by Mohinder Singh
- 6) Electrical and electronics measurement and Instrumentation by A.K. Sawhney
- 7) Text book of Electrical Technology by B.L. Thereja

**Practicals:** Minimum Ten experiments at least one on each of the following aspects.

1. Active and Passive components.
2. Network theorems, voltmeter, Ammeter, ohmmeter multimeter and CRO.
3. Regulated power supply, rectifiers, filters, IC regulators.
4. Bi-polar devices and its applications.
5. Uni-polar and optoelectronic devices and its applications.
6. IC testing, IC know how, IC connection, simple IC circuits, mounting of IC on PCB and checking of voltage at each pin.

**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 6I	-	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

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	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,  $\alpha$  &  $\beta$  anomers, mutarotation

Reactions of aldehyde, ketone groups & hydroxyl groups, amino sugars, deoxy sugars, types of glycosidic bonds, structure, occurrence & 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 &  $\beta$  alanine) Peptides: structure of 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:

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

##### UNIT- V : Nucleic Acids & Porphyrins:

- 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.
- Chemistry of porphyrins nucleus: Classification, important, metalloporphyrins (hemoglobin, cytochromes, chlorophyll) Bile pigments: chemistry & physiological role.

##### UNIT-VI : Vitamins & Hormones:

- Vitamins: Chemistry, sources, daily allowances function & deficiency of water soluble & fat soluble vitamins.
- Hormones: Defination, 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.

- Qualitative tests for carbohydrates.
- Qualitative tests for proteins, lipids and amino acids.
- Preparation of buffer of different pH.
- Measurement of pH of given sample by Universal indicator solution, pH strip and pH meter.

##### Section II: Titrometry

- Determination of acid value of fat.
- Determination of Saponification number of oil.

- c) Estimation of Glycin 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 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-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 & Vandyke, 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) Condenser- 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. Bergey'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- Procaryotic and Eucaryotic
- vii. Plasmid- Definition, General characters, classes
- viii. Bacterial chromosome
- ix. Endospors- 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, Semi-solid, 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 $\phi$  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 ó 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 ó Voce	-	10 Marks
4.	Spotting	-	10 Marks
5.	Laboratory Journal	-	05 Marks

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**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 (Introduction to Health of Professional) : Paul A. Ketchum.

- 16) Molecular Biology of the gene : J.D. Watson.
- 17) Molecular Genetics : Taylor J.H.
- 18) Gene Expression Vol. I, II III, IV : Lewin
- 19) Elementary Microbiology Vol. I & II : Modi (Akta Prakashan)
- 20) Basic experimental Microbiology : Ronald M., Atlas, & Alfred Miller E.Brown, Kenneth W. Dobra, Lionas (1986) (Prentice Hall - 316 PP)
- 21) General Microbiology : Robert F.Boyd (1984) times mirror / mosby college, Pub. 22 PP.
- 22) Fundamentals of Biostatistics (Biometry) : Satguru Prasad, Emkay Publications, Delhi.
- 23) Text Book of Microbiology : Dubey & Maheshwari (S.Chand, Publication)
- 24) Introduction to Computer by : Shrivastav (Macmillan)
- 25) Fundamentals of Computer : Rajaraman (PHL)
- 26) Office automotion : Bajaj (Macmillan)
- 27) Computer made simple : Taxilli.

#### List of Books For PRACTICALS

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

## 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

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**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
E) Practical Record	-02 marks

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**Total - 50 marks**  
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## 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) Contemporar y fermentations ó organic acids-vin-egar and citric acid, antibiotics, enzymes, vitamins.
- c) Study of Industrially Important Microorganisms  
 General characteristics, Structures, Modes of reproduction and industrial importance of : Yeast, Bacteria, Actinomyces, 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 ó 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 ó water, sources of energy, carbon, nitrogen, minerals
- b) Special ingredients ó growth factors, buffers, precursors, inhibitors, inducers, antifoam agents, oxygen requirements, redox potential
- c) Types of media used- synthetic, natural ó industrial and agricultural wastes
- d) Raw materials ó 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 ó Nutrient agar/soil extract agar/soybean casein digest agar
  - b) Fungi ó Potato dextrose agar/Czapek Dox agar
  - c) Yeasts ó Glucose yeast extract agar/ Sabouraudø agar
  - d) Actinomycetes ó Glycerol Asparagine agar/coconut water agar
  - e) Lactic acid bacteria ó Neutral red chalk lactose (NRCL) agar atypical peptone tryptone (APT) agar
  - f) Algae ó Geitlerø medium
3. Isolation and cultivation of microorganisms from appropriate sources on the media described above and their microscopic examination.
  - a) Bacteria ó From soil, monochrome and Gram staining
  - b) Fungi ó Aspergillus and Penicillium from soil, lactophenol mounting
  - c) Yeasts ó Saccharomyces cerevisiae, monochrome staining
  - d) Actinomycetes ó from soil and cultivation using coverslip/slide/agar cylinder methods and direct microscopic observation
  - e) Lactic acid bacteria ó from curd or buttermilk, gram staining
  - f) Algae ó 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 ó H<sub>2</sub>SO<sub>4</sub> 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

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**Total            50 Marks**

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#### Reference Books :- (Fir Sem-I)

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

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**Total** **50 Marks**  
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**Books Recommended :**

- 1) Binmore : "Mathematical Analysis", Cambridge University Press.
- 2) Edward Batschelet : óIntroduction to Mathematics for Life Sciencesö 3rd Edition(1992).
- 3) Edwards , J:öDifferential Calculas for Beginnersö, MacMilan and Co.ltd (1963).
- 4) Edwards , J:öIntegral Calculas for Beginners ö, AITBS Publishers & Distributors(1994).
- 5) GorakhPrasad :ö Differential Calculas ö, Pothishala Pvt Ltd, Allahabad
- 6) GorakhPrasad :ö Integral Calculas ö, 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) öCalculus, Vol. I and IIö; Vishwanathan Printers and Publishers.
- 9) Veerarajan, T. (2003) öEngineering mathematicsö; Third Edition, Tata McGraw Hill Publishing Co. Ltd, New Delhi.
- 10) Veerarajan, T. (2003) öTrigonometry, Algebra and Calculusö; Third Edition, Tata McGraw Hill Publishing Co. Ltd, New Delhi.
- 11) Sharma, A.K. (2005) öText Book of Integral Calculusö, Discovery Publishing House.
- 12) Grewal, B.S. (2000) öHigher Engineering Mathematicsö; Thirty seventh edition, Khanna Publishers, New Delhi.
- 13) E. Horowitz and S. Sahani, öFundamentals of Data structuresö, Galgotia Booksource Pvt. Ltd., (1999)
- 14) Ellis Horwitz, Sartaz Sahani and Sanguthevar Rajasekaran, (1999), öComputer Algorithmsö, Galgotia Publications
- 15) T.H. Cormen, C. E. Leiserson, R.L. Rivest (2001) öIntroduction to Algorithmsö, 3rd Ed PHI.

## 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 ó 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 ó 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 in relation to available of flora within foraging range over stocking.

**UNIT-VI:** Individual Colony Records :- Colony number, strength, food storage, honey yield. Pollen income.

### Semester-I Practical-I

#### Practicals :-

- (1) Study of Identification features of honey bees :-  
A. mellifera, 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<br>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 |

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Total 50

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**(Note :** List of Reference Books and Required equipments is given at the end of syllabi of Semester-II, Apiculture.)

### 30. Forensic Science (Effective from session 2015-16)

The examination in Forensic 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 4 to 6 hours duration and carry 50 marks.

The following syllabus 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 Forensic Science (Basics of Forensic Science)

**Total Lectures: 84**

**Marks: 80**

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

**Unit I : Developmental Growth of Forensic Science 14L**

Introduction to Forensic science ó nature, need and function.  
Laws and Principles, basics of Forensic Science. Historical



development and scope of Forensic Science in India. Investigating officers and their assigned role and duties. Global perspective in the field of forensic science: history, development, education and training. Organizational setup of forensic science lab and other national & international agencies. Ethical issues in Forensic Science.

**Unit II :** **14L**

**A) Forensic Science Laboratories and Facilities [5L]**

Growth of Forensic Science Laboratories in India ó Central and State level Laboratories. Services and functionalities provided by various FSLs. Various divisions in the FSL.

**B) Recognition of Bloodstain Patterns [9L]**

History of Bloodstain Pattern interpretation, properties of human blood, target surface considerations, Size, Shape and Directionality of bloodstains, Spattered blood, other Bloodstain Patterns, interpretation of Bloodstain on clothing and footwear, Documentation and Photography for Bloodstain Pattern Analysis.

**Unit III: Crime and Crime Scene management 14L**

Criminals, criminal behavior, Crime Scene survey, physical evidence, collection preservation types and importance of criminal investigations. Components of Crime Scene Management ó Information management, manpower, technology & logistics management, role of crime scene managers and first responding officers. Crime Scene Reconstruction: defining crime scene reconstruction, nature & stages of crime scene reconstruction.

**Unit IV : Impressions and Prints 14L**

**Finger prints:** Nature, Location, collection and evaluation, taking control samples, Forensic Significance.

**Footprints:** Importance, Gait Pattern, Casting of footprints in Different medium, Taking Control samples.

**Tire Marks/prints and Skid marks,** taking control samples, Forensic Significance.

**Lip Prints:** Nature, Location, collection and evaluation, taking control samples, Forensic Significance.

**Bite Marks:** Nature, Location, collection and evaluation, taking control samples, Forensic Significance.

**Ear Prints:** Nature, Location, collection and evaluation, taking control samples, Forensic Significance.

**UNIT V : Forensic Documents 14L**

Various types of forensic documents: genuine and forged

documents, classification of forensic documents: Specimen writings, admitted writings, Handling, preservation and marking of documents, natural variation and disguise in writing, Principle of Handwriting Identification, general and individual characteristics, Basic Tools needed for forensic documents examination and their use. Functions of a Forensic Document Examiner.

**Unit VI: Forensic Medicine 14L**

Global Medical Jurisprudence, Legal Procedure in India, Documentary evidence: Medical certificates, medical reports, dying declaration. Determination of time since death, including by histopathological methods. Medico legal investigation of sexual offences, including examination of victims and suspects. Medico legal aspects of death: causes of death such as asphyxia, electrocution, thermal trauma, heat burns, starvation, natural death, sudden death, death by accident. Medico legal aspects of wounds: medical and legal definition of wounds, types of mechanical and regional injuries, aging of wounds.

**Semester- I**

**1S Forensic Science (Basics of Forensic Science)**

**Total Laboratory sessions: 21**

**Marks: 50**

**List of Practicals**

1. Collection and Handling of Petroleum samples.
2. Collection and Handling of murder case samples.
3. Collection and Handling of fire crime scene samples.
4. Sketching and Photography of various type of crime scene.
5. Document and Fingerprint Photography.
6. To take Plain and Rolled inked fingerprints and to identify the patterns.
7. To develop Latent fingerprints with Powder method.
8. Lifting of Fingerprints.
9. Detection of forgeries including traced and stimulated forgery and built up documents.
10. Examination of security features of Currency Notes and Indian Passports.
11. Report writing and interpretation.
12. Scientific Report Writing.
13. Blood Spatter Analysis.
14. Identification of Handwriting General and individual characteristics.
15. Detection of various type of forgery.

16. Identification of Indented and Invisible writing.
17. Identification of typescripts and printing matter.

**Distribution of Marks for Practical Examination.**

**Time: 4 – 6 hours**

**Marks: 50**

Exercise- I	í í í ..	12
Exercise- II	í í í ..	12
Exercise- III	í í í ..	12
Viva-Voce	.í í í .	07
Record	.í í í .	07
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	Total:	50

**Books Recommended:**

1. Introduction to Forensic Science in Crime Investigation By Dr.(Mrs.) Rukmani Krishnamurthy.
2. Forensic Biology by Shrikant H. Lade.
3. Crime Scene Processing and Laboratory Work Book by Patric Jones.
4. Forensic Science: An Introduction to Scientific and Investigative Techniques 3rd ed. by Stuart H. James.
5. Crime Scene Management with Special Emphasis on National level Crime Cases by Dr. Rukmani Krishnamurthy under publishing.
6. Forensic Science: An Introduction to Scientific and Investigative Techniques By S.H James, J J Nordby.
7. Advanced Crime Scene Photography by C.D. Duncan.
8. Scientific Examination of Questioned Documents by Ordway Hilton.
9. Questioned Documents by Albert S. Osborn.
10. Suspect Documents their scientific examination By Wilson R. Harrison.
11. Speculation in Fingerprint Identification By Chatterjee S. K.
12. Criminal Investigation, Practical Fingerprinting by Briges B. C.
13. Forensic Science in India: A vision for the twenty first century Nanda, B.B. & Tewari,R.K.(2001)New Delhi.
14. Forensic Science: An introduction to scientific and investigative techniques, James, S. H. and Nordby, J. J. (2003) CRC Press, USA.

**31. Renewable Energy  
(Implemented from the Academic Session 2015-16)**

**Semester-I**

**1S : Renewable Energy**

**Fundamentals of Energy Systems**

- Unit-I :** Work and Heat: Definition of work, thermodynamic work, displacement work and other forms of work, Definition of Heat, Work and heat transfer as path function, comparison of work and heat, work done during various processes, P-V diagrams. First law of thermodynamics: Energy of a system, classification of energy, law of conservation of energy law applied to closed system under going a cycle, Joules experiment
- Unit-II:** First Law applied to flow processes: Steady state, steady flow process, mass balance and energy balance in steady flow process, steady flow energy equation and its application to nozzles and diffusers, turbine and compressor pumps, heat exchangers, Throttle valve etc. work done and Heat transfer during steady flow processes.  
Second Law of thermodynamics , Kelvin-Plank and Clausius statements, reversible and irreversible processes, Carnot cycle, two propositions regarding the efficiency of Carnot cycles. The thermodynamic temperature scale. Reverse carnot cycle. COP of heat pump and refrigeration. Inequality of Clausius.
- Unit III : Fluid Properties and Classification of Fluid:** Viscosity, Newton's law of viscosity, Newtonian and Non- Newtonian Fluids, Ideal and real fluids, Steady & Unsteady Flow, Uniform & Non-Uniform Flow, Laminar & Turbulent Flow, Compressible & Incompressible Flow, Surface tension, Definitions, units and Dimensions
- Unit IV : Fluid Pressure & Its Measurement:** Definition of pressure, units and dimensions, Pressure at a point, Pascal's law, Hydrostatic pressure law, Absolute and Gauge pressure Measurement of pressure, Simple Manometer & Differential Manometer theory and problems, Mechanical Pressure Gauges.
- Unit V : Dynamics of Fluid Flow** Concept of Inertia force and other forces causing motion, Derivation of Euler's equation and, Modification of Bernoulli's equation, problem on Bernoulli's equation without and with losses, Flow through Orifices; classification, Hydraulic Co-efficient of an Orifice and relation between them,
- Unit VI : Energy Sources & World Energy Status :** Energy Sectors: Domestic, Transportation, Agriculture, Industry Sector, Energy Scenario, World Energy Present Situation, Availability of

Conventional & Non Conventional Energy Resources.

**Conventional Energy Sources :** Fossil Fuel, Hydro Resources, Nuclear Resources, Coal, Oil, Gas, Thermal Power Stations, Comparison of various conventional energy systems, their prospects and Limitations, Advantages and Disadvantages of Conventional Energy Sources.

**Non-Conventional Energy Sources :** Solar Energy, Wind Energy, Energy from Biomass & Biogas, Ocean Thermal Energy Conversion, Tidal Energy, Geothermal Energy, Hydrogen Energy, Fuel Cell, Magneto Hydro-Dynamics Generator, Advantages & Limitations of Non-Conventional Energy Sources.

**Books Recommended Text Books :**

- 1) Engineering Thermodynamic - by P.K.Nag.
- 2) Thermodynamics Volume: I & II; R. Yadav;
- 3 Basic Engineering Thermodynamics - by Reyner Joel
- 4) Thermodynamics - by C.P. Arora.
- 5) Fundamentals of Classical Thermodynamics - by G.J. Vanwylen.
- 6 Engineering Thermodynamics; P. Chattopadhyay; Oxford
- 7) Engineering Thermodynamics; Gordon Rogers, Yon Mayhew; Pearson
- 8) Energy for a sustainable world: Jose Goldenberg, Thomas Johansson, A.K.N.Reddy, Robert Williams (Wiley Eastern).
- 9) Energy policy for : B. V.Desai (Weiley Eastern),
- 10) Modeling approach to long term demand and energy implication : J.K.Parikh.
- 11) Energy Policy and Planning : B.Bukhootsow.
- 12) TEDDY Year Book Published by Tata Energy Research Institute (TERI),
- 13) World Energy Resources : Charles E. Brown, Springer2002.
- 14) -International Energy Outlookø-EIA annual Publication
- 15) Heat and Thermodynamics ó M.W. Zemansky (McGraw Hill Publication)
- 16) Heat and thermodynamics ó D.S.Mathur
- 17) Text book of Heat ó J.B.Rajam
- 18) Heat and thermodynamics ó Rajam & Arora
- 19) Heat ó Rajkumar & Sharma
- 20) Non-Conventional Energy Sources, G D. Rai, Khanna Publication.
- 21) Non-Conventional Energy Resources, B. H. Khan, The McGraw Hill
- 22) Fluid Mechanics and Fluid Power Engineering by D.S. Kumar, S. K. Kataria & Sons
- 23) Fluid Mechanics and Hydraulic Machines by R.K. Bansal, Laxmi Prakashan

- 24) Theory and Applications of Fluid Mechanics by K. Subramanya, TMH outline series, Tata McGraw Hill Publishing Company Lt

**List of Experiments**

- 1) Study of the processes of Heat Engine
- 2) Study Layout of Thermodynamics laboratory
- 3) To investigate the first law of thermodynamic using heat Engine
- 4) To investigate the Second law of thermodynamic using heat Engine
- 5) To investigate the relation between pressure and temperature of Saturated Steam
- 6) To determine the flow rate using convergent nozzle.
- 7) To determine the nozzle thrust.
- 8) To determine the efficiency of nozzle
- 9) Study of heat exchangers
- 10) Determination of efficiency of pumping system
- 11) Determination of viscosity of liquid by Poiseuille's method.
- 12) Determination of viscosity of liquid by Stoke's method.
- 13) To determine surface tension of liquid by Jaeger's method.

**32. Animation**

**(Implemented from the Academic Session 2015-16)  
Semester I**

**1S : Animation**

**Computer Fundamentals and Animation**

- Unit-I :** Introduction to computer, relevant hardware and software, their list and general-purpose utility in actual practical application, connection diagrams with each other (simple block diagrams expected).
- Unit-II :** Introduction to different operating systems (OS) like **Windows, Linux**, etc. (their names and general idea should be given), requirements, etc. (brief idea and simple explanation only).
- Unit-III :** Basic idea of networks with block diagrams and definitions only (general-purpose networks like WAN, MAN and the LAN topologies and sub-topologies of LAN), their applications (brief idea and simple explanation only).
- Unit-IV :** Basic idea of memory, RAM, ROM, PROM, EPROM, etc. their definitions with description (brief idea and simple explanation only)
- Unit-V :** Using internet explorer, different browsers, email, attachment techniques, using compression utilities, search engine techniques (brief introduction), downloading, etc. introduction to POP and SMTP mail server configurations techniques.

**Unit-VI:** History of animation. Different types of animations and its applications.

(Types : 2D animation , 3D animation , Stop motion animation, etc. & Applications : Entertainment, Education, Computer/ Mobile Gaming, Special Effects, etc.)

**Practicals :** Minimum eight experiments based on above contents are to be performed.

**Recommended Books :**

1. Recommended Text Books: Computers & Common Sense by Roger Hunt, John Shelley, Published by Prentice-Hall of India, Edi.2004.
2. Reference books: Fundamentals of Computers by Rajaraman, Published by Prentice-Hall of India, Edi.2004.
3. Digital Computer Fundamentals by Bartee, Edi.2001.
4. Computer Fundamentals and Information Technology by Ramesh Bangia, Edi.2008.

The Concerning teachers are also suggested to use other relevant material available on the net, to update the knowledge of the students

Following are the recommended links, for further search-

- 1) [www.tatamcgrawhill.com](http://www.tatamcgrawhill.com)
- 2) [www.books.google.co.in](http://www.books.google.co.in)
- 3) [www.penguinbooksindia.com](http://www.penguinbooksindia.com)
- 4) [www.bookcafe.in](http://www.bookcafe.in)
- 5) [www.newindianbooks.com](http://www.newindianbooks.com)
- 6) [www.newasiabooks.org](http://www.newasiabooks.org)

**Syllabus Prescribed for B.Sc. Part-I Semester-II  
(Implemented from the A.S.2015-2016)**

**7. MATHEMATICS**

**2S Mathematics Paper-III**

**(Differential Equations: Ordinary and Partial)**

**Unit-I :** Degree and order of an ordinary differential equation, linear differential equations and differential equations reducible to the linear form. Exact differential equations. Differential equations of first order and higher degree, differential equations solvable for  $p$  and  $y$ , differential equations in Clairaut's form. Orthogonal trajectories.

**Unit-II:** Second order linear differential equations with constant coefficients, homogeneous linear ordinary differential equations, equations reducible to homogeneous differential equations.

**Unit-III:** Reduction of order, transformation of the equation by changing the dependent variable and independent variable, normal form, method of variation of parameters. Ordinary simultaneous differential equations.

**Unit-IV:** Formation of partial differential equations, partial differential equations of the first order, total differential equation ( Pfaffian). Lagrange's method, some special types of equations which can be solved easily by methods other than the general method.

**Unit-V :** Compatible differential equations. Charpit's general method of solution, partial differential equations of second and higher orders. Homogeneous and non-homogeneous equations with constant coefficients.

**References :**

- 1) Ayres F Jr. : Differential equations, Schaum's outline series, McGraw Hill, 1981.
- 2) Ayres F.Jr. : Calculus, Schaum's Outline series, McGraw Hill, 1981.
- 3) Birkhoff G : Ordinary Differential equations, John Wiley and Sons, and Rota G.C.1978.
- 4) Coddington : An Introduction to Ordinary Differential Equations, E.A.Prentice Hall of India, 1998.
- 5) Karade T.M., Bendre M.S.: Lectures on Calculus and Differential and Equations, Sonu-Nilu, 5, Bandu Soni layout, Gayatri Road Parsodi, Nagpur.
- 6) Murray D.A.: Introductory course in Differential Equations, Orient Longman(India), 1967.

- 7) Erwin, Kreyszig: Advanced Engineering Mathematics, John Wiley & Sons, 1999.
- 8) Piaggio HTS: Differential Equations, CBS Publishers & Distributors, Delhi, 1985.
- 9) Siminons G.F. : Differential Equations, Tata McGraw Hill, 1972.
- 10) Karade T.M., Maya S. Bendre : Integration and Differential equations, Sonu- Nilu, 5, Bandu Soni layout, Gayatri Road Parsodi, Nagpur.
- 11) T.M.Karade, Lectures on Differential Equations, Sonu Nilu Publication, Nagpur.
- 12) A.R.Forsyth. A Treatise on Differential Equations. Macmillan and Co.Ltd.London.
- 13) Ian N., Sneddon, Elements of Partial Differential Equations. McGraw-Hill Book Company, 1988.
- 14) Jane Cronin. Differential equations, Marcel Dekkar, 1994.
- 15) Frnak Ayres. Theory and Problems of Differential Equations. McGraw Hill Book Company, 1972.
- 16) Richard Bronson, Theory and Problems of Differential Equations. McGraw Hill Inc, 1973.

### Semester II

#### 2S Mathematics Paper-IV

##### (Vector Analysis and Solid Geometry)

- Unit-I** : Scalar and vector product of three vectors, product of four vectors, vector differentiation and vector integration.
- Unit-II** : Space curve t, n, b vectors, fundamental planes, curvature, torsion, Frenet-Serret formulae.
- Unit-III** : Gradient, divergence and Curl, directional derivative, line integral (existence and evaluation), work done, Greens theorem.
- Unit-IV** : Sphere: Different forms of sphere, section of a sphere by a plane, sphere through a given circle, intersection of sphere and a line, orthogonal sphere and condition of orthogonality.
- Unit-V** : Cone : The equation of a cone with a guiding curve, cone with vertex and origin, right circular cone. Cylinder: equation of right circular cylinder.

##### References :

- 1) Murray R. Spiegel, Theory and problems on Advanced Calculus, Schaum Publishing Company, New York.
- 2) Murray R. Spiegel, Vector Analysis, Schaum Publishing Company, New York.

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

### 8. 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 RMS 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  $\delta J_0$  by Callendar and Barne's method.
3.  $C_p/C_v$  by Clement and Desormes' 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.  $C_1 / C_2$  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:L : Semester 2S-PHY**

1. Heat and thermodynamics ó D.S.Mathur
2. Text book of Heat ó J.B.Rajam
3. Heat and thermodynamics ó Rajam & Arora
4. Heat ó Rajkumar & Sharma
5. Electricity & Magnetism ó Chakraborty P.
6. Foundations of Physics Vol. I & Vol. II ó Gambhir R.S.
7. Electromagnetics ó Laud B.B.
8. Electromagnetic field & waves ó Sarwate V.V.

9. Electricity and Magnetism Vol. II ó Berkley Physics Course
10. Electricity and Magnetism ó D.N. Vasudeva
11. Electricity and Magnetism ó Brijlal & Subramaniam
12. Electrodynamics ó S.L. Gupta & R. Singh
13. Electricity & Magnetism ó Reitz & Millford
14. Electricity & Magnetism ó A.S. Mahajan & A.A. Rangawala (TMH)
15. Principle of electricity & Magnetism ó Panofsky & Philips
16. Electricity & Magnetism ó S.S. Atwood
17. Electromagnetic waves & radiating systems ó 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

**14L**

- A] Polarisation-Definition, polarising power, polarizability, effect of polarization on nature of bond. Fajan's rules of polarisation and its applications. **[4]**
- B] Covalent bonding-Directional nature of covalent bond. Hybridisation, types of hybridisation to explain geometries of  $\text{NH}_4^+$  ion,  $\text{PCl}_5$ ,  $\text{SF}_6$  and  $\text{IF}_7$ . **[4]**
- C] **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. **[6]**

#### Unit II

**14L**

- A] **P-Block Elements**-Comparative study of 16<sup>th</sup> and 17<sup>th</sup> group elements with reference to electronic configuration, ionization energy and oxidation states. Oxidising properties of halogens with reference to oxidation potential. 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  $\text{XeF}_2$ ,  $\text{XeF}_4$ ,  $\text{XeF}_6$ ,  $\text{XeO}_3$  and  $\text{XeO}_4$  **[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. Acid base, precipitation, redox, solvolysis and complexation reactions in liquid ammonia. Merits and demerits of liquid ammonia as a solvent. **[6]**

**[6]**

#### Unit III

**14L**

- A] **Alkyl Halides:** Synthesis of vinyl chloride from acetylene and allyl chloride from propylene, Reactions of both with aqueous and alcoholic KOH, Comparison of reactivity of vinyl and allyl chloride. **[4]**
- B] **Aryl Halides:** Synthesis chlorobenzene from benzene, phenol and benzene diazonium chloride, Synthesis of benzyl chloride from toluene and benzyl alcohol, Reactions of both with aqueous KOH,  $\text{NH}_3$  and sodium ethoxide, Comparison of reactivity of chlorobenzene and benzyl chloride. Benzene intermediate mechanism. **[4]**
- C] **Alcohols:** Dihydric alcohols: Ethylene glycol- Preparation from ethylene, ethylene chloride and ethylene oxide, Reactions- with Na,  $\text{PCl}_5$ ,  $\text{CH}_3\text{COOH}$ ,  $\text{ZnCl}_2$ , conc.  $\text{H}_2\text{SO}_4$  and dehydration with heat. Trihydric alcohols: Glycerol- Preparation from propylene, Reactions- with Na, HCl,  $\text{PCl}_5$ ,  $\text{HNO}_3$  and  $\text{KHSO}_4$ . Pinacol- pinacolone rearrangement (mechanism). **[6]**

#### Unit IV

**14L**

- A] **Phenols:** Methods of formations a) from aniline b) from cumene. Acidic character, Reaction of Phenols- a) Carboxylation (Kolb's reaction), b) Fries Rearrangement, c) Claisen Rearrangement and d) Reimer ó Tiemann reaction. **[6]**
- B] **Ethers:** Diethyl ether- Preparation by Williamson's synthesis and continuous etherification process, Reactions- with cold and hot HI. **[4]**
- C] **Epoxides:** Synthesis of ethylene oxide from ethylene and styrene oxide from styrene. Ring opening reactions of both catalysed by acid and alkali. **[4]**

#### Unit V - Physical Properties and Molecular Structure

**14L**

##### A] Electrical Properties:

- (i) Polar and non-polar molecules. Dipole moment.
- (ii) Induced polarization and orientation polarization. Clausius-Mossotti equation (only qualitative treatment).
- (iii) Measurement of dipole moment by temperature and refractivity methods.
- (iv) Applications of dipole moment for the determination of molecular structure. i.e. percentage ionic character of covalent bonding, molecular geometry, cis-trans isomers, ortho, meta and para isomers of a disubstituted benzene. **[7]**

**B] Magnetic Properties:**

- (i) Paramagnetic and diamagnetic substances, origin of paramagnetism, diamagnetism, ferromagnetism and antiferromagnetism.
- (ii) Volume, specific, mass and molar susceptibility. Relationship between molar magnetic susceptibility and magnetic moment.
- (iii) Relationship between magnetic moment and number of unpaired electrons.
- (iv) Gouy's balance method for determination of magnetic susceptibility.
- (v) Application of magnetic moment in the determination of molecular structure.
- (vi) Numericals. [7]

**Unit VI - Chemical Kinetics**

[7]

14L

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

Derivation of rate equation for first and second order reaction with equal initial concentration and different initial concentration of a reactant. Characteristics of first and second order reaction. Examples of first and second order reaction and their kinetics study with modified rate equation viz. the reactions (i) decomposition of  $H_2O_2$ , (ii) reaction between  $K_2S_2O_8$  and KI, (iii) hydrolysis of methyl acetate catalyzed by acid, (iv) saponification of ethyl acetate by NaOH and (v) inversion of canesugar.

Determination of order of a reaction by integration, graphical, equifractional change, vant Hoff's differential method and Ostwald's isolation method. Effect of temperature on reaction rates. Arrhenius equation, activation energy and its determination using Arrhenius equation. Numericals. [14]

**Semester II****2S Chemistry Practicals****Total Laboratory Sessions: 26****Marks: 50****Exercise I: Organic Qualitative Analysis****16 Laboratory Sessions**

Complete analysis of simple organic compounds containing one or two functional groups and involving following steps:

- 1) Preliminary examinations
- 2) Detection of the elements

- 3) Detection of functional groups
- 4) Determination of m.p./ b.p.
- 5) Preparation of derivative and its m.p./ b.p.
- 6) Performance of spot test if any.
  - 1) Acids : Oxalic acid, Benzoic acid, Salicylic acid, Phthalic acid.
  - 2) Phenols : Resorcinol,  $\alpha$ -naphthol,  $\beta$ -naphthol.
  - 3) Aldehydes : Benzaldehyde, Glucose.
  - 4) Bases : Aniline, *p*-Toluidine
  - 5) Nitro compounds: *m*-Dinitrobenzene.
  - 6) Amides : Benzamide, Urea, Acetamide.
  - 7) Hydrocarbons: Naphthalene, Anthracene.
  - 8) Halogen compounds : Chloroform, Chlorobenzene.

**Exercise II: Physical Chemistry Experiments****10 Laboratory Sessions**

- 1) To determine surface tension of a given unknown liquid by Stalagmometer (Density measurement is must).
- 2) To determine coefficient of viscosity of unknown liquid by Ostwald's viscometer (Density measurement is must).
- 3) To compare cleaning power of detergent samples by Stalagmometer.
- 4) To determine parachor value of  $-CH_2-$  group by Stalagmometer.
- 5) To determine unknown percentage composition of given ethanol-water mixture by viscometer.
- 6) To determine activation energy of a reaction between  $K_2S_2O_8$  and KI.
- 7) To determine heat of solution of  $KNO_3$ .

**Distribution of Marks for Practical Examination**

<b>Time: 6 hours (One Day Examination)</b>		<b>Marks: 50</b>
<b>Exercise-I</b>	í í í ..	<b>18</b>
<b>Exercise-II</b>	í í í ..	<b>18</b>
<b>Viva-Voce</b>	.í í í .	<b>07</b>
<b>Record</b>	.í í í .	<b>07</b>
	ô ô ô ô ô ô ô ô	
		<b>Total: 50</b>

**Books Recommended:**

1. Principles of Inorganic Chemistry by Puri, Sharma and Kalia- S. Naginchand & Co., Delhi.
2. Text book of Inorganic Chemistry by A.K. De, Wiley East Ltd.
3. Selected Topics in Inorganic Chemistry by Malik, Tuli and Madan- S. Chand & Co.



4. Modern Inorganic Chemistry by R.C. Agrawal, Kitab Mahal.
5. Instrumental Methods of analysis by Chatwal and Anand, Himalaya Publishing House.
6. Concise Inorganic Chemistry by J.D. Lee, ELBS.
7. Inorganic Chemistry by J.E. Huheey- Harper & Row.
8. Fundamental concepts of Inorganic Chemistry by E.S. Gilreath, McGraw Hill book Co.
9. Modern Inorganic Chemistry by W.L. Jolly, McGraw Hill Int.
10. Chemistry Facts, Patterns & Principles by Kneen, Rogers and Simpson, ELBS.
11. Theoretical Principles of Inorganic Chemistry by G.S. Manku, Tata McGraw Hill.
12. Inorganic complex compounds by Murmann, Chapman & Hall.
13. Text book of Inorganic Chemistry by K.N. Upadhyaya, Vikas Publishing House, Delhi.
14. Advanced Practical Inorganic Chemistry by Gurdeep Raj, Goel Publishing House, Meerut.
15. Co-ordination Chemistry by D. Banerjee, TMH Publication.
16. Text book of Inorganic Chemistry by Marathe, Bhadange, Mopari and Kubade.
17. Organic Chemistry by R.T. Morrison & R.T. Boyd, 6<sup>th</sup> edition, PHI.
18. Organic Chemistry by Pine, 5<sup>th</sup> edition.
19. Organic Chemistry Vol. I, II and III by Mukharjee, Singh and Kapoor-Wiley Eastern.
20. Organic Chemistry by S.K. Ghosh.
21. Reaction Mechanism in Organic Chemistry by S.M. Mukharjee and S.P. Singh.
22. Spectroscopy of Organic Compounds by P.S. Kalsi.
23. Stereochemistry and mechanism through solved problems by P.S. Kalsi.
24. Organic Chemistry by TWG Solomons, 4<sup>th</sup> edition, John Wiley.
25. Hand Book of Organic Analysis by H.J. Clarke, Arnold Heinmen.
26. Text book of Practical Organic Chemistry by A. I. Vogel.
27. Text book of Organic Chemistry by Jamode, Ganar, Makode, Waghmare, Mahajan, Toshniwal.
28. Text book of Organic Chemistry by P.S. Kalsi published by Macmillan India Ltd., 1999, Delhi.
29. Practical Organic Chemistry by F.G. Mann, B.C. Saunders, Orient Longman.

30. Comparative Practical Organic Chemistry (Qualitative Analysis) by V.K. Ahluwalia and Sunita Dhingra, Orient Longman.
31. Comprehensive Practical Organic Chemistry (Preparation and Qualitative Analysis) by V.K. Ahluwalia and Renu Agrawal, Orient Longman.
32. Physical Chemistry: Walter, J. Moore, 5<sup>th</sup> edn., New Delhi.
33. 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, 4<sup>th</sup> 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. Text book of Chemistry, B.Sc.-I, Second Semester, Bokey Prakashan, Amravati

**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 0-360°C	20 nos./batch
6. Thermometer 0-110°C	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	05 ECH/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 Mantle	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 (Shankø 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, Rittenerø law, Kickø law, Bondø law, Types of size reduction equipments- Jaw crusher, Smooth roll crusher, Ball mill, Hammer mill.
- B) Mechanical Separation: Screening-Types of screening equipments, Grizzlyø screens, Trammelø 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 ó 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.**

<b>Time: 6 – 8 hours (One Day Examination)</b>		<b>Marks: 50</b>	
UNIT ó I:	Exercise No.1 (Numericals)	1 1 1 ..	06
	Exercise No.2 (Practical Expt.)	1 1 1 ..	12
UNIT ó II:	Exercise No.2 (Practical Expt.)	1 1 1 ..	12
	Viva-Voce	1 1 1 ..	10
	Record	1 1 1 ..	10
			-----
<b>Total:</b>			<b>50</b>

**11. PETROCHEMICAL SCIENCE****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 Liquefaction, 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 H<sub>2</sub> 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.)	í í í .	15
Exercise No.2 (Practical Expt.)	í í í ..	15
Viva-Voce	í í í ..	10
Record	í í í ..	10
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<b>Total:</b>		<b>50</b>

**List of book:-**

- Petroleum Refining and Petrochemical. N.K. Sinha, Umesh Publication Delhi
- Advance Petrochemical, Dr. G.N. Sarkar, Khanna Publication, Delhi
- A text on Petrochemical, Dr.B.K. Bhaskararao, Khanna publication, Delhi
- Introduction to petrochemical, Sukumar Maiti,
- Fuels and Combustion, Samir Sarkar, Orient Longman Ltd. Hyderabad
- Catalyst and Chemical Process, Ronald Pearce and William R. Patterson, Leonard Hill, Glasgow
- Systematic Experimental Physical chemistry, S.W. Rajbhoy; Dr. T.K. Chondhekar; Anjali Pub. Aurangbad
- Advance Petroleum Refining, G.N. Sarkar, Khanna pub. Delhi
- Petroleum Refining Technology, Dr. Ram Prasad, Khanna pub. Delhi
- Unit operation II, K.A. Gavhane, Nirali Prakashan, Pune
- Modern Petroleum Refining Process, Dr. B.K. Bhaskararao
- Basic Organic Chemistry, Part 5, Industrial product, J.M. Tedder, A.Nechvatal, & A.H. Jubb, John Wiley, London
- Industrial Organic chemistry, K. Weissmerl & H.J. Arpe, Veriag, chemie, New York
- Chemical from Petroleum, A.L. Waddams, Murray, London
- An introduction to industrial organic chemistry, P. Wiseman, Applied Science, London
- Modern Petroleum Technology, G.D. Hobson, Jhon Wily, Chichester
- 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 110oC I P Grade)	10 Nos.
11. Thermometer (0 to360oC 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 Pont apparatus (I P Grade)	01 No.
15. Pensky Martenø Flash Point apparatus	01 No.
16. Clevaland Open Cup Flash point Apparatus01	
17. Porceline dish	10 Nos.
18. Constant Temprature 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 Mental	06 Nos.
46. ASTM Distillation apparatus	01 No.

47. Viscometr 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 Minerology ó Nature of Light, Ordinary and plane polarized light, Reflection and Refraction, total internal reflection and critical angle, Double Refraction ó Nicol prism. Petrological Microscope ó Its parts & functioning, Optical properties under plane polarized light ó Colour, Pleochorism. Relief, Refractive Index and Becke line, Twinkling, Form & Cleavage. Properties under crossed Nicol ó Isotropism & Anisotropism, Extinction, Interference Colours and Colour chart, Twinning.
- UNIT-II :** Mineralogy ó Physical, Chemical, Optical Properties & Structure of following Mineral groups, Feldspar, Mica Pyroxene, Amphibole, Garnet & Olivine group
- UNIT-III :** Igneous Petrology :- Classification  
a) Chemical, Silca based, Silica Saturation and CIPW.  
b) Mineralogical Classification ó 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 Phyllum Mollusca and Brachiopoda,

**UNIT-VI:** Stratigraphy ó Lithostratigraphic Classification of India. Classification, geographic distribution, lithological characteristic, fossil content and economic importance of Archean Super group, Dharwar Super group, Vindhyan ó 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 ó 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

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**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 Enterpress- Bombay.
10. Fundamentals of Invertebrate Palaentology - M.A.Koregave, Pub.Book World Enterprises.
11. 1. G.W.Tyrell (1998) Principles of Petrology B.I.Publications Pvt.Ltd., New Delhi.
12. H.F.Read: Rutleyø 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 Inida 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 Ingenous, Sedimentary and metamorphic rocks.

**Mineralogy Practicals :**

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

2. A Set of 100 Minerals slides (thin sections) for microscope study. (Set should include all the minerals listed in practical and the scheme in different directions.
3. A set of 25 Oriented Minerals slides to demonstrate axiality, optic sign, pleochroism scheme Extinction 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 Practicals an 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<br>(For Demonstration of this section) with screen  | 1.No.   |
| 2. Magnifiers 10x or more<br>(Table/Hand model with large view for Magascopic Study) | 20 Nos. |
| 3. Hand lens 10 x or 20 x  | 20Nos.  |
| 4. Pen knife   | 20 Nos. |
| 5. Streak Plates   | 20 Nos. |
| 6. Perrological ploarizing miscroscope   | 20 Nos. |
| 7. Minocular microscope with point counter,<br>Camera Lucida and U. Stage fitting.   | 1 Nos.  |

#### **Crystallography**

1. A set 150 wooden crystallography models belonging Normal class of six major crystal system.
2. A set 25 wooden models showing twinning and the type and laws.
3. Contact Goniometer 5 Nos.
4. Set of transparant, Crystal models demonstrating axes planes and centre of symmetry of different Normal class of major system.
5. A set of atomic structure models demonstrating basic types.

#### **Palaeontology**

1. A set of 100 fossil as included in the practical syllabus and the phyllum mentioned in theory in course.
2. A set of 20 plant fossils as mentioned in practical course and their varieties.
3. A set of 25 Geomorphological models.
4. Index map of Survey of India.

#### **Cermorphology**

- |   |        |
|---|--------|
| 1. Toposheet of survey of India on 1:50.000 scale covering Entire Vidarbha.     |        |
| 2. Degree sheets of survey of India on 1.25,000 scal covering entire, Vidarbha. |        |
| 3. Rotarameter  | 5 Nos. |
| 4. Planimeter   | 5 Nos. |
| 5. Tracing table (large size)   | 1 Nos. |

#### **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 comples. In addition about 20-25 problems are to be taken on dip, strik, thickness, three points problem, borehole problem.
1. Large scale geological map in India.
  2. Geological maps of various states or Geological sheet atlas of India.
  3. Tectonic map of India.
  4. Hydrogeological map in India.
  5. Geological map of various geological systems and the type area.

#### **Charts**

As for as possible maximum no of charts should be present for demonstration of symmetry elements, crstallographic system. Morphology of various phyllum, structural diagram, geodynamics, 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. Harver Sack  | 20 Nos. |
| 3. Field camera (Plntax) with zoomlens and flash guns | 1 Nos.  |
| 4. Water bottle                                       | 2 Nos.  |
| 5. Steel tapes 5 Mtr., 10 & 50 Metrs.                 | 2 Each. |
| 6. Clinometer compass                                 | 15 Nos. |
| 7. Bruten compass                                     | 5 Nos.  |

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

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

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

**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 ó Annual, biannual,perennials
- 3.2. Roots ó Types of root : tap and adventitious, modification of root : for food storage, respiration, and supports.
- 3.3. Stem ó Types of Stem, Characteristic features, branching, modification of Stem ó Underground

and aerial

- 3.4. Leaf ó Parts of leaf, types of leaves ó simple and compound; Phyllotaxy; Venation; Stipule. Modification of leaves

**UNIT-IV : Morphology (15)**

- 4.1. Inflorescences ó Types: Racemose, Cymose and Special.
- 4.2. Flower ó Flower as modified shoot; Structure of flower ó Calyx, Corolla, Androecium and Gynoecium. Placentation; Types of Pollination.

**UNIT-V : Morphology and Utilization of Plants (15)**

- 5.1. Fruits ó Morphological types
- 5.2. Utilization of Plants
  - 5.2.1. Food Plants ó Wheat, Potato ó Morphology, varieties and economic importance.
  - 5.2.2. Fiber Plant ó Morphology, varieties and economic importance of Cotton.
  - 5.2.3. Oil yielding Plant ó Morphology, Varieties and economic importance of Ground nut.

**UNIT-VI :Utilization of Plants (15)**

- 6.1. SpicesóGeneral 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 ó General account, economic importance of Eucalyptus.
- 6.4. Pharmacognosy and Phytochemistry with respect to following medicinal plants ó
  - 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
  - ó
  - 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) Gifford 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.
- 42) A Text Book of Botany óPaleobotany, Gymnosperms, Morphology and Utilization of Plants (2014), Dr.P.W.Deotare, Dr.M.A.Shahezad, Dr.Mrs.U.G.Malode, Dr.U.S.Patil, Dr.Mrs.P.S.Kokate,

Dr.Mrs.S.P.Khodke, Published by Nabh Prakashan, Amravati.

- 43) Morphology of Angiosperms and Utilization of Plants, Dr.Shubhangi Ingole, Published by Paygun Publishers, Amravati.

**Semester – II**  
**Practical Schedule**

<b>Time : 4 hours</b>	<b>Marks : 50</b>
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 ó Parasitism and predation. (Lectures-14)

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

Characters used in community structures-

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

Synthetic- i) presence and Constance, 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, O<sub>2</sub>, CO<sub>2</sub> and radioactive.

b) Ecological succession ó Definition, causes, types. General process of succession. Hydro sere, xerosere as a succession models. Ecological niche, Ecotone.

(Lectures-14)

**UNIT VI** a) Biodiversity ó 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. Ambusth.
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 ó 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 ó 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

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**TOTAL 50**  
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### 15. SEED TECHNOLOGY (VOCATIONAL)

#### 2S-SEED TECHNOLOGY

#### PLANT BREEDING METHODS FOR CROP IMPROVEMENT AND

#### SEED PRODUCTION .

- UNIT I :** Genetic basis of crop improvement ó 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 ó 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 ó Definition of pureline, Characters of pureline and its importance, Field techniques of pureline selection, Advantages and limitations.  
Clonal selection ó 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 ódevelopment 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 improvementô 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 breedingô 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 hybridizationô 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 Indiaô History of systematic crop improvement in India, Setting up of council of Agricultural Research, Crop Research Institutes.

**UNIT IV:** General introductionô 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 ó 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 maintenanceô 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 productionô 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 productionô 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 productionô 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 .

Benovalent, 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, rogueing ,  
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 polli-  
nated crops.
- 12 Study of pollination and fertilization, insect pollinators- their iden-  
tification, 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, rogueing, harvest-  
ing 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 tech-  
niques of seed production.
- 16 Seed planning cost of seed production.

#### PRACTICAL EXAMINATION

	<b>Distribution of marks.</b>	<b>Marks</b>
1	Prepare temporary squash/smear of the given material and Identify two stages .	7
2	Problem based on segregation/ Independent assortment Gene interaction chisquare test using coloured seeds .	7
3	Identify and describe specimens A, B, C and D giving reasons ( Inflorescence , Pollination, crop seed seeds )	8
4	Identification and classification of seeds on the basis of seed production practices (any two)	7
5	Submission of visit report .	7
6	Submission of seed specimens and viva voce.	7
7	Record book.	7
	<b>Total Marks</b>	<b>50</b>

#### 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 pub-  
lisher, 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, Reproduc-  
tion 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.

	<b>Marks</b>
1) Paper-II: Cell and Developmental Biology	
Theory (Written)	í í . 80
Internal assessments	í ... 20
2) Practical:	í í . 50
<b>Total :</b>	<b>150 Marks</b>

## 2S-ZOOLOGY

### CELLAND DEVELOPMENTAL BIOLOGY

- UNIT-** 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,
- UNITV:** 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.

### CELLAND DEVELOPMENTAL BIOLOGY

#### I) Cell Biology:-

1. Use, care and maintenance of microscope.
2. Bacterial Culture, Gram staining.
3. Permeability tests using erythrocytes.
4. Preparation of Polytene chromosome in Chironomous or Drosophila larva.
5. Preparation of various stages of mitosis in Onion root tip.
6. Preparation of various stages of meiosis in insectø testis.

#### II) Developmental Biology.

1. Study of stages of Gametogenesis in rat/frog, (Permanent Stained Slides)
2. Study of different of types animal eggs
3. Study of developmental stages (Life Cycle) of Cockroach, Housefly, mosquito, Butterfly, Moth, Frog (Any Four).
4. Sperm in physiological saline using phase contrast optics.
5. Demonstration of developing chick through available resources.
6. Developmental stages of frog: Cleavage, blastula, gastrula, neurula, and tadpoles through available resources.
7. Permanent slides of chick embryos at 24, 36, 48, 72 hrs of incubation.
8. Study of different types of placenta with suitable histological slides or visual diagrams.

**Distribution of Marks during Practical Examination:** Time : 4 hrs.

i) Identification and comments on spots (1-8)	16 Marks
6 4 Cytological, 4 Embryological	
ii) Cytological Preparation	10 Marks
iii) Comments on given Life Cycle	10 Marks
iv) Certified class record -	05 Marks
v) Submission of photographs of any three crop pests	04 Marks
viii) Viva- voce	05 Marks

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Total:- 50 Marks

**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 í .. 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)	í í . 80
	Internal assessments	í ... 20
2)	Practical:	í .. 50

-----  
**Total : 150 Marks**

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

- UNIT I**
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.**
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.**
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.
- UNIT IV.**
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).

- UNIT V.**
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.

- UNIT VI.**
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:**

1. Study of food and feeding habits of fishes - Analysis of stomach content qualitative and quantitative methods.
2. Estimation of growth rate and ageing by indirect methods- (Using scales and otoliths, length weight relationship & ponderal index.)
3. Plankton analysis: qualitative and quantitative, permanent stained preparations of planktons.
4. Estimation of relative conditions factors, gonad somatic index and fecundity.
5. Study of spawning habits based on ova diameter polygons.
6. Identification of egg hatching spawn, fry and fingerlings of Indian major carps.
7. Study of larval stages of crustacean and molluscs.
8. Study of various types of external and internal fish tags.
9. Field visits -
  - (1) Visit to fish catching, center to assess catch compositions species
  - (2) Study of crafts and gears in inland water
  - (3) Fish market statistical data.
  - (4) Visit to a polluted water body to assess its impact on fishery.
  - (5) Visit to fish farm.

**PRACTICALS EXAMINATION**

**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         |
| <b>Total</b>  | <b>50 Marks</b> |

**List of Equipments**

- 1) Microscopes common and Inverted.
- 2) Fish measuring Boards.
- 3) Dissection sets.
- 4) Scale reader
- 5) Hot air oven.
- 6) Weighing Balance (Single Pan Balance)
- 7) Otolith cutter and grinder
- 8) Bone cutters.
- 9) Oculometer and stage micrometer
- 10) Microtome
- 11) Camera lucida
- 12) Projection microscope
- 13) Centrifuge (Electrically operated)
- 14) Sedgwick Rafter Cells.
- 15) Tissue homogenizer
- 16) 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 CO<sub>2</sub>
- 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 movie. 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 Fishicule 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)	1 1 . 80
Internal assessments	1 ... 20
2) Practical	1 1 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. ..í ..í í	5 marks
Q6.	Practical record ..í ..í í .	5 marks
Q 7	Viva voce í í ....í .	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 Rank correlation ó Spearman's and Kendall's rank correlation coefficient.
- 1.4 Intraclass correlation coefficient.

#### UNIT II : Regression Theory :

- 2.1 Concept of regression, lines of regression, two lines of regressions.
- 2.2 Coefficient of regression and its derivation, properties of regression coefficients.
- 2.3 Principle of least square, fitting of linear regression, polynomial and exponential curve.
- 2.4 Concept of Multiple regression, equation of plane of regression of three variables.
- 2.5 Definition of Partial regression.

#### 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 ó its definition, mean, variance.
- 4.2 Bernoulli distribution ó 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 ó 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) 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 |

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**Total 50 marks**

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**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(), fputs(), 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 |

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**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>, <Br>, <HR>, Heading tags, table tags, <A>, <LINK>, <IMG>, <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 Ritche
- 10) Programming in C - V.Rajaraman
- 11) Programming in ANSI C - 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 Marks
2. Practical record -----10 Marks
3. Viva Voce----- 10 Marks

### Semester II 2S-ELECTRONICS Digital Electronics

#### Unit I : Binary Arithmetic & Logic gates :

Binary, Octal & Hexadecimal number system and their inter-conversion, Binary arithmetic (addition and subtraction using 1's & 2's compliment), multiplication & division. Binary codes : 8421 BCD, Excess-3 & Gray code.

NOT, OR, AND, NAND, NOR gates (definition and truth table). EXNOR & EXOR gates, Half adder, full adder , 4 bit binary full adder.

#### Unit II : Boolean Algebra & Logic families:

Boolean laws, De-morgans theorem, Simplification of Boolean equations using Boolean algebra, Fundamental products & sum terms, K-map (K-map upto 4 variable).

Classification of logic families, characteristics (Fan-in, Fan-out, Noise immunity, Propagation delay, Power dissipation), DTL, TTL & CMOS logic.

#### Unit III : Multivibrators and Flip Flops:

Construction & working of Astable, monostable and Bistable transistorised multivibrators, RS, CK-RS, D, JK, JKMS and T Flip Flops (Logic diagram, Truth table, construction & working), Concept of edge trigger Flip-Flop, Concept of preset & clear terminal.

#### Unit IV : Counters and Shift registers:

Asynchronous & synchronous Counter, Up-down counters (up to 4-bits), modified asynchronous counter (Mod -7 ,Mod-10, and Mod-13).

Types of shift registers, SISO, SIPO, PISO & PIPO, IC version of Mod -10 shift registers (Construction & working), IC version of shift register 67495, Application of shift register. Ring counter, Johnson's counter.

#### UNIT V : Combinational logic circuit:

Encoder: Binary to BCD, Decimal to BCD, IC 74147, Decoder: 2 to 4 line, BCD to decimal, BCD to 7 segment, IC 7447, Multiplexer: 4X1, 8X1, De multiplexer: 1X4, 1X8, (Definition, construction, operation and application of above)

#### Unit VI : Semiconductor Memories:

Concept of memory, primary and secondary memory, classification of memories, volatile and non volatile memories, memory Hierarchy, semiconductor memory: RAM, ROM, PROM, EPROM, EEPROM, flash memory.

#### Books Recommended:

1. Digital and analog technique by Navneet, Kale and Gokhale ( Kitab mahal prakashan)
2. Introduction to digital electronics by Mohinder Singh
3. Digital principle and application by Malvino and Leach
4. Modern digital electronics by R. P. Jain
5. Pulse, digital and switching waveforms by Millman and Taub

**Practicals:** Minimum Ten experiments at least one on each of the following aspects.

1. Half adder, full adder, code converter, Identification and verification of logic gates, 4-bit binary full adder(IC versions)
2. DeMorgan's theorems, K-map, TTL and CMOS logic, knowing characteristics of logic families.
3. Transistorized Astable, Bistable and monostable multivibrator, JK and JKMS flipflops, Data Flipflop, RS , CK RS Flipflop.
4. 4-bit binary counter, modifying counter, ring and Johnson's Counters (Using ICs), SISO, SIPO, PISO and PIPO.
5. Decoder, multiplexer, IC74147 mounting and testing.
6. Study of memories.

**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	-ö-
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  $\Delta G$  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

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**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 ó Lytic cycle (T4), Lysogeny (Lambda phage)
- v) Cultivation of viruses ó 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 ó 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 ó Biofertilizers & Biopesticides.
- ii) Human and Animal Health ó Antibiotics, Vaccines
- iii) Industry ( Food, Chemical & Pharamaceutical) ó List of Microbial products ( and producing organisms)
- iv) Environmental ó Biodegradation and Bioremediation.

#### UNIT-IV BASIC BIOCHEMISTRY –

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

#### UNIT-V : BIostatISTICS

- i) Importance & application ó Tabulation & Classification of data, Frequency distribution & graphical distribution of data.
- ii) Measures of central tendencies ó Mean , Mode, Median & their Properties
- iii) Co relation & their Linear regression ó 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 ó Hardware, input devices, CPU, output devices , Monitor, software.
- ii) Memory concept- Computer memory primary & second-

- ary 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 ó 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 ó 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

#### IInd Semester Microbiology Practicals

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

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**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 ó 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.
27. Food & Nutrition, Nikhilesh Kulkarni, Mahendra Deshpande, Himalaya Publishing House.

**26. INDUSTRIAL MICROBIOLOGY**

**2S Indsutrial Microbiology**

**Fermentation Equipment and Techniques**

**UNIT-I : 1. Basic Fermentor design:**

Parts and their functions of Conventionalstirred 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 ó 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 ó 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 ó adsorption, ion exchange, gel, affinity.
- f) Distillation
- g) Cr ystallisation

**UNIT-V : Detection and Assay of f ermentation 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, recover y 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 |

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Total -50 marks  
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**List of Reference Books :-**

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

Classification of bacteria according to Bergey's Manual of Sys-

tematic Bacteriology

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

**UNIT III: Microbial Metabolism:**

Energy production by aerobic and anaerobic processes, (Glycolysis, Krebs 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 : (Penicillium 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

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**Total                    50 Marks**  
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**Reference Books (For Sem-II)**

- 1) Microbiology-Pelczar
- 2) General Microbiology ó 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 ó 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 ó Bus, Tree, Ring, Star, Hybrid, WAN, MAN.  
Communication Protocols ó 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

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**Total                    50 Marks**  
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#### Books Recommended

11. Practicals based on internet.
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 ó Michel Doprtch (BPB)
11. Local Area Network ó Keiser - TMH

<b>List of Equipments : (For Sem I &amp; Sem II)</b>	<b>Quantity</b>
(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.

#### 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 comption of honey.

#### 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 :-

	<b>Duration : 4 Hours</b>
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

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Total 50

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##### 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 Nations Bulletin No.124.
- 4 Studies in Chemistry of Indian Honeys & 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 ~~Hand Book of Beekeeping (2nd Edition) (1984) by R. S. Khosla, KVIC, Mumbai~~
  - 10 ~~Hand Book of Beekeeping (2nd Edition) (1984) by R. S. Khosla, KVIC, Mumbai~~
  - 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, Cornell University Press ó By ó 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-specification (Second Rev.) I S 4941; 1994, BIS New Delhi
  - 22 Technology & Honey Bull-R.Borneeke & Gronnet
  - 23 Anatomy of Honey bee R.E.Snoadgrass.
  - 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

### 30. Forensic Science

#### 2S Forensic Science (Forensic Chemistry)

The examination in Forensic Science of Second 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 4 to 6 hours duration and carry 50 marks.

The following syllabus 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).

**Total Lectures: 84**

**Marks: 80**

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

#### Unit I

**14L**

##### A) Qualitative-Quantative Analysis

**[5L]**

Organic - inorganic products - oils, paints, petroleum products, cement.

##### B) Forensic Chemistry

**[5L]**

Screening, sampling-methods type (collection), statistical method, different standard methods, Inorganic analysis, Micro-chemical methods for forensic analysis.

##### C) Miscellaneous

**[4L]**

Characteristics/examination/act/organic-inorganic products-Gold, silver, tobacco, milk, coffee, tea, sugar, salts, fertilizers, dyes, drugs, paints, fats, various acts (legal aspects).

#### Unit II: Separation and detection technique

**14L**

**Gas chromatography:** Theoretical principles, instrumentations and technique, columns, stationary phases, detectors, Forensic applications. **HPLC:** Review of theory, Instrumentation, Technique, column, detectors, LC-MS, Forensic applications. **Atomic Absorption Spectroscopy and Flame spectrometry** - Theory and Forensic applications.

#### Unit III: Forensic Toxicology

**14L**

Introduction and concept of forensic toxicological examination and its significance. **Poisons:** (Plant Poison, Animal Poison, Metallic Poison) classification of poisons, types of poisoning, collection and preservation of toxicological exhibits in fatal and survival cases, signs and symptoms of poisoning, mode of action and its effect on vital functions, medico-legal and post mortem examination report/finding studies, specific analysis plan/approach to toxicological

examination of poisoning samples, excretion of poisons, detection of poisons on the basis of their metabolic studies, interpretation of analytical data and forming of opinion.

**Unit IV: Narcotic Drugs and Psychotropic Substances 14L**

Analysis of Narcotic Drugs and Psychotropic Substances, Drug effects, drug Hazards, Tolerance and dependence of drugs, Problems of drug addiction, Identification of drug addict, Drug addicts and crimes, Classification of Narcotics and other drugs, Analytical techniques for identification of drugs. Types of Pharma drugs, Steroids, Forensic Pharmacological studies, Ingestion of drugs, absorption, distribution, metabolism, pathways of drug metabolism, drug metabolism and drug toxicity, excretion of drugs.

**Unit V: Study of Analysis of Beverages 14L**

Introduction, Definition of alcohol and illicit liquor, Alcoholic and non-alcoholic beverages and their composition, Proof spirit, absorption, de-toxication and excretions of alcohol, problems in alcohol cases and difficulties in diagnosis, Alcohol and prohibition, Consequences of drunken driving, Analytical techniques in the analysis of alcohol and other articles. Case study.

**UNIT VI: Miscellaneous Topics 14L**

**Arson:** chemistry of fire, investigation and evaluation of clue material, analysis of arson exhibits by instrumental methods: Management of Arson cases. **Food adulteration:** Introduction, Prevention of food adulteration, Analytical techniques for analysis of exhibits involved in food and other material cases. **Relevant provision of:** 1. Prevention of Food Adulteration Act 1954 (Definition, Power of Food Inspector, Offences and Penalties), 2. Narcotic Drugs & Psychotropic Substances Act 1985 (Definition, Licit Opium Cultivation, Minimum and Commercial Quantity in Narcotic Drugs, Offences and Penalties), 3. Prevention of Illicit Trafficking in NDPS Act 1985 (Detention of a Person Under the Act), 4. Drugs Control Act 1940 (Definition, Power of Chief Commissioner Under the Act), 5. Drugs & Cosmetics Act 1945 (Definition, Adulterated, Misbranded, Spurious Drugs and Cosmetics, Offences and Penalties).

**Semester- II**

**2S Forensic Science (Forensic Chemistry)**

**Total Laboratory sessions: 21**

**Marks: 50**

**List of Practicals :**

1. Identification of food adulteration - vegetable oil, Cold drinks etc. (2nos).
2. Quantitative or qualitative study of drug opiates. (2 nos).
3. Examination of fire arson cases by GC, TLC. (1 nos).

4. Detection and determination of various adulterants in alcohol, by colour tests. (Qualitative analysis) (2 nos.).
5. Analysis of Jaggery samples.
6. Qualitative Test for Examination of Ethyl Alcohol in Human Blood.
7. Detection of Inorganic Poison As, Hg, Cu, Ba,  $\text{PO}_4^{3-}$  etc.
8. Colour Tests for identification of poisons, drugs. (2 nos).
9. Plant, animal, Metallic poison analysis. (2 nos.).
10. Quantitative Estimation of Zinc Phophite.
11. Separation of Sampling Material by TLC (drugs, poison etc.) (2nos).
12. Study of Steroids (separation by TLC).
13. Examination of chemicals used in Trap cases by UV-visible spectroscopy. (2 nos)
14. Analysis of Molasses Samples.
15. Analysis of Medicinal and Toilet preparation samples.
16. Analysis of French Polish.
17. Analysis of Ammonium Chloride and Sodium Chloride Mixture Samples.
18. Analysis of Soft Drinks.
19. Analysis of Diesel.

**Distribution of Marks for Practical Examination :**

**Time: 4 – 6 hours**

**Marks: 50**

Exercise- I	í í í ..	12
Exercise- II	í í í ..	12
Exercise- III	í í í ..	12
Viva-Voce	.í í í .	07
Record	.í í í .	07
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Total:		50

**Books Recommended:**

1. Instrumental Analysis by Skoog, Holler and Crouch.
2. Instrumental Method of Chemical Analysis. Chatwal & Anand, Himalya Publication.
3. Advance in Chromatography by Brown P. R.
4. Introduction of Forensic Science in Crime Investigation by Dr. (Mrs.) R. Krishnamurthy.
5. Howard: Forensics Analysis by Gas Chromatography.
6. Methods in Toxicology Anmol Publication, New Delhi (1998) by Prakash M. et.al.
7. The basic Science of Poisons Casarett & Doll Toxicology,
8. Instrumental Methods of Analysis, Willard H. H. et. al : 1974.
9. Hand book of drug and alcohol abuse by Holfmann, F. G.

10. Bare Acts with short notes on the following : Narcotic Drugs & Psychotropic Substances Act, Drugs & Cosmetics Act, Explosive Substances Act, Dowry Prohibition Act, Prevention of Food Adulteration Act, Prevention of Corruption Act, Arms Act, Wild Life Protection Act
11. Practical Books : Physical Chemistry Practicals by J.B. Yadav.
12. Qualitative Analysis by Vogel.

### 31. Renewable Energy

#### 2S-Renewable Energy

##### Fundamentals of Electricity

- Unit I :** **Electric Network:** Network elements: branch, junction, node, mesh. Network Laws: Kirchoff's laws, Thevenin's theorem, Power in electric circuit, unit of power, power in pure resistive circuit, Maximum power transfer theorem,  
**Energy sources:** Voltage source, Current source. Combination of Sources: voltage and current sources, Voltage source series combination, current source series combination. Voltage source parallel combination, current source parallel combination, numerical.
- Unit II: Electromagnetic Induction :** Relation between Magnetism and Electricity-Production of Induced E.M.F. and Current-Faraday's Laws of Electromagnetic Induction- Lenz's Law-Induced E.M.F. -Self-Inductance-Coefficient of Self-Inductance (L)-Mutual Inductance-Coefficient of Mutual Inductance (M)-Coefficient of Coupling-Inductances in Series and Parallel, Transformer construction, working, applications and losses.
- Unit III:** Magnetic Hysteresis- Area of Hysteresis Loop Properties and applications of Ferromagnetic Materials, Permanent magnet materials, Hysteresis Law-Energy Stored in Magnetic Field, Rate of Change of Stored Energy, Transient Current: Rise and decay of current in series LR, CR Circuits.
- Unit IV : Elements of Electro-mechanical Energy Conversion:** Introduction, Salient aspects of conversions, Energy- Balance, Magnetic-field System; Energy and Co-energy, A Simple Electromechanical System, Energy in Terms of Electrical Parameters, Rotary Motion, Dynamic Equations and system-model of a simple system.
- Unit V: A C Fundamental - A.C.** Through Resistance, Inductance and Capacitance, A C applied to LR, CR and LCR circuits, , power consumption in ac circuit, Apparent Power, Power factor, Power consumed in pure inductive and capacitive circuit, Resonance in

LCR Circuits, Graphical Representation of Resonance, Sharpness of Resonance Curve, Q-Factor of a Series Resonant Circuit, Parallel A.C. Circuits, Bandwidth of a Resonant Circuit.

**Unit VI:** Primary and Secondary Batteries, Classification of Secondary Batteries based on their Uses, Classification of Lead Storage Batteries, Parts of a Lead-acid Battery, Electrical Characteristics of the Lead-acid Cell, Application of Lead-acid Batteries, Battery Ratings, Indications of a Fully Charged Cells.

##### Reference Book:

1. Text Book of 'Electrical Technology' Vol. II, B.L. Theraja & A.K. Theraja, S. Chand Publications.
2. 'Electrical Machines' by P. S. Bhimbra.
3. Energy Demand and Supply, (Stathis) Michaelides, Efstathios E. Springer Germany, 2012
4. Solar Electricity Handbook - 2012 Edition: A Simple Practical Guide to Solar Energy - Designing and Installing Photovoltaic Solar Electric Systems, Michael Boxwell, Greenstream Publishers, 2012
5. Photovoltaics: Design and Installation Manual, Solar Energy International, 2012
6. Solar Electric Handbook: Photovoltaic Fundamentals and Applications, Solar Energy International, 2012
7. Electrical Technology, Naidu-Kamakshiah, Tata McGraw-Hill Education, 2006
8. Fundamentals of Electrical Engineering, Rajendra Prasad, PHI Learning Pvt. Ltd., 2005
9. A Text Book of Electrical Technology, B.L. Theraja, S. Chand Limited, 2008
10. Photovoltaic: Design and Installation Manual, Solar Energy International, 2012

##### Practical

1. Simulation of Hysteresis Loop on the CRO
2. Characteristics of LVDT
3. Characteristics of Current Transformers and Potential Transformers
4. Power measurement using current transformer & potential transformer
5. Power factor improvement with capacitor banks
6. Testing of energy meters

**32. Animation****2S : Animation****Fundamentals of Graphics**

**Unit-I :** **Adobe Photoshop:** concepts of graphics, file menu basic of layers, selection, move, lasso, magic wand, crop, etc. (study of all tools expected).

**Unit-II:** All types of paint tools like air brush, custom shapes, quick mask, notes, audio annotation tools, masking, path, etc.

**Unit-III:** Working with layers, applications of masking to matting (study of all menus related to layers); image menu, color correction, scanning, filters, creating backgrounds & textures for website, slice tools, web related concepts. Creation of a simple web and presentation graphics, file automate options, video editing techniques.

**Unit-IV :** **Adobe illustrator:** Concepts of graphics designing, interface, basic shapes, all types of menus like file menu, edit, view, select, group/ungroup, lock, hide/show, etc.; File/outline, gradients, patterns, symbols, styles, swatches, mesh tool, paint brush. Creating a greeting card, etc.

**Unit-V:** Deformation tools, symbols tools, redrawing or cartoon making, type tools and type menus.

**Unit-VI :** Use of different tools like path, envelop, clipping and crop mask, etc; filters and effect menus, exporting document, idea of printing, setting bleed, idea of PDF technology.

**Practicals :** Minimum eight experiments based on above contents are to be performed.

**Recommended Books :**

1. Recommended Text Books: Digital fashion illustration with Photoshop and Illustrator by Kevin Tallon; Published by Batsford 2008.
2. Reference books: Real word Adobe Illustrator CS4 by Mordy Golding; Published by Pretence-Hall of India, 2008.
3. Creative Suite 3 integration: Photoshop, Illustrator by Keith Martin; Published by Pretence-Hall of India, 2008.
4. Special edition using Adobe Photoshop 7 by Peter Bauer, Jeff Foster; Published by Pretence-Hall of India, 2008.

The Concerning teachers are also suggested to use other relevant material available on the net, to update the knowledge of the students.

Following are the recommended links, for further search-

- 1) [www.tatamcgrawhill.com](http://www.tatamcgrawhill.com)
- 2) [www.books.google.co.in](http://www.books.google.co.in)
- 3) [www.penguinbooksindia.com](http://www.penguinbooksindia.com)

- 4) [www.bookcafe.in](http://www.bookcafe.in)
- 5) [www.newindianbooks.com](http://www.newindianbooks.com)
- 6) [www.newasiabooks.org](http://www.newasiabooks.org)

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