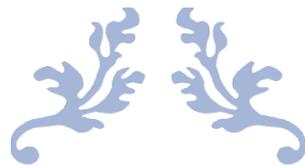


1.3 - Curriculum Enrichment



1.3.2 (A) - Programme / Curriculum/ Syllabus of the courses



Vinayak Vidnyan Mahavidyalaya Nandgaon Kh.



Pravin Khodke Memorial Trust, Amravati's
VINAYAK VIDNYAN MAHAVIDYALAYA
Nandgaon Khandeshwar, Dist. Amravati
NAAC Accredited B++ Grade with CGPA 2.83

Sau. Sulbha Sanjay Khodke
(MLA, Amravati)
President, PKM Trust, Amravati

College Code :197 Ph. No.07221-222245
E-mail: vvm197@sgbau.ac.in

Dr. Alka A. Bhise
Principal
Mob. 98235 26341

Outward no/PKMT/VVM/1224/Q

Dt.04/12/2024

Self- Declaration

This is to certify that the information, reports, true copies of the supporting documents, numerical data and web links furnished in this files are verified by I.Q.A.C and head of the institute and found correct.

Hence this certificate is issued

Dr Suchita Khodke
I.Q.A.C. Co-ordinator
Vinayak Vidnyan Mahavidyalaya
Nandgaon Kh.

Dr Alka A. Bhise
PRINCIPAL
Vinayak Vidnyan Mahavidyalaya,
Nandgaon Khan. Dist. Amravati



1.3.2 Number of courses that include experiential learning through project work/field work/internship during the year

Program name	Program code	Name of the Course that include experiential learning through Internship	Course code	Year of offering	Name of the student studied course on experiential learning through Internship	Link to the relevant document
B.Sc. II BOTANY	BOT BSc. II	BOT SEM-IV	BOT 02S03	2023-24	12	
B.Sc. II ZOOLOGY	ZOO BSc. II	ZOO SEM-IV	ZOO 02S03	2023-24	11	
B.Sc. II CHEMISTRY	CHE BSc. II	CHE SEM-IV	CHE 02S03	2023-24	12	
B.Sc. II PHYSICS	PHY BSc. II	PHY SEM-IV	PHY 02S03	2023-24	16	
B.Sc. II MATHMATICS	MTH BSc. II	MTH SEM-IV	MTH02S03	2023-24	11	
B.Sc. II COMPUTER SCIENCE	CS BSc. II	CS SEM-IV	CS 02S03	2023-24	11	
B.Sc. II ELECTRONICS	ELE BSc. II	ELE SEM-IV	ELE 02S03	2023-24	10	

Sneha

I.Q.A.C. Co-ordinator
Vinayak Vidnyan Mahavidyalaya
Nandgaon Kh.

Bhish

PRINCIPAL
Vinayak Vidnyan Mahavidyalaya,
Nandgaon Khan, Dist. Amravati

Vinayak Vidnyan Mahavidyalaya, Nandgaon Kh.

Program name	Program code	Name of the Course that include experiential learning through project work/field work	Course code	Year of offering	Name of the student studied course on experiential learning through project work/field work	Link to the relevant document
B.Sc. III BOTANY	BOT BSc. III	BOT SEM-V	BOT 03S05	2023-24	34	
	BOT BSc. III	BOT SEM-VI	BOT 03S06	2023-24	34	
B.Sc. III ZOOLOGY	ZOO BSc. III	ZOO SEM-V	ZOO 03S05	2023-24	34	
	ZOO BSc. III	ZOO SEM-VI	ZOO 03S06	2023-24	34	
B.Sc. III CHEMISTRY	CHE BSc. III	CHE SEM-V	CHE 03S05	2023-24	41	
	CHE BSc. III	CHE SEM-VI	CHE 03S06	2023-24	41	
B.Sc. III PHYSICS	PHY BSc. III	PHY SEM-V	PHY 03S05	2023-24	16	
	PHY BSc. III	PHY SEM-VI	PHY 03S06	2023-24	16	
B.Sc. III MATHMATICS	MTH BSc. III	MTH SEM-V	MTH 03S05	2023-24	20	
	MTH BSc. III	MTH SEM-VI	MTH 03S06	2023-24	20	
B.Sc. III COMPUTER SCIENCE	CS BSc. III	CS SEM-V	CS 03S05	2023-24	10	
	CS BSc. III	CS SEM-VI	CS 03S06	2023-24	10	
B.Sc. III ELECTRONICS	ELE BSc. III	ELE SEM-V	ELE 03S05	2023-24	04	
	ELE BSc. III	ELE SEM-VI	ELE 03S06	2023-24	04	

Sneha

I.Q.A.C. Co-ordinator
Vinayak Vidnyan Mahavidyalaya
Nandgaon Kh.

Bhis

PRINCIPAL
Vinayak Vidnyan Mahavidyalaya,
Nandgaon Khan. Dist. Amravati

Syllabus of SGBAU

1

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

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

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

Ordinance No. 1 : Enrolment of
Students. Ordinance No. 2 : Admission of
Students. Ordinance No. 4 : National Cadet Corps
Ordinance No. 6 : Examination in General
(relevant extracts)
Ordinance No. 18/2001 : An Ordinance to provide
grace marks for passing in a Head of
passing and Improvement of
Division (Higher Class) and
getting Distinction in the

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subject and condonation of
deficiency 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

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	1	2
Ordinance No. 19	: Admission Candidates to Degrees	
Ordinance No.109 name	: Recording of a change of 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.	

Registrar
Sant Gadge Baba Amravati
University

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**SANTGADGEBABAAMRAVATIUNIVERSITY,
AMRAVATIDIRECTION**

No. : 16/2010

11/06/2010

Date :

**Subject : Examinations leading
to the Degree of एकेडेमिक
(Bachelor of Science)
(Three Year De- gree
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 11th Plan – 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

4

Whereas, the faculty of Science in its emergent meeting held on 11th 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-

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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).

AN
D

Whereas, Ordinance No.143 in respect of Examinations leading to the Degree of $\text{प्रीतिज्ञान अक्षात्रि$ (Bachelor of Science) is in existence in the University as per annual pattern examination system.

AN
D

Whereas, new scheme of examination as per semester patterns 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.

AN
D

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 SantGadge 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 $\text{प्रीतिज्ञान अक्षात्रि}$ (Bachelor of Science) (Three Year Degree Course- Semester Pattern), Direction, 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 $\text{प्रीतिज्ञान अक्षात्रि}$ (Bachelor of Science) in the faculty of Science-
 - (1) The $\text{प्रीतिज्ञान अक्षात्रि}$ $\text{पत्र-1, अत्रि-1 \& 2}$ (B.Sc. Part-I, Sem-I & II) Examination;
 - (2) The $\text{प्रीतिज्ञान अक्षात्रि}$ पत्र-2, अत्रि-3 (B.Sc. Part-II, Semester-III) Examination;

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- (3) The $\text{प्रीतिज्ञान अक्षात्रि}$ पत्र-2, अत्रि-4 (B.Sc. Part-II, Semester-IV) Examination;
- (4) The $\text{प्रीतिज्ञान अक्षात्रि}$ पत्र-5, अत्रि-5 (B.Sc. Final, Semester-V) Examination; and

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- (5) The $\frac{1}{2}$ final examination (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 be 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) A student of a College who has prosecuted a regular course of study for not less than one academic year prior to that examination;
- (b) A teacher in a Educational Institution eligible under the provisions of Ordinance No.18, and

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- (c) A women candidate who has not pursued a regular course of study.

Provided that in the case of the persons eligible under clauses

(b) and (c) an applicant to the examination shall have attended a full course of laboratory 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.**

- (i) English and any one of the following languages Marathi, Hindi, Urdu, Sanskrit, and Supplementary English.
- (ii) Three optional subjects atleast one subject from the following groups be selected.

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:-

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

Group C :- Botany, Zoology, Bio-Chemistry,

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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.

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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**

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(III) In the case of the Examination Scheme-2 & 3 & 4 (B.Sc. Part-II, Sem-III & IV) Examination:-

have passed not less than one academic year previously the Examination Scheme-1, & 2 (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 Examination Scheme-5 & 6 (B.Sc. Final, Sem-V & VI) Examination:- have passed not less than one academic year previously the Examination Scheme-2, & 3 & 4 (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,
- (i) he/she satisfied the condition in the table and the provisions thereunder.
 - (ii) he/she has prosecuted a regular course of study in a college affiliated to the University.
 - (iii) 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

1	2	3
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 Examination Scheme-2, & 3 & 4 (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 Examination Scheme-1, & 2 (B.Sc. Part-I, Sem-I & II) Examination.
11. Every examinee for the Examination Scheme-5 & 6 (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 Examination Scheme-2, & 3 & 4 (B.Sc. Part-II, Sem-III & Sem-IV) Examination.

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12. An examinee who is successful at the B.Sc. Part-I, Sem-I & II Examination, may offer an additional subject mentioned in Para (6) (iii) not offered by him at the 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 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.

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Explanation :

Division at the 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 B.Sc. Final Examination shall be awarded on the basis of the marks obtained at the 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

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of examination leading to the degree of Bachelor of Sci- ence (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 *तंत्रिका आदेशांतो* +*खत* (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 Ord- nance 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 *तंत्रिका आदेशांतो* (वे-1, वे-1 ' 2 (B.Sc. Part-I, Sem-I & II) and the *तंत्रिका आदेशांतो* (वे-2, वे-3 ' 4 (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 *तंत्रिका आदेशांतो* +*खत* वे-6 (B.Sc. Final, Sem-VI) Examination, shall on payment of the prescribed fees, receive a Degree

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Appendix-A

Examination Scheme

तंत्रिका आदेशांतो वे-1

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

Sr. No.	Subject	Theory				Practical		Total Theory, Pract. & Int.Ass.
		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	—	—	50
2	Languages	40	10	50	18	—	—	50
3	Mathematics (Paper-I)	60	15	150	54	—	—	150
4	Mathematics (Paper -II)	60	15			—	—	
5	Science subjects excluding Mathematics	80	20	100	35	50	18	150

in the Pre-scribed form, signed by the Vice-Chancellor.

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Appendix-C

ବିଦ୍ୟାର ମୂଲ୍ୟାଙ୍କନ 2- ୧ମ 3

**(B.Sc. Part-II)
(Semester-III)**

Sr. No.	Subject	Examination Scheme						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			—	—	
4	Mathematics (Paper-VI)	60	15	150	60		—	150
5	Science subjects excluding Mathematics	80	20	100	40	50	20	150

Grand Total of Semester-III : 450

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Appendix-E

ବିଦ୍ୟାର ମୂଲ୍ୟାଙ୍କନ 4ମ 5

**(B.Sc. Final)
(Semester-V)**

Sr. No.	Subject	Examination Scheme						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-IX)	60	15			—	—	
4	Mathematics (Paper-X)	60	15	150	60		—	150
5	Science subjects excluding Mathematics	80	20	100	40	50	20	150

Grand Total of Semester-V : 450

Appendix-D

ବିଦ୍ୟାର ମୂଲ୍ୟାଙ୍କନ 2- ୧ମ 4

**(B.Sc. Part-II)
(Semester-IV)**

Sr. No.	Subject	Examination Scheme						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			—	—	
4	Mathematics (Paper-VIII)	60	15	150	60		—	150
5	Science subjects excluding Mathematics	80	20	100	40	50	20	150

Appendix-F

ବିଦ୍ୟାର ମୂଲ୍ୟାଙ୍କନ 4ମ 6

**(B.Sc. Final)
(Semester-VI)**

Sr. No.	Subject	Examination Scheme						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			—	—	
4	Mathematics (Paper-VIII)	60	15	150	60		—	150
5	Science subjects excluding Mathematics	80	20	100	40	50	20	150

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Note : 1 There shall be only one theory paper of each sciencesubject 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 as-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	Mathematics	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
Total marks for Sem-I/II				10	15	20
3	Sem-III, IV, V & VI	Project Assignment	On latest developments in the subject in 100-200 words	—	03	04
4	Sem-III, IV, V & VI	Class Test	Two class test (on passing test)	—	08	10

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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/	Any one of the activity with report of the activity.	—	04	06

Note : 1. The concerned teacher shall have to keep the record of all the above activities till the passing out of that batch.

2. 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.
3. Teacher shall announce the schedule of activity for Internal Assessment in advance in consultation with HOD/Principal.
4. 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.
5. 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.
6. Final submission of internal marks to the University shall be before commencement of the theory examinations.

1

Appendix-H

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.

2.

Head of the
Department

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

2

Sang Gadge Baba Amravati

University, Amravati

DIRECTION

No. : 37 / 2011

Amravati
Date : 11/6/2010

Date: 26.7.2011

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

1

Subject : Corrigendum to Direction No.16/2010 in re- spect 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 – Semester Pattern), Direction-2010 is in existence.

AN
D

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 examination shall be conducted annually for each semester.

AN
D

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 con- duction of theory and practical examination of B.Sc. Semester-I to VI at the end of each semester, from the Academic Session 2011-12.

AN
D

Whereas, making amendments in the Ordinance for above ex-amination is a time consuming process.

AN
D

2

Whereas, it is necessary to carryout the corrections to Direc-tion 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 Uni-versities Act., 1994, do hereby direct as under:

1. This Direction may be called "Corrigendum to Direction No.16/2010 in respect of Examinations leading to the Degree of (Bachelor of Science) (Three Year Degree Course – Semester Pattern)".

2

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.

Amravati
Date : 26/7/2011

Sd/-
(Dr.Mohan K.Khedkar)
Vice-Chancellor

DIRECTION

No. : 1 / 2012
:23.1.2012

Date

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 – 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 – 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- "Chemistry, Environmental Science, Industrial Microbiology," and the

2

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 cor-rection 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.16of 2010 issued earlier for the Examinations leading to the Degree of (Bachelor of Science) (Three Year Degree Course – 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 Uni-versities Act., 1994, do hereby direct as under:

1. This Direction may be called "Corrigendum to Direction No.16/ 2010 in respect of Examinations leading to the Degree of (Bachelor of Science) (Three Year Degree Course – Semester Pattern) in the faculty of Science".
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 – Semester Pattern) in the faculty of Science-
 - A) the words "Industrial Microbiology" after the word "Bioinformatics" 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 "Two assignments" be replaced by the words "One assignment".
 2. In column No.4, at Sr.No.2, the words & signs "Two Class Tests (On passing test)" be replaced by the words "One test".
 3. In column No.4, at Sr.No.4, the words & signs "Two Class Tests (On passing test)" be replaced by the words "One test".
 4. In column No.4, at Sr.No.5, the words "Any one of the activity" be replaced by the words "Any one of the activities".

2

5. The Note No.4 be deleted and substituted by the following para.

“The test with maximum 30 marks be conducted for the students and the marks be allotted based on the performance of the students as under-”

	Languages	Mathematics		Other Sci. subjects	
	Sem-I& II	Sem-I & II	Sem-III to VI	Sem-I & II	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 -
 “The student who remain absent for internal assessment through out the semester, ‘Zero’ marks be given to him/her while posting the marks instead of writing “Ab” before his/her name.”

2

SANTGADGEBABAAMRAVATIUNIVERSITY,AMRAVATI

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

Examination:

B. Sc. Part - I

Subject	Theory	Practical
1. Chemistry	6	6
2. Physics	6+1 Tutorial	6
3. Botany	6	6
4. Zoology	6	6
5. Geology	6	6
6. Mathematics	9+1 Tutorial-	-
7. Statistics	6	6
8. English		
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

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SANT GADGE BABA AMRAVATI UNIVERSITY GAZETTE



Official Publication of Sant Gadge Baba Amravati University

PART TWO

Thursday, the 27th June, 2019

NOTIFICATION

No. 56 / 2019

Date: 27/6 /2019

Subject : I) Introduction of new syllabi for the subject Geology at B.Sc. Part-III (Sem. V & VI) level, which to be implemented from the academic session 2019-20.

II) Introduction of new syllabi for B.Sc. Part-III (Semester-V & VI) Computer Science / Computer Application/ Information Technology/Computer Application(Vocational)which to be implemented from the academic session 2019-20.

I) It is notified for general information of all concerned that the authorities of the University has introduced new syllabi for the subject Geology at B.Sc. Part-III (Sem. V & VI) level, which to be implemented from the academic session 2019-20. Hence, the page Nos. 42 to 46, appearing in prospectus No. 2016123 be substituted respectively by the **APPENDIX-A**, which is appended with this notification.

II) It is notified for general information of all concerned that the authorities of the University has introduced new syllabi for B.Sc. Part-III (Semester-V & VI) Computer Science / Computer Application/ Information Technology/Computer Application(Vocational), which to be implemented from the academic session 2019-20. Hence, the page Nos. 88 to 97, appearing in prospectus No. 2016123 be substituted respectively by the **APPENDIX-B**, which is appended with this notification.

Sd/-

(Dr.

T.R.Deshmukh)

Registrar,

Sant Gadge Baba Amravati University

PUBLISHEDBY

**Dineshkumar
Joshi**Registrar,
Sant Gadge Baba Amravati
University,Amravati - 444602

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B.Sc.Part-II (Semester-III & IV)
(Prospectus No.2015122)

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**SANTGADGE BABA AMRAVATI UNIVERSITY,
AMRAVATI**

% ORDINANCE NO. 42 OF 2005

**Examination in Environmental Studies leading to
Bachelor Degree, Ordinance, 2005**

Whereas it is expedient to frame an Ordinance relating to Examination in Environmental Studies leading to Bachelor Degree level, hereinafter appearing, the Management Council is hereby pleased to make the following Ordinance.

1. This Ordinance may be called "Examination in Environmental Studies leading to Bachelor Degree, Ordinance, 2005."
2. This Ordinance shall come into force from the Academic session 2005-06.
3. In this Ordinance and in other ordinances relating to the examination, unless there is anything repugnant in the subject or context :-
 - (i) "Academic session" means a session commencing on such date and ending with such date of the year following as may be appointed by the Management Council.
 - (ii) "Admission to an examination" means the issuance of an admission card to a candidate in token of his having complied with all the conditions laid down in the relevant ordinance, by a competent officer of the University.
 - (iii) "Applicant" means a person who has submitted an application to the University in the form prescribed for admission to an examination.
 - (iv) "Candidate" means a person who has been admitted to an examination by the University.
 - (v) "Regular Candidate" means an applicant who has applied for admission to a University examination through an affiliated college, Department or Institute in which he/she has prosecuting a regular course of study.
 - (vi) "Examinee" means a person who present himself/herself for an examination to which he/she has been admitted.
 - (vii) "Examination" means an examination prescribed by the University under the relevant Ordinance.
 - (viii) "External Candidate" means a candidate who is allowed to take a University examination in accordance with the provision of Original Ordinance No. 151.

% Amended by ordinance No. 7 of 2006 and 10 of 2007.

- (ix) "Non-Collegiate Candidate" means a candidate who is not a collegiate candidate.
 - (x) An "Ex-student" is a person who having once been admitted to an examination of this University, is again required to take the same examination by reason of his failure or absence thereat and shall include a student who may have joined a college, Department or Institute again in the same class.
 - (xi) "Bachelor Degree Examination" means an examination leading to Bachelor Degree of the University.
 - (xii) "Previous Year" means a year following by final year of Bachelor Degree.
4. Save as otherwise specifically provided, the conditions prescribed for admission to the examination under this Ordinance shall apply to all persons who wish to take the examination to the Degrees of the University mentioned in para 5 below.
 5. The conditions prescribed for admission to examination under this Ordinance shall apply to following degrees of the University :-
 - 1) Bachelor of Arts
 - 2) Bachelor of Performing Arts
 - 3) Bachelor of Fine Arts
 - 4) Bachelor of Mass Communication
 - 5) Bachelor of Social Work
 - 6) Bachelor of Commerce
 - 7) Bachelor of Business Administration
 - 8) Bachelor of Science
 - 9) Bachelor of Computer Science
 - 10) Bachelor of Computer Applications
 - 11) Bachelor of Pharmacy
 - 12) Bachelor of Science (Home Science)
 - 13) Bachelor of Technology (Cosmetics)
 - 14) Bachelor of Engineering
 - 15) Bachelor of Engineering (Part Time) (Civil)
 - 16) Bachelor of Textile
 - 17) Bachelor of Technology (Chemical Technology)
 - 18) Bachelor of Technology (Chemical Engg.)

2	3																					
<p>19) Bachelor of Architecture, and 20) Bachelor of Laws (Five Year Course)</p> <p>6 i) Environmental Studies shall be a compulsory subject for a previous year examination of the following Bachelor Degrees of the University,</p> <ol style="list-style-type: none"> 1) Bachelor of Arts 2) Bachelor of Performing Arts 3) Bachelor of Fine Arts 4) Bachelor of Mass Communication 5) Bachelor of Social Work 6) Bachelor of Commerce 7) Bachelor of Business Administration 8) Bachelor of Science 9) Bachelor of Computer Science 10) Bachelor of Computer Applications <ol style="list-style-type: none"> 11) Bachelor of Pharmacy 12) Bachelor of Science (Home Science) <ol style="list-style-type: none"> 13) Bachelor of Technology (Cosmetics) 14) Bachelor of Engineering (Part Time) (Civil) <p>ii) Environmental Studies shall be a compulsory subject for IIIrd & IVth Semester of the following Bachelor Degrees of the University,</p> <ol style="list-style-type: none"> 1) Bachelor of Engineering 2) Bachelor of Textile 3) Bachelor of Technology (Chemical Technology) 4) Bachelor of Technology (Chemical Engineering) 5) Bachelor of Architecture, and <p>iii) Environmental Studies shall be a compulsory subject for Vth & VIth Semester of the Degree of Bachelor of Laws (Five Year Course)</p> <p>iv) Students admitted to Second Year/Third Year/IVth Semester Vth Semester of various degree examination courses in different faculties in the academic session 2005-06 or thereafter shall have</p>	<p>to appear for examination in the subject Environmental studies.</p> <p>7. The main Examination leading to Environmental Studies shall be held in Summer and Supplementary examination in Winter every year, at such places and on such date as may be appointed by the Board of Examinations. Explanation :- Examination shall be conducted on the basis of one common question paper for all Bachelor Degree examination courses irrespective of annual or semester pattern.</p> <p>8. Scope of the subject for annual pattern examination and or semester pattern examination shall be as provided under the syllabus.</p> <p>9. Common question paper for all courses covered under this Ordinance along with answer books shall be supplied by the University to the Colleges, Departments and Institutes for conducting the examination of the subject.</p> <p>10. Valuation of the answer books relating to this subject shall be done at College/Department/Institution level only. Remuneration for valuation of answer books shall not be paid by the University. Provided that prescribed evaluation fee for evaluation of each answer Book/s of an external examinee/s appeared from the examination centre shall be paid to each examination centre.</p> <p>11. It shall be obligatory on the part of the College/Department/Institute to submit candidate wise following information to the University on or before the date as may be prescribed by the University :-</p> <table border="1" style="width: 100%; border-collapse: collapse; margin-top: 10px;"> <thead> <tr> <th style="text-align: center;">Sr.No.</th> <th style="text-align: center;">Grade/Category</th> <th style="text-align: center;">Marks secured</th> </tr> </thead> <tbody> <tr> <td style="text-align: center;">1.</td> <td style="text-align: center;">"A"</td> <td style="text-align: center;">- 60 and above</td> </tr> <tr> <td style="text-align: center;">2.</td> <td style="text-align: center;">"B"</td> <td style="text-align: center;">- 45 to 59</td> </tr> <tr> <td style="text-align: center;">3.</td> <td style="text-align: center;">"C"</td> <td style="text-align: center;">- 35 to 44</td> </tr> <tr> <td style="text-align: center;">4.</td> <td style="text-align: center;">"D"</td> <td style="text-align: center;">- 25 to 34</td> </tr> <tr> <td style="text-align: center;">5.</td> <td style="text-align: center;">"Fail"</td> <td style="text-align: center;">- 24 and below</td> </tr> <tr> <td style="text-align: center;">6.</td> <td style="text-align: center;">"Absent"</td> <td></td> </tr> </tbody> </table>	Sr.No.	Grade/Category	Marks secured	1.	"A"	- 60 and above	2.	"B"	- 45 to 59	3.	"C"	- 35 to 44	4.	"D"	- 25 to 34	5.	"Fail"	- 24 and below	6.	"Absent"	
Sr.No.	Grade/Category	Marks secured																				
1.	"A"	- 60 and above																				
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3.	"C"	- 35 to 44																				
4.	"D"	- 25 to 34																				
5.	"Fail"	- 24 and below																				
6.	"Absent"																					

2

12. For the purposes of teaching, learning and examination, the Committee consisting of three teachers shall be appointed by the Principal/ Head of the Department/Head of the Institution under his/her Chairmanship/Chairpersonship. While appointing three teachers on the said committee, the Principal shall take care that the teachers to be appointed on the committee, if necessary, shall be from different faculty.
13. i) Duration of theory examination of this subject shall be three hour.
ii) For all Bachelor Degree examinations, common question paper of 100 marks shall be provided by the University.
iii) Distribution of these 100 marks shall be as follows :-
a) Part-A, Short Answer Pattern -25 Marks
b) Part-B, Essay type with inbuilt choice -50 Marks
c) Part-C, Essay on Field Work -25 Marks
14. Medium of instruction shall be English or Marathi or Hindi. Question paper shall be supplied in English and Marathi and Hindi. A candidate shall have option to write answers in English or Marathi or Hindi.
15. Examination for the subject Environmental Studies shall be compulsory for external candidates appearing as a fresh candidate at Winter and/or Summer examination.
16. For teaching of the subject, there shall be atleast two hour per week. For teaching the subject to the regular candidates, a full time approved teacher of the University and or a person having Postgraduate Degree in any faculty with second class shall be considered eligible.
17. For teaching of the subject, additional fee to be charged to regular candidate shall be as prescribed by the University.
18. Every College/University Teaching Department shall Charge additional fee of Rs. 100/- to every student of the subject Environmental Studies. Out of this Rs.100/-, the College/University Teaching Department shall have to pay Rs.25/- to the University as an examination fee of each candidate for the subject Environmental Studies.

3

19. The Grade secured by an examinee in the examination of this subject shall not be considered for providing the facility of A.T.K.T. in next higher class.
20. The provisions of Ordinance No. 18/2001 shall not be applicable for securing a grade or higher grade in the examination of this subject.
21. Result of the Final Year of the respective Degree shall not be declared of an examinee unless he/she secures any one of the grade in the examination of subject.
Provided an examinee admitted to Five Year LL.B. course desiring not to continue his/her education beyond Sixth Semester of the said course shall have to secure any one of the grade in the examination of the subject otherwise his/her result of Sixth Semester for awarding B.A. degree shall not be declared.
22. Certificates shall be issued, to the successful examinees in the subject Environmental Studies, after the examination.

**SYLLABUS PRESCRIBED FOR B.Sc.
PART-II SEMESTER-III &
IV**

(Implemented from the Session 2011-2012)

1. MATHEMATICS

**3S-Mathematics – Paper-V(
Advanced Calculus)**

- Unit I** : Sequence : Theorems on limits of sequences, bounded and monotonic sequences, Cauchy's convergence criterion.
- Unit II** : Series : Series of non negative terms, convergence of geometric series and the series $\sum \frac{1}{n^p}$ Comparison tests, Cauchy's integral test, Ratio test, Root test.
- Unit III** : Limit and continuity of functions of two variables, Algebra of limits and continuity, Taylor's theorem for function of two variables. Maxima and minima, Lagrange's multipliers method. Jacobians.
- Unit IV** : Properties of Beta and Gamma functions. Double integral : Definition and Evaluations of double integral.
- Unit V** : Change of order of integration in double integral, triple integral (evaluation technique only). Double integral by transforming it into polar coordinates.

Reference Books :

- 1) T. M. Karade, M. S. Bendre : Lectures on Vector Analysis and Geometry, Sonu-Nilu Publication, Nagpur.
- 2) T. M. Karade, J. N. Salunke, A. G. Deshmukh, M. S. Bendre: Lectures on Advanced Calculus, Sonu-Nilu Publication, Nagpur.
- 3) Gorakh Prasad : Differential Calculus, Pothishala Pvt. Ltd., Allahabad.
- 4) Gorakh Prasad : Integral Calculus, Pothishala Pvt. Ltd., Allahabad.
- 5) Murray R. Spiegel : Theory and Problems of Advanced Calculus, Schaum Outline Series.
- 6) S. C. Malik and Arora : Mathematical Analysis, Wiley Estem Ltd., New Delhi.
- 7) O. E. Stanaitis : An Introduction to Sequences, Series and

improper Integrals, Holden-Dey, Inc. San Francisco, California.

1

- 8) Earl D. Rainville : Infinite series, The Macmillan Co., New York.
- 9) N. Piskunov : Differential and Integral Calculus, Peace publishers, Moscow.
- 10) Shanti Narayan : A Course of Mathematical Analysis, S. Chand & Co., New Delhi.
- 11) D. Somasundaram and B. Choudhary: A First course in Mathematical Analysis, Narosa Publ. House.

3S-Mathematics –
Paper-VI (Partial
Differential Equations)

Unit I : Partial differential equations of first order. Lagrange's solutions. Some special types of equations which can be solved easily by methods other than general method. Charpit's general method of solutions. Jacobi's Method.

Unit II : Partial differential equations of second and higher orders. Homogeneous and non-homogeneous equations with constant coefficients. Partial differential equations reducible to equations with constant coefficients.

Unit III : Classifications of linear partial differential equations of second order.
Monge's methods.

Unit IV : Calculus of Variation : Functional, continuity of functional, variational problems with fixed boundaries, Extremum of a functional.

Unit V : Method of separation of variables, method of separation of variable for wave equations and heat equation in one dimension.

Reference Books :

- 1) T. M. Karade : Lectures on Differential Equations, Somnilu Publication, Nagpur.
- 2) J. N. Sharma : Differential Equations, Krishna Prakashan

2

- Mandir, Meerut.
- 3) Ian N. Sneddon : Elements of Partial Differential Equations, McGraw Hill Book Company, 1988.
 - 4) D. A. Murray : Introductory course on Differential Equations. Orient Longman (India), 1967.

3

- 5) Erwin Kreyszig : Advanced Engineering Mathematics, John Wiley and Sons, Inc. New York, 1999.
- 6) A. R. Forsyth : A Treatise on Differential Equations, Macmillan and Co. Ltd. , London.
- 7) Frank Ayres : Theory and Problems of Differential Equations. McGraw Hill Book Company, 1972.
- 8) B. Courant and D. Hilbert : Methods of Mathematical Physics, Vol. I & II, Wiley-interscience, 1953.
- 9) A. S. Gupta : Calculus of Variations with Applications, Prentice-Hall of India, 1997.
- 10) I. M. Gelfand and S. V. Fomin : Calculus of Variations, Prentice-Hill Englewood Cliffs (New Jersey), 1963.
- 11) J. I. Oden and J. N. Reddy : Variational Methods in Theoretical mechanics, Springer Verlag, 1976.
- 12) Jane Cronin : Differential Equations, Marcel Dekkar, 1994.
- 13) G.S.Sharma, I.J.S. Saran, Engineering Mathematics, P.B.H. Publishing, New Delhi.
- 14) Rajsinghaniya M.D. : Ordinary and Partial Differential Equations, S.Chand and Co., New Delhi.
- 15) K. Shaukatrao Rao, Partial Differential Equations.

**4S-Mathematics – Paper-VII
(Laplace Transforms and Fourier Series)**

- Unit I** : Laplace transform. Linearity of Laplace transform. Existence theorem for Laplace transform, Shifting Theorem, Change of scale property, Laplace transform of derivatives. Multiplication by power of t.
- Unit II** : Inverse Laplace transform, Shifting Theorem, Change of scale property, Inverse Laplace transform of derivative, division by s. Convolution theorem.
- Unit III** : Solution of integral equations and system of ordinary and partial differential equations using the Laplace transform. Solutions of simultaneous ordinary differential Equations using Laplace transform
- Unit IV** : Fourier Series, Fourier expansion of piecewise monotonic functions, Fourier series of Even and odd function. Half- range series..
- Unit V** : Bessel and Legendre functions and their Properties, recurrences relations and generating functions. Sturm-

4

Liouville problem. Eigen Function, Orthogonality of eigen functions.

Reference Books :

- 1) T. M. Karade : Lectures on Differential Equations, Sonu-Nilu Publication, Nagpur.
- 2) Erwin Kreyszig : Advanced Engineering Mathematics, John Wiley and Sons, Inc. New York, 1999.
- 3) A. R. Forsyth : A Treatise on Differential Equations, Macmillan and Co. Ltd. , London.
- 4) Frank Ayres : Theory and Problems of Differential Equations. McGraw Hill Book Company, 1972.
- 5) B. Courant and D. Hilbert : Methods of Mathematical Physics, Vol. I & II, Wiley-interscience, 1953.
- 6) I. N. Sneddon : Fourier Transforms, McGraw Hill Book Co.
- 7) Goel and Gupta : Integral Transforms, Pragati Prakashan , Merut.
- 8) Raisinghaniya, M.D., Integral Transform, S.Chand & Co., N.D.

**4S-Mathematics – Paper-VIII
(Mechanics)**

Statics :

- Unit I** : Coplanar forces : Forces acting at a point, Triangle law of forces. Parallel forces. Equilibrium of forces, Lami's theorem. Analytical conditions of equilibrium of coplanar forces.
- Unit II** : Virtual work. Uniform Catenary.

Dynamics :

- Unit III** : Velocities and accelerations along the coordinate axes, radial and transverse directions, tangential and normal directions. Projectile.
- Unit IV** : Constraints. Generalised Coordinates D'Alembert's principle and Lagrange's equations of motion.
- Unit V** : Central force motion : Areal velocity. Equivalent one body problem. Central Orbit . Virial theorem. Kepler's laws of motions (Statement Only).

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Reference Books :

- 1) T. M. Karade, M. S. Bendre : Lectures on Mechanics, Sonu-Nilu Publication, Nagpur.
- 2) H. Goldstein : Classical Mechanics (2nd edition), Narosa Publishing House, New Delhi.
- 3) S. L. Loney : Statics, Mc-Millan and co., London.
- 4) R. S. Verma : A Text Book on Statics, Pothishala Pvt. Ltd. , Allahabad.
- 5) S. L. Loney: An Elementary Treatise on the Dynamics of a particle and of rigid bodies, Cambridge University Press, 1956.
- 6) D. K. Daftari, V. N. Indurkar : Elements of Statics, Published by Dattsons, J. Neharu Marg, Nagpur.
- 7) M. A. Pathan : A modern Text Book of Statics, Pragati Prakashan, Nagpur.

PHYSICS3S PHY

Unit I : Mathematical background and Electrostatics (12)

Gradient, divergence and curl of a vector fields and their physical significance, line surface and volume integral. Gauss divergence theorem , Stocks theorem. Work done on charge in electrostatic field, flux of electric field, force on moving charge, Lorentz force equation and definition of B. Ampere's force law, Ampere's Law and its applications.

Unit II : Magnetostatics and Maxwell's Equations (12)

Faraday's Law, Integral and differential form of Faraday's law, displacement current and Maxwell's Equation , wave Equation satisfied by E and B. Plane electromagnetic wave in vacuum, Poynting vector and Poynting theorem.

Unit-III : Solid State Electronics Devices-I – (12)

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Physics of semiconductors : Introduction to semiconductors ; Charge carriers & electrical conduction through semiconductors ; Doping , extrinsic semiconductors ; Fermi level & energy level diagrams ; Drift current in

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semiconductor , mobility, conductivity ; Hall effect, Hall coefficient, Semiconductor diode & its biasing, LED, Varactor diode.

Unit-IV : Solid State Electronics Devices-II – (12)

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Introduction to BJT ; working of BJT ; modes of operation; Current gains β and α , their relation ; CB & CE characteristics ; JFET- construction & working , characteristics of FET ; Basic concept of Difference amplifier, IC-OP AMP , electrical parameters of OP AMP, inverting & noninverting modes ; OP AMP as adder, subtractor, differentiator & integrator.

Unit: V : Special Theory of Relativity (12)

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Postulates of Special Theory of Relativity, Lorentz transformations, Length contraction, Time dilation, relativistic addition of velocities, relativity of mass, Einstein's Mass - energy relation, Numericals.

Unit: VI : Atmosphere and Geophysics (12)

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Structure of earth – The crust, mantle, core.

Part of the earth – As a planet; The Atmosphere, The lithosphere, The Hydrosphere Composition of Atmosphere

Earthquakes – Causes, terminologies associated with earthquakes. Type of earthquakes scale of intensity, recording of earthquakes.

Radiation in the atmosphere, Propagation of energy through vacuum, Intensity of radiation, Scattering.

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absorption and reflection of solar radiation by the atmosphere. Moisture and clouds: mechanism that produces clouds , Cloud produced by mixing and by cooling.

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

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

Total	50 marks

- 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..

format.

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

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Date-wise Record of the experiments

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											

- a. Completion Certificate: is must for practical record book.
- b. The semester examination will be of Four Hour duration and the student will have to perform one experiment in the semester examination

Experiments:-

1. To determine characteristics of CB transistor
2. To determine characteristics of CE transistor
3. Measurement of magnetic field by Hall probe method
4. To study variation of gain of CE amplifier with load
5. To study Zener regulated power supply
6. To determine characteristics of FET
7. To study FET as a voltmeter
8. To study Weins bridge oscillator
9. To study phase shift oscillator
10. To study Wein's bridge oscillator
11. To study p-n diode as a rectifier
12. To determine characteristics of p-n junction.
13. Study of OPAMP as an inverting amplifier
14. Study of OPAMP as noninverting amplifier
15. Study of OP AMP as an adder
16. Study of OP AMP as subtractor
17. Study of OP AMP as differentiator
18. Study of OP AMP as an integrator
19. To determine characteristics of Phototransistor

8

20. Measurement of field strength its variation in a solenoid.

21. To draw the BH curve of iron by using a Solenoid and to determine the energy loss due to Hysteresis.

Reference Books:--

1. Solid state Electronics Devices- B.G.Streetman (PHI)
2. Electronics Devices & Circuits – A. Mottershead (PHI)
3. Integrated Electronics—J.Millman ; C.Halkias (TMH)
4. Electronics Devices & circuits –Sanjeev Gupta (Dhanpat Rai Pub.)
5. Electronics Devices & circuits-I & II – Godse & Bakshi (Tech. Pub. , Pune)
6. Solid State Devices & Electronics—Kamal Singh & S.P.Singh (S. Chand & Co.)
7. Electromagnetic theory and holography – satya parakash
8. A text book of geology – G.B. mahapatra
9. Engineering and general geology – parbin singh.
10. The atmosphere – Richard A. Anthes, Hans A. Panotsky, Jhon J Cahir, Albert Rango.
11. Relativity—Goyal and Gupta
12. Text book of Physics --- V. K. Sewane
13. Elements of Special theory of relativity—S.P.Singh and M.K.Bagde
14. A course in Electromagnetic field by S.W.Anwane, B.P.B. Publication, New Delhi.

4SPHY

Unit I : Geometrical optics and interference (12)

Cardinal points of an optical system, equivalent focal length and power of coaxial lens system, Interference in thin films due to reflected and transmitted light, interference in wedged shaped thin film, Newton's ring by reflected light, measurement of wavelength of monochromatic light by Newton's, ring, determination of refractive index of liquid by Newton's rings.

Unit II : Diffraction (12)

Fresnel and Fraunhofer Diffraction, Fresnel half period zone, zone plate construction and theory. Double slit diffraction.

Plane diffraction grating; construction and elementary theory, determination of wavelength of monochromatic light by using grating. Resolution of images, Rayleigh's criteria for resolution. R. P. of grating.

Unit III : Polarization (12)

Concept of polarization, optic axis, double refraction, polarization by double refraction, phase retardation plate :- Quarter wave plate, half wave plate, (Nicol prism-production and analysis of polarized light). Theory of production of elliptically and circularly polarized light, production and detection of elliptically and circularly polarized light. Half shade polarimeter, blue of the sky.

Unit IV : Laser (12)

Introduction to Maser, Absorption, spontaneous and stimulated emission, population inversion, pumping characteristics of laser beam. Main components of laser system, three level and four level laser system. Ruby laser, He-Ne laser, semiconductor laser, application of laser. Holography-principle .

Unit V : Fiber optics (12)

introduction of fiber optics, total internal reflection, structure and classification of optical fiber. Propagation of light wave in an optical fiber, Acceptance angle and numerical aperture, dispersion, fiber losses, fiber optic communication. Advantages and Disadvantages of optic fibers, application of fiber optics.

Unit VI : Renewable Energy Sources (12)

Introduction to various renewable energy sources – Solar energy, Wind energy, ocean energy- Waves & tides, geothermal energy, Hybrid Systems, Hydrogen energy systems, Fuel cells.

Solar energy - Solar radiations on earth - availability

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Solar Energy Storage :- Methods of storage, properties of storage materials. Principle of Solar Thermal Applications, Solar water heater, Solar concentrating collectors -Types , applications.

Solar Photovoltaic systems -- Operating principle, Photovoltaic cell concepts , power of a solar cell and solar PV panel ; Applications.

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

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

Total	50 marks

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

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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	OHI										
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 exoeriments 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											

- a. Completion Certificate: is must for practical record book.
- b. The semester examination will be of Four Hour duration and the student will have to perform one experiment in the semester exami-nation

Practicals :

1. To determine the wavelength of monochromatic light by Newton'srings.

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2. To verify the Brewster's law.
3. To determine the refractive indices for ordinary and extra-ordinary rays using double image prism.

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4. To determine the Concentration of sugar solution by half shade polarimeter.
5. To determine the wavelength of monochromatic light by plane diffraction grating.
6. To find the number of lines per centimeter of the given grating.
7. To determine the resolving power of plane diffraction grating.
8. To determine the resolving power of telescope.
9. To determine the wavelength of laser light.
10. Determination of refractive index of a prism by spectrometer.
11. Determination of dispersive power of prism material
12. To determine the resolving power of prism.
13. study of interference of light by bi-prism experiment and find the wavelength of sodium light.
14. To verify the law of Malus of plane polarized light.
15. Polarplots of solarpanel
16. Measurement of direct radiation using Pyrheliometer .
17. Measurement of global & diffuse radiation using pyranometer
18. Determination of solar constant
19. To determine frequency and phase of signal using CRO.
20. To determine capacitance by Schering bridge method.
21. To determine self inductance by bridge rectifier method.
22. To determine frequency of AC mains by Sonometer.
23. To study and plot I-V characteristics of solar cell.
24. To study time constant of an RC circuit experimentally and verify the result theoretically.
25. Verification of Stefan's law of radiation by using an incandescent lamp as black body Radiator.
26. To study (a) Half-wave Rectifier and (b) Full-wave Bridge Rectifier and investigate the effect of C, L and π filters.

REFERENCE BOOKS:

1. Laser and non-linear optics – B B Laud.
2. Optoelectronics and fiber optics communication – C.K Sarkar, D.C. Sarkar.
3. An introduction to fiber optics – R. Allen Shotwell
4. Optics – Ajoy Ghatak.

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8. Optics and atomic physics – D.P.Khandelwal.
9. Non Conventional Energy Sources, G. D. RAI(4th edition), Khanna Publishers, Delhi.
10. Solar Energy, S.P. Sukhatme (second edition), Tata Mc. Graw Hill Ltd, New Delhi.
11. Solar Energy Utilisation, G. D. RAI (5th edition), Khanna Publishers, Delhi.
12. Principles of Solar Energy- Kreith Kreider.
13. Renewable Energy - BentSarensen.

3.

Chemistry

3S

Chemistry

(Effective from session 2014-15)

The examination in Chemistry of Third 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-III (8 marks).

B.Sc. Part- II

(Semester- III)3S

Chemistry

Total Lectures: 84

Marks: 80

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

Unit I

14L

A) Covalent Bonding:

Molecular Orbital Theory. Postulates of MO theory. LCAO approximation. Formation of bonding and antibonding MOs. Rules for LCAO. MO energy level

88

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diagram. Concept of bond order. MO structure of homonuclear diatomic molecules of namely He, H, N and

5. Optical fiber Communication – John M. Senior
6. Principles of optics – B.K. Mathur
7. Optics and laser – V.K. Sewane

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O. Stability sequence of species of O i.e. O, O

², O₂²⁺, O₂⁻ and O₂²⁻. Paramagnetic nature of O₂. MO structure of

heteronuclear diatomic molecules viz. NO, HF and CO (Coulson's structure). Explanation of important properties of CO viz. - triple

<p style="text-align: center;">1</p> <p>bond, almost nonpolar nature, electron donor and acceptor behaviour. Comparison of VB and MO theories. [6]</p> <p>B] Metallic Bonding: Free electron theory and properties of metals such as electrical and thermal conduction, malleability, ductility and metallic lusture. VB theory or Resonance theory of metals. Band theory to explain nature of conductors, insulators and semiconductors (both intrinsic and extrinsic). [3]</p> <p>C] VSEPR Theory: Various rules under VSEPR theory to explain molecular geometry (following examples may be taken to explain various rules- BeCl_2, BF_3, CH_4, NH_3^+, PCl_5, SF_6, IF_7, SnCl_4, NH_3, H_2O, SF_6, ClF_3, BrF_3, XeF_6, SOF_2, COF_2, PCl_5,). Limitations of VSEPR theory. [5]</p> <p style="text-align: center;">3 4 4 5 6 7 2 3 2 4 3 5</p> <p>Unit II - Theory of Quantitative Inorganic Analysis 14</p> <p>LA] Volumetric Analysis: (a) Introduction:- Volumetric analysis, titrant, titrate, end point, equivalence point, indicator etc. Requirements of volumetric analysis. Definition of standard solution, primary standard substance. Requirements of primary standard substance. Terms to express concentrations namely- molarity, normality, molality, mole fraction and percentage. (Simple numericals expected). (b) Acid-Base titrations:- Types of acid base titrations. pH variations during acid base titration. Acid base indicators. Modern theory (Quinoid theory) of acid base indicators. Choice of suitable indicators for different acid base titrations. (c) Redox Titrations:- General principles involved in redox titrations (redox reactions, redox potentials, oxidant, reductant, oxidation number). Brief idea about use of KMnO_4, $\text{K}_2\text{Cr}_2\text{O}_7$ as oxidants in acidic medium in redox titrations. Use of I_2 in iodometry and iodimetry. Redox indicators-external and internal indicators. Use of starch as an indicator. Iodometric estimation of Cu (II). [8]</p> <p>B] Gravimetric Analysis: Definition. Theoretical principles underlying various</p>	<p style="text-align: center;">1</p> <p>Unit III 14L</p> <p>A] Aldehydes and Ketones: Preparation of acetaldehyde from ethanol, ethylidene chloride and acetylene. Preparation of benzaldehyde from benzene (Gattermann-Koch reaction) and toluene. Preparation of acetone from isopropyl alcohol, isopropylidene chloride and propyne. Preparation of acetophenone from benzene and ethyl benzene. Structure of carbonyl group, acidity of α-hydrogen in carbonyl compounds. Reactions of aldehydes &/or ketones: Cannizzaro's, Reformatsky, Perkin with mechanism, Mannich reaction, Benzoin and Aldol condensations. Clemmensen, Wolf-Kishner, MPV and LiAlH_4 reductions. [8]</p> <p>B] Carboxylic acids: Structure and reactivity of carboxylic groups. Acidity of steps involved in gravimetric analysis with reference to estimation of barium as barium sulphate. Coprecipitation and post precipitation. (Definition, types and factors affecting). [6]</p>
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carboxylic acids, effects of substituents on acids strength.
Oxalic acid: Preparation from ethylene glycol and cyanogen.
Reactions: Reaction with ethyl alcohol, ammonia, glycerol and action of heat. Lactic acid: Preparation from acetaldehyde and pyruvic acid.
Reactions: Reaction with ethanol, PCl_5 , action of heat, oxidation and reduction. Benzoic acid: Preparation from toluene, benzyl alcohol, phenyl cyanide and benzamide.
Reactions: Reaction with ethanol, PCl_5 and ammonia. Salicylic acid: Preparation by Reimer-Tiemann reaction. Reactions: Reaction with CH_3COCl , CH_3OH and $\text{C}_6\text{H}_5\text{OH}$. [6]

Unit IV 14L

A) Optical isomerism:

Element of symmetry, chirality, asymmetric carbon atom, enantiomers, diastereoisomers, relative and absolute configurations, DL and RS nomenclature, racemisation and resolution (by chemical method). [4]

B) Geometrical isomerism:

Cis-trans & E-Z nomenclature, Methods of structure determination. [3]

C) Conformational isomerism:

Bayer's Strain theory and its limitations. Stability of cycloalkanes, conformational isomers of ethane, n-butane and cyclohexane, their energy level diagrams. Newman & Sawhorse projection formulae. [7]

<p style="text-align: center;">1</p> <p>Unit V 14L</p> <p>A) Thermodynamics and Equilibrium: [10]</p> <p>(i) Gibb's and Helmholtz's free energy function. Physical significance of Gibb's free energy, Change in free energy as a criteria of spontaneity and equilibrium. Variation of free energy G with P & T. Gibb's-Helmholtz's equation in terms of G and its application. (ii) Partial molal function, chemical potential, derivations of Gibb's-Duhem equation. Chemical potential of an ideal gas in gaseous mixture. Derivation of vant Hoff's isotherm and its application to equilibrium state. Derivation of vant Hoff's equation and its applications. (iii) Numericals.</p> <p>B) Phase Equilibrium: [4]</p> <p>(i) Immiscible liquids, Nerst distribution law and its application to association and dissociation of solute in one of the solvent. Process of extraction, derivation of formula for the amount of solute left unextracted after nth extraction. (ii) Phase transition - Clausius-Clyperon equation (only qualitative statement). (iii) Partially miscible liquids - Phase diagram of phenol-water, triethyl amine - water and nicotine-water systems. (iv) Numericals.</p> <p>Unit VI 14L</p> <p>A) Liquid state: [4]</p> <p>(i) Surface tension, determination and its S.I. Unit. Effect of temperature on surface tension, derivation of expression for relative surface tension by Drop number method. Application of surface tension. (ii) Viscosity, determination and its S.I. Unit. Effect of temperature on viscosity, derivation of expression for relative viscosity by Ostwald's viscometer method. Applications of viscosity.</p> <p>B) Electrochemistry: [10]</p> <p>(i) Conductance of electrolyte solution. Specific, equivalent and molar conductance. Determination of conductance of electrolyte solution, variation of specific and equivalent conductance with dilution for strong electrolyte. Conductometric titrations. Applications of conductometric titration. (ii) Migration of ions under the influence of electric field. Transport number of ions. Determination of transport number by Hottorf's method and Moving boundary method (iii) Kohlrausch's law of independent migration of ions. Determination of λ_{∞} and degree of dissociation α of a weak electrolyte. Determination of dissociation constant of weak electrolyte. (iv) Numericals.</p>	<p style="text-align: center;">1</p> <p style="text-align: center;">Semester- III 3S Chemistry Practicals</p> <p style="background-color: yellow;">Total Laboratory sessions: 26 Marks: 50</p> <p>Exercise I:</p> <p>a) Volumetric Analysis (Standard solutions to be prepared by students only)</p> <p>16 Laboratory sessions</p> <ol style="list-style-type: none"> 1) Prepare 0.1N oxalic acid standard solution and find out the acid neutralizing capacity of an antacid using NaOH as an intermediate solution. 2) Prepare 0.1N H₂SO₄ solution and find out its exact normality using NaOH as an intermediate solution and 0.1N oxalic acid as standard solution. 3) To determine the strength of oxalic acid by titration with KMnO₄. 4) To determine percentage purity of Ferrous Ammonium Sulphate (FAS) by titration with KMnO₄. 5) To determine strength of FAS by titration with K₂Cr₂O₇ using internal indicator. 6) To determine strength of K₂Cr₂O₇ by titration with FAS using internal indicator. 7) Estimation of copper (II) in commercial copper sulphate sample by iodometric titration. <p>b) Gravimetric Analysis Estimation of Ba²⁺ as BaSO₄, Fe³⁺ as Fe₂O₃ using china and silica crucible and Ni²⁺ as Ni-DMG using sintered glass crucible.</p> <p>Exercise II: Physical Chemistry experiments</p> <p>10 Laboratory sessions</p> <ol style="list-style-type: none"> 1) To determine refractive index by Abbe's refractometer. 2) To construct phase diagram of phenol-water system and to determine consolute temperature for the system. 3) To determine transition temperature of MnCl₂·4H₂O. 4) To study kinetics of hydrolysis of methyl acetate catalyzed by acid. 5) To study kinetics of saponification of ethyl acetate by NaOH. (Equal concentration) 6) To determine partition coefficient of benzoic acid between benzene and water.
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<p>7) To determine partition coefficient of iodine between CCl₄/Kerosene and water.</p> <p>8) To determine solubility of benzoic acid at different temperature and heat of solution.</p> <p style="text-align: center;">Distribution of Marks for Practical</p> <p style="text-align: center;">Examination Time: 6 hours (One Day Examination)</p> <p style="text-align: center;">Marks:</p> <p style="text-align: center;">50</p> <table style="width: 100%; border-collapse: collapse;"> <tr> <td style="border-bottom: 1px dotted black;">Exercise-I.....</td> <td style="text-align: right; border-bottom: 1px dotted black;">18</td> </tr> <tr> <td style="border-bottom: 1px dotted black;">Exercise-II.....</td> <td style="text-align: right; border-bottom: 1px dotted black;">18</td> </tr> <tr> <td style="border-bottom: 1px dotted black;">Viva-Voce.....</td> <td style="text-align: right; border-bottom: 1px dotted black;">07</td> </tr> <tr> <td style="border-bottom: 1px dotted black;">Record.....</td> <td style="text-align: right; border-bottom: 1px dotted black;">07</td> </tr> <tr> <td style="border-bottom: 1px dotted black;">Total: 50</td> <td style="border-bottom: 1px dotted black;"></td> </tr> </table> <p style="text-align: center;">B.Sc.Part-II, Semester-IV4S Chemistry</p> <p>Total Lectures: 84 Marks: 80</p> <p>Note: Figures to the right hand side indicate number of lectures.</p> <p>Unit I 14L</p> <p>A) Chemistry of elements of transition series: [11]</p> <p style="margin-left: 20px;">Definition of transition elements. General characteristics of transition elements. Comparative study of first transition series elements (3d) with reference to following properties: (i) Electronic configuration (ii) Atomic and ionic size (iii) Ionization energy (iv) Metallic nature (v) Oxidation states (vi) Magnetic properties (vii) Color of salts (viii) Catalytic properties (ix) Complex formation behaviour. Study of 4d and 5d series elements-Electronic configuration. Comparison of 3d series elements with 4d and 5d series elements with respect to size, oxidation states,</p>	Exercise-I.....	18	Exercise-II.....	18	Viva-Voce.....	07	Record.....	07	Total: 50		<p>magnetic properties and color.</p> <p>B) Extraction of elements: [3]</p> <p style="margin-left: 20px;">Principles involved in extraction of elements. Major methods of extraction of elements. Factors affecting choice of extraction method. Thermodynamics of reduction processes-Ellingham diagrams for oxides and importance of this diagram (only preliminary ideas).</p>
Exercise-I.....	18										
Exercise-II.....	18										
Viva-Voce.....	07										
Record.....	07										
Total: 50											

1	2
<p>Unit II 14L</p> <p>A) Inner transition elements: Definition, Lanthanides and Actinides. Comparative study of Lanthanides with respect to following properties: (i) Electronic configuration (ii) Atomic and ionic radii lanthanide contraction- definition, cause and effect of lanthanide contraction (iii) Oxidation states (iv) Magnetic properties (v) Color of salts (vi) Complex formation behavior. Occurrence of lanthanides. Isolation of lanthanides by ion exchange method. Actinides- Electronic configuration and oxidation states. Comparison of lanthanides and actinides. [11]</p> <p>B) General Principles of Metallurgy: Definition of metallurgy, steps in metallurgy. Ore dressing by gravity separation, froth floatation and electromagnetic separation. Calcination, roasting, smelting and refining of metals. Meaning of term hydrometallurgy and pyrometallurgy. [3]</p> <p>Unit III 14L</p> <p>A) Polynuclear hydrocarbons: Naphthalene - Haworth synthesis, orbital picture, Reactions – electrophilic substitution (orientation) Preparation of naphthols from naphthalene sulphonic acids and naphthylamines from naphthols. [4]</p> <p>B) Reactive methylene compounds: Malonic Ester: Synthesis from acetic acid, Synthetic applications- Synthesis of acetic acid, succinic acid, glutaric acid, crotonic acid and malonyl urea. Acetoacetic ester: Synthesis from ethyl acetate, Synthetic applications- Synthesis of acetic acid, propionic acid, isobutyric acid, succinic acid, glutaric acid, crotonic acid, acetyl acetone and 4-methyl uracil. [6]</p> <p>C) Carbohydrates: Constitution of glucose, cyclic structure, Pyranose and Furanose structure, Epimerization, conversion of</p>	<p>glucose to fructose and vice-versa, Introduction to fructose, ribose, 2- deoxyribose, maltose, sucrose. (their structures only- determination not needed). [4]</p>

<p style="text-align: center;">2</p> <p>Unit IV 14L</p> <p>A] Aromatic nitro compounds: Nitrobenzene: Synthesis from benzene, Reduction of nitrobenzene in acidic, neutral and alkaline medium. [3]</p> <p>B] Amino Compounds: Basicity and effect of substituents. Methods of preparation of aniline from nitrobenzene, Reactions: with acetyl and benzoyl chlorides, Br₂(aq) and Br₂(CS₂), Carbylamine reaction, alkylation, Hoffmann's exhaustive methylation and its mechanism. [4]</p> <p>C] Diazonium Salts: Preparation benzene diazonium chloride, Synthetic applications- Preparation of benzene, phenol, halobenzene, nitrobenzene, benzonitrile, coupling with phenol and aniline. [3]</p> <p>D] Amino acids and Proteins: Classification, Strecker and Gabriel phthalimide synthesis, Zwitterion structure, Isoelectric point, peptide synthesis, Structure determination of polypeptides by end group analysis. [4]</p> <p>Unit V - Colligative Properties of Dilute Solutions: 14L</p> <p>(i) Definition and examples of colligative properties. (ii) Elevation of boiling point, thermodynamic derivation of the relationship between elevation of boiling point and molar mass of a non-volatile solute. Cottrell's method for determination of elevation of boiling point. (iii) Depression of freezing point, thermodynamic derivation of the relationship between depression of freezing point and molar mass of a non-volatile solute. Rast's method for determination of depression of freezing point. (iv) Abnormal behavior of solution. Van't Hoff's factor 'i'. Determination of degree of association and dissociation from Van't Hoff's factor. (v) Numericals.</p> <p>Unit VI- Crystalline state 14L</p> <p>Symmetry in crystal, plane of symmetry, axis of symmetry and point of symmetry. Law of constancy of interfacial angles. Elements of symmetry in cubic crystals. Laws of symmetry. Law of rational indices, Weiss and</p>	<p style="text-align: center;">2</p> <p>Miller indices of a lattice planes,</p>
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calculation of interplaner distance $d(h,k,l)$ from Miller indices in a cubic system. Seven crystal systems and fourteen Bravais lattices, Bravais lattices of cubic system. Simple cubic system (S.C.C.), body centered cubic system (B.C.C.) and face centered cubic system (F.C.C.). Calculation of number of constituent units in S.C.C., B.C.C. and F.C.C. Ratio of interplaner distances for 100, 110 and 111 lattice plane in S.C.C., B.C.C. and F.C.C. (No geometrical derivation). Derivation of Bragg's equation for X-ray diffraction, Bragg's X-ray spectrometer method for the determination of crystal structure of NaCl and KCl. Anomalous behaviour of KCl towards X-ray. Numericals.

Semester-IV 4S Chemistry Practicals

Total Laboratory sessions: 26 **Marks: 50**

Exercise I: Inorganic estimations 14 **Laboratory sessions**

- 1) Chromatographic separation of binary mixture containing Cu(II), Co(II) and Ni(II) ions by paper chromatography and determination of R_f values.
- 2) Estimation of Zn(II) by complexometric titration.
- 3) To determine the strength of unknown calcium salt solution by complexometric titration.
- 4) Estimation of hardness of water by complexometric titration.
- 5) Colorimetric or spectrophotometric estimation of Cu(II) in commercial copper sulphate sample as ammonia complex.
- 6) To determination of concentration of unknown $KMnO_4$ solution from standard solutions of $KMnO_4$ by colorimetrically or spectrophotometrically.

Exercise II: Organic Chemistry Practicals 12

Laboratory Sessions

1. Isolation of casein from milk.
2. Isolation of nicotine from tobacco leaves.
3. Isolation of caffeine from tea leaves.

2

4. Isolation of lycopene from tomato juice.
5. Estimation of glucose.
6. Estimation of acetamide.
7. Determination of equivalent weight of an organic acid.

2

Distribution of Marks for Practical Examination

Time: 6 hours (One Day Examination)

Marks: 50

Exercise-I	18
Exercise-II	18
Viva-Voce	07
Record	07
Total:	50

Books Recommended: (Common for Semester III and Semester IV)

- Principles of Inorganic Chemistry by Puri, Sharma and Kalia- S. Naginchand & Co., Delhi.
- Text book of Inorganic Chemistry by A.K. De, Wiley East Ltd.
- Selected Topics in Inorganic Chemistry by Malik, Tuli and Madan- S. Chand & Co.
- Modern Inorganic Chemistry by R.C. Agrawal, Kitab Mahal.
- Instrumental Methods of analysis by Chatwal and Anand, Himalaya Publishing House.
- Concise Inorganic Chemistry by J.D. Lee, ELBS.
- Inorganic Chemistry by J.E. Huheey- Harper & Row.
- Fundamental concepts of Inorganic Chemistry by E.S. Gilreath, McGraw Hill book Co.
- Modern Inorganic Chemistry by W.L. Jolly, McGraw Hill Int.
- Chemistry Facts, Patterns & Principles by Kneen, Rogers and Simpson, ELBS.
- Theoretical Principles of Inorganic Chemistry by G.S. Manku, Tata McGrawHill.
- Inorganic complex compounds by Murmann, Chapman & Hall.
- Text book of Inorganic Chemistry by K.N. Upadhyaya, Vikas Publishing House, Delhi.
- Advanced Practical Inorganic Chemistry by Gurdeep Raj, Goel Pulishing House, Meerut.
- Co-ordination Chemistry by D. Banerjee, TMH Publication.
- Text book of Inorganic Chemistry by Nema, Agrawal, Solanki, Morkhade, Meshram, Berad.
- Text book of Inorganic Chemistry by Bhadange, Pagariya, Deshmukh, Joshi, Bombatkar, Mandlik, Bokey Prakashan, Amravati.

2

- Organic Chemistry by R.T. Morrison & R.T. Boyd, 6th edition, PHI.
- Organic Chemistry by Pine, 5th edition.
- Organic Chemistry Vol. I, II and III by Mukharjee, Singh and Kapoor- Wiley Eastern.
- Organic Chemistry by S.K. Ghosh.
- Reaction Mechanism in Organic Chemistry by S.M. Mukharjee and S.P. Singh.
- Spectroscopy of Organic Compounds by P.S. Kalsi.
- Stereochemistry and mechanism through solved problems by P.S. Kalsi.
- Organic Chemistry by TWG Solomons, 4th edition, John Wiley.
- Hand Book of Organic Analysis by H.J. Clarke, Arnold Heinmen.
- Text book of Practical Organic Chemistry by A. I. Vogel.
- Text book of Organic Chemistry by Wadodkar, Raut, Dighade, Thakre, Kale, Kadu, Chinchoikar.
- Text book of Organic Chemistry by P.S. Kalsi published by Macmillan India Ltd., 1999, Delhi.
- Practical Organic Chemistry by F.G. Mann, B.C. Saunders, Orient Longman.
- Comparative Practical Organic Chemistry (Qualitative Analysis) by V.K. Ahluwalia and Sunita Dhingra, Orient Longman.
- Comprehensive Practical Organic Chemistry (Preparation and Qualitative Analysis) by V.K. Ahluwalia and Renu Agrawal, Orient Longman.
- Text book of Organic Chemistry by Deshmukh, Awinashe, Tayade, Wadekar, Meshram, Parhate, Bokey Prakashan, Amravati.
- Physical Chemistry: Walter, J. Moore, 5th edn., New Delhi.
- Physical Chemistry: G.M. Barrow, McGrawHill, Indian Edn.
- Principles of Physical Chemistry: Maron and Prutton.
- Principles of Physical Chemistry: Puri, Sharma and Pathaniya.
- Physical Chemistry: P.W. Atkins, 4th Edn.
- Text book of Physical Chemistry: P.L. Sony, O.P. Dharma.
- Physical Chemistry: Levine.
- Practical Physical Chemistry: Palit and De.
- Practical Physical Chemistry: Yadao.
- Practical Physical Chemistry: Khosla.
- Laboratory Manual of Physical Chemistry: W.J. Popiel.
- Practical Chemistry: Dr. S.B. Lohiya, Bajaj publication, Amravati.
- Text book of Physical Chemistry: Satpute, Kabra, Raghuvanshi, Wankhade, Jumle and Murarka.

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2

47. Text book of Chemistry, B.Sc.-II, Third Semester & Fourth Semester, Nabh Prakashan.

2

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	10 nos./batch
100ml	
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 nos./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 Crystal types and their symmetry)	01 no./batch

32. Flame Photometer	2	02 nos./batch
33. Spectrophotometer		02 nos./batch
34. Shaking Machine		01 no./batch
35. Polarimeter		02 nos./batch

4. INDUSTRIAL CHEMISTRY (REGULAR/VOCATIONAL)

The examination in Industrial Chemistry (Regular/Vocational) of Third 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-III (8 marks).

3S Industrial Chemistry (Regular/Vocational) Unit Processes and Process Equipments

Total Lectures: 84

Marks: 80

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

Unit I [14]

- A) **Nitration** – Introduction, nitrating agents, nitration of i) Benzene to nitrobenzene and m-dinitrobenzene. ii) Chlorobenzene to *o* and *p*- nitrochlorobenzenes. iii) Acetanilide to p-nitroacetanilide. Continuous and batch nitration.
- B) **Amination by Reduction** – Introduction, methods of reduction, Bechamp. Reduction (Iron and Acid Reduction), sulphide reduction, alkali sulphite reduction, metal hydrides, cathodic reduction. Factors affecting amination. Manufacturing of aniline, m-nitroaniline, p-aminophenol.
- C) **Alkylation** – Introduction, alkylating agents, mechanism of alkylation. Manufacturing of alkylbenzene, ethylbenzene.
- A) **Halogenation** – Introduction, halogenating agents, nuclear and side chain aromatic halogenation. Manufacturing of chlorobenzene, chloral, monochloro acetic acid.
- B) **Hydrolysis** - Introduction, mechanism and thermodynamics of hydrolysis, various hydrolyzing agents.

Unit III [14]

- A) **Oxidation** – Introduction, various hydrolyzing agents, types of oxidative reactions, mechanism of oxidation, liquid and vapour phase oxidation. Manufacturing of benzoic acid, acetaldehyde and acetic acid.
- B) **Hydrogenation** - Introduction, various catalysts used for hydrogenation, Manufacturing of methanol from carbon monoxide and hydrogen, hydrogenation of vegetable oil.
- C) **Esterification** - Introduction, esterification of organic acids using unsaturated compounds. Manufacturing of

Unit IV: Process Equipments [14]

- A) **Thermometer** – Glass, bimetallic, pressure spring, resistance and radiation pyrometer.
- B) **Pressure** – Manometer, barometer, pressure gauge, diaphragm, Maclean and Pirani gauge.
- C) **Liquid level** – Direct and indirect liquid level, measurement, float type liquid level gauge, ultrasonic level gauge, and bell type liquid level gauge.

Unit V [14]

- A) **Corrosion**- Introduction, types of corrosion (galvanic, open air, underwater & underground). Mechanism of corrosion. Factors affecting corrosion.
 - a. **Passivity** – Introduction, chemical and mechanical passivity, oxide film
 - b. theory of passivity.
- B) **Methods adopted for preventing corrosion** (metal coating processes)

2

- a. i) Galvanizations of iron (ii) Electro plating (iii) Painting (iv) Plastic
- b. coating. Corrosion inhibitor.

2

- C) **Oil Paints and Varnishes** - Introduction, manufacture and their applications in preventing Corrosion.

UNIT VI: Industrial solid waste and Treatment processes [14]

- A) Introductions, types of solid wastes, methods of industrial solid waste treatment & disposal.
 - i) Composting, ii) Sanitary Land-fills, iii) Thermal process (Incineration & pyrolysis) iv) Recycling & reuse.
- B) **Hazards waste –**
Types, radioactive waste, biomedical waste and non radioactive waste containing toxic and heavy metals. Methods of their disposal.

3S Industrial Chemistry Practical List of Experiments

Unit I

- 1) Preparation of Benzoic acid from Benzaldehyde by Oxidation Method.
- 2) Preparation of Benzoic acid from Benzamide by Hydrolysis Method.
- 3) Preparation of m- nitroaniline from m-dinitrobenzene. (Reduction Method).
- 4) Preparation of Iodoform from Ethanol.
- 5) Preparation of p- bromoacetanilide from Acetanilide by Halogenation Method.
- 6) Preparation of Sulphanilic acid from Aniline by Sulphonation Process.
- 7) Preparation of p- nitroacetanilide from Acetanilide by Nitration Method.

Unit II

- 1) Preparation of m-dinitrobenzene from Benzene by Nitration Method.
- 2) Preparation of Acetanilide from Aniline.
- 3) Preparation of Acetylsalicylic acid (aspirin) from Salicylic acid.

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<p style="text-align: center;">2</p> <p style="text-align: center;">(NaOH + Na₂CO₃) method.</p> <p>6) Estimation of Calcium in Dolomite or Lime stone.</p> <p>7) Determination of Iron in water sample by colorimetry.</p> <p>Distribution of Marks for Practical</p> <p>Examination Time: 6–8 hours (One Day)</p> <p>Examination) Marks: 50</p> <table style="width: 100%; border-collapse: collapse;"> <tr> <td style="width: 80%;">1. Unit – I : (Exercise No. 1).....</td> <td style="width: 20%; text-align: right;">15</td> </tr> <tr> <td>2. Unit – II : (Exercise No. 2).....</td> <td style="text-align: right;">15</td> </tr> <tr> <td>3. Viva-Voce</td> <td style="text-align: right;">10</td> </tr> <tr> <td>4. Record.....</td> <td style="text-align: right;">10</td> </tr> </table> <p style="text-align: right; margin-top: 10px;">Total: 50</p> <p>Books Recommended:</p> <ol style="list-style-type: none"> 1) Unit processes in Organic Synthesis – P.H.Groggins. 2) Industrial Organic Chemistry - Peter Weismann (Elsevier publication) 3) Environmental Chemistry – S.S. Dara 4) Environmental Chemistry- A. K. De 5) Environmental Chemistry- Tyagi & Mehara 6) Industrial Chemistry – B. K. Sharma 7) Environmental Chemistry- S.S.Dara 8) Environmental Chemistry- Shashi Chawala, Dhanpat Rai, co. 9) Process instrumentation & control- A.P. Kulkarni 10) Industrial Chemistry – D. P. Eckman , Jon- Wiley & Sons. 11) Instrumentation and Control for the process Industries – S. Sorer, Elsevier applied Science. <p style="text-align: center; margin-top: 20px;">4S Industrial Chemistry (Regular/ Vocational) Material Science and Industrial Pollution</p> <p>Total Lectures: 84 Marks: 80</p> <p>Note: Figures to the right hand side indicate number of lectures.</p> <p>Unit I A) Ceramics – Introduction, types, raw materials, manufacturing processes. Properties and applications.</p> <p>B) Refractories – Introduction, classification, manufacture, properties and applications of fire clay bricks, and high</p>	1. Unit – I : (Exercise No. 1).....	15	2. Unit – II : (Exercise No. 2).....	15	3. Viva-Voce	10	4. Record.....	10	<p style="text-align: center;">3</p> <p style="text-align: center;">alumina bricks.</p>
1. Unit – I : (Exercise No. 1).....	15								
2. Unit – II : (Exercise No. 2).....	15								
3. Viva-Voce	10								
4. Record.....	10								

2

C) **Glasses** – Introduction, types, compositions, manufacturing process. Properties and applications. [14]

Unit II Cement- Introduction, types of cement, raw materials, manufacturing processes- Wet, dry and semi-dry process. Setting and hardening of cement. Properties of cement. Specifications and testing of cement (tensile, compression, fineness, specific gravity). Additives for cement. Major engineering problems in cement manufacturing. [14]

Unit III Polymers – Introduction, classification (natural, artificial, inorganic, organic, thermosetting, thermoplastic). Classification of polymerization processes (addition and condensation polymerization without mechanism).

Manufacturing processes, properties and applications of – polyethylene, polystyrene, polyvinyl chloride (PVC), polyester (PET), nylon, teflon, phenol, phenol formaldehyde and urea formaldehyde resins. [14]

Unit IV : Water pollution due to Industrial Effluents

A) **Classification of water** - sea water, surface water (river, lake, pond) and ground water (well, tube well, stream); their properties in brief.

B) **Water quality parameters** – pH, hardness, alkalinity, acidity, TDS, DO, COD, BOD. IS and WHO standards of water quality.

C) **Inorganic Pollutants** – Heavy metals, Pb, Hg, As, Cd, Cr, Ni, Cu, mineral acids, alkalis and their sources (inorganic based industries)

D) **Organic pollutants** – Phenols, detergents, dyes, plastics, oils, greases etc. and their sources (organic based industries). Effects of these pollutants on water quality. Water pollution due to paper and sugar industries. [14]

Unit V: Water and Waste Water Treatment [14]

3

A) **Water Treatment – Methods for water treatment** - Sedimentation, filtration, coagulation and sterilization.

B) **Waste Water Treatment** – Industrial and sewage water treatments: Primary, secondary and tertiary treatment.

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- C) **Biological Methods** - Aerobic, anaerobic, trickling filter and activated sludge.
- D) **Chemical Methods For Inorganic Chemicals**- Precipitation, electrolysis, ion - exchange, evaporation and adsorption.

Unit VI : Air Pollution due to Industries
[14
]

- A) **Classification of Air Pollutants** - Primary and secondary pollutants e.g. oxides of carbon, sulphur, nitrogen, hydrocarbon and particulates.
- B) **Industries as Source of Air Pollution** - Steel Industries, Fertilizer Industries, Thermal Power Plants, Refineries, paper and pulp industries, metallurgical and mining operations.
- C) **Methods of Control of Air Pollution** - Electrostatic precipitators, scrubbing, filters mist eliminator. Harmful Effects of Air Pollutants on human being, plants and materials. Green House Effect (Global Warming).
- D) **Air Pollution Monitoring** - Methods of collection of air samples, SPM and determination of air pollutants like SO₂, NO_x and solid particulate matter (SPM). Sources of noise pollution, units of noise level and control.

4S Industrial Chemistry
Practical List of
Experiments

- Unit I**
- 1) To determine temporary and permanent hardness of water sample.
 - 2) To determine total dissolved solids, (TDS) of water sample.
 - 3) To determine acidity of water sample.
 - 4) To determine alkalinity of given water sample.
 - 5) To find out dissolved oxygen (DO) of given water sample.
 - 6) To find biological oxygen demand (BOD) of given water sample.
 - 7) To find out chemical oxygen demand (COD) of given water sample.
- Unit II**
- 1) To determine Ca in cement by sample complexometric method.
 - 2) To determine SiO₂ in cement by gravimetric method.
 - 3) To determine Fe in cement gravimetrically.

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- 4) Determination of SO₂ in air sample by colorimetry.
- 5) Determination of SPM in a sample using high volume sampler.
- 6) Determination of Acid value of a Plastic material.
- 7) Preparation of Urea formaldehyde Resin.
- 8) Preparation of Phenol formaldehyde Resin.

Distribution of Marks for Practical

Examination Time: 6 – 8 hours (One Day)

Examination) Marks: 50

1. Unit – I: (Exercise No. 1).....	15
2. Unit – II: (Exercise No. 2).....	15
3. Viva-Voce.....	10
4. Record.....	10

Total: 50

Books Recommended:

- 1) Engineering Materials – Rangwala
- 2) Material Science and Metallurgy – O.P. Khanna
- 3) Unit Process in Organic Synthesis – P.H. Groggins
- 4) A Text Book of Engineering Chemistry – Shashi Chawala, Dhanpat Rai and Co.
- 5) A Text Book of Engineering Chemistry – S.S. Dara, S. Chand and Co.
- 6) Industrial Chemistry – B.K. Sharma
- 7) Dryden's Outline of Chemical Technology – M. Gopalrao and Marshall Sittig
- 8) Environmental Chemistry – S.S. Dara, S. Chand and Co.
- 9) Environmental Chemistry – Moor and Moor
- 10) Pollution Monitoring and Control – Dr. Priyaranjan Trivedi
- 11) Systems Approach to Air pollution Control – R.J. Bibbero and J.G. Young
- 12) Air Pollution Vol. I-IV – A.C. Stem
- 13) NEERI Manual.
- 14) A Text Book of Environmental Chemistry – O.D. Tyagi and M. Mehara, Anmol Publication Pvt. Ltd.

3

5. PETROCHEMICALS ENCE3S Petrochemical Science

The examination in Petrochemical Science of Third 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-III (8 marks).

Semester-III

35 Petrochemical Science

Total Lectures: 84

Marks: 80

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

Unit-I: Thermal Cracking [14]

- Introduction to thermal cracking
- Thermal Cracking reactions
- Mechanism for thermal cracking
- Effect of operating variables on cracking
- Properties of cracked material

Unit-II: Thermal Cracking Processes [14]

- Vis-breaking: operation and description operating conditions and products
- Coking: Delayed and fluid coking
- Steam naphtha cracking: Various routes Chemistry, Process parameters, flow scheme.
- Physical, storage, and safety properties of ethylene
- Composition of pyrolysis products
- Break up of ethylene market
- Ethylene product tree

Unit-III: Catalytic Cracking [14]

- Introduction to catalytic cracking
- Reactions in catalytic cracking
- Mechanism for catalytic cracking

3

- Feed stocks and catalytic cracking conditions
- Composition and structure of cracking catalysts (Zeolites)

3

- Difference between amorphous silica-alumina and zeolites

UNIT IV: Catalytic cracking processes [14]

- Various cracking processes
- Type and working of catalytic processes
- Reaction variables
- Impact of catalyst to oil contact time on selectivity
- Houdray fixed bed cracking unit
- Modern fluid bed cracking unit
- Product profile of catalytic crackers
- Recovery of propane and propylene from cracked gases
- Relative yields of propylene and ethylene from various hydrocarbon feed stocks
- Market for propylene
- Tree diagram of propylene products

UNIT V: Manufacture and recovery of butadiene [14]

- Recovery of butadiene from naphtha steam cracking effluent stream
- Dehydrogenation of butane (Houdray process)
- Dehydration of ethyl alcohol
- Separation of butadiene using technique :selective extraction
- Separation of butadiene using techniques :extractive distillation
- Production of butanol through conventional (Oxo-process) process and BASF process
- Relative comparison based on operating parameters catalysts and its uses

UNIT VI: Reforming process: recovery and manufacture of aromatics

[1

4]

- Introduction to thermal reforming
- Catalytic reforming reactions process flow and description

3

- Reaction conditions: effect of temperature and pressure

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<p style="text-align: center;">3</p> <ul style="list-style-type: none"> • Reforming catalysts • Separation of aromatics from reformat gasoline • Udex process for separation of BTX aromatics • Separation of Benzene, Toluene, Xylene and ethyl benzene from mixed aromatic stream • Separation of mixed xylenes into their individual isomers <p style="text-align: center;">Semester -III 3S Petrochemical Science Practical</p> <p>List of Experiments:</p> <ol style="list-style-type: none"> 1. Simple distillation 2. Binary distillation 3. Steam distillation 4. Vacuum distillation 5. ASTM distillation of Petroleum Sample 6. Reid vapor pressure of volatile petroleum sample 7. Copper corrosion test for petroleum sample 8. Oil in wax determination in given oil sample 9. Water determination in given oil sample 10. Solubility diagram for acetic acid-water-benzene system <p style="text-align: center;">Distribution of Marks for Practical Examination Time: 6 hours (One Day Examination) Marks : 50</p> <table style="width: 100%; border-collapse: collapse;"> <tr> <td style="border-bottom: 1px dotted black;">Exercise No. I: (Practical Expt.).....</td> <td style="text-align: right; border-bottom: 1px dotted black;">15 Marks</td> </tr> <tr> <td style="border-bottom: 1px dotted black;">Exercise No. II: (Practical Expt.).....</td> <td style="text-align: right; border-bottom: 1px dotted black;">15 Marks</td> </tr> <tr> <td style="border-bottom: 1px dotted black;">Viva-Voce.....</td> <td style="text-align: right; border-bottom: 1px dotted black;">10 marks</td> </tr> <tr> <td style="border-bottom: 1px dotted black;">Record.....</td> <td style="text-align: right; border-bottom: 1px dotted black;">10 Marks</td> </tr> <tr> <td style="text-align: right;">Total : 50</td> <td></td> </tr> </table> <p style="text-align: center;">Semester-IV 4S Petrochemical Science</p> <p>UNIT I: Ethylene Derivatives-I [14]</p> <ul style="list-style-type: none"> • Vinyl Chloride Monomer by direct chlorination of ethylene • Vinyl chloride monomer by oxy-chlorination of ethylene • Market for Vinyl chloride monomer • Manufacture of Vinyl acetate monomer from ethylene and other sources 	Exercise No. I: (Practical Expt.).....	15 Marks	Exercise No. II: (Practical Expt.).....	15 Marks	Viva-Voce.....	10 marks	Record.....	10 Marks	Total : 50		<p style="text-align: center;">3</p> <ul style="list-style-type: none"> • Role of PdCl₂ and CuCl₂ in VAM synthesis • Application and uses of VAM • Acetaldehyde manufacture through oxidation of ethyl alcohol (Wacker's Process) • Market for acetaldehyde • Ethanol manufacture by direction of ethylene (Shell process) • Market for ethanol <p>UNIT II: Ethylene Derivatives –II [14]</p> <ul style="list-style-type: none"> • Ethylene oxide by direct oxidation of ethylene • Ethylene oxide through chlorohydrin process • Comparison between direct oxidation and chlorohydrin routes for ethylene oxide manufacture • Uses of ethylene oxide • Production aspects of ethylene glycol • Market for ethylene glycol • Manufacture , chemistry , properties and uses of ethanol amine <p>UNIT III: Propylene Derivatives [14]</p> <ul style="list-style-type: none"> • Production of propylene through direct oxidation • Production of propylene oxide by chlorohydrin process • Halcon and oxirane process for propylene oxide manufacture • Properties of propylene oxide like molecular formula, molecular weight, melting point, boiling point, density, solubility, flash point, ignition temperature, explosive limits • Production aspects of Isopropyl alcohol by direct and catalytic hydration of propylene • Sulfuric acid, Veba process ,Tokayama , ICI , Taxaco process for Isopropyl alcohol • Market for Isopropyl alcohol • Manufacture of acetone from Isopropyl alcohol • Acrylonitrile manufacture by amoxidation of propylene(Sohio process and other routes) • Market for acrylonitrile
Exercise No. I: (Practical Expt.).....	15 Marks										
Exercise No. II: (Practical Expt.).....	15 Marks										
Viva-Voce.....	10 marks										
Record.....	10 Marks										
Total : 50											

3	<ul style="list-style-type: none"> Acrylamide manufacture with respect to chemistry catalyst and optimum conditions and market 	3	<ul style="list-style-type: none"> Viscosity determination of petroleum sample by Redwood method I
UNIT IV	: Butadiene derivatives		
	[14]		
]	<ul style="list-style-type: none"> Synthesis of isoprene by various routes Good-Year Scientific design process, dehydrogenation of tert-amylenes (Shell process) / dehydrogenation of C₅ stream, acetone-acetylene route Manufacture of adipic acid, sulpholane, chloroprene from butadiene Chemistry process flow and market for above products 		
UNIT V	: Benzene derivatives		
	[14]		
]	<ul style="list-style-type: none"> Chemistry, operating conditions, flow scheme, description and market for the benzene derivatives Production of phenol by cumene route Phenol manufacture through chlorobenzene Aniline manufacture Caprolactum preparation 		
UNIT VI	: Xylene derivatives		
	[14]		
	<ul style="list-style-type: none"> Chemistry, operating conditions, flow scheme, description and market for the xylene derivatives Terephthalic acid: para-xylene oxidation route, Toray industries process, Lummus process Di-methyl Teraphalete through para-xylene Phthalic anhydride from o-xylene and naphthalene Comparison of the o-xylene and naphthalene routes 		
Semester IV			
4S Petrochemical Science Practical			
List of experiments:			
1.	Viscosity index determination		
2.	Ductility of bitumen determination		
3.	Cone penetration index of grease		
4.	Needle penetration index of bitumen		
5.	Melting point determination of wax by various method		

3

3

7. Viscosity determination of petroleum sample by Redwood method II
8. Proximate analysis of coal
9. Determination of carbon residue of lubricating oil using Conradson's apparatus
10. Determination of cloud and pour point of given petroleum sample

Distribution of Marks for Practical Examination Time:

6 hours (One Day Examination)	Marks :
50 Exercise No. I: (Practical Expt.)	15 Marks
Exercise No. II: (Practical Expt.)	15 Marks
Viva-Voce	10 marks
Record	10 Marks

Total: 50

Books Recommended:

1. Petroleum Refining and Petrochemicals, N.K. Sinha, Umesh Publications, Delhi
2. Advance Petrochemicals, Dr. G. N. Sarkar, Khanna Publications, Delhi
3. A Text on Petrochemicals, B.K. B Rao, Khanna Publications, Delhi
4. Introduction to Petrochemicals, S. K. Maiti, Oxford-IBH Publications
5. Fuels and Combustions, Sameer Sarkar, Orient- Longman Ltd. Hyderabad
6. Catalysis and Chemical Processes, Ronald Pearce and William Patterson, Leonard-Hill Publication, Glasgow
7. Systematic Experimental Physical Chemistry, S.W. Rajabhoj, Dr. T. K. Chondhekar, Anjali publications Aurangabad
8. Advanced Petroleum Refining, G.N. Sarkar, Khanna Publications, Delhi
9. Petroleum Refining Technology, Dr. Ram Prasad, Khanna Publications, Delhi
10. Unit Operations II, K.A. Gavane, Nirali prakashan, Pune
11. Modern Petroleum Refining Processes, Dr. B. K. Bhaskarrao, Oxford-IBH Publication New Delhi
12. Chemicals from Petroleum, A.L. Waddams, Murray, London

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3		4	
13.	An Introduction to Industrial Organic Chemistry, P. Wiseman, Applied Science, London	26 .	Refrigerator 01 No.
14.	Modern Petroleum Technology, J.D. Hobson, Jon-Wiley Chester	27.	Water Distillation Plant 01 No.
15.	Chemicals form Synthesis Gas, R.A. Sheldon, B. Reidel Publishing Company. Dordrecht	28 .	Beaker 250 ml 20 Nos.
16.	Textbook of Polymer, Volume I, II, III, M.S. Bhatnagar, S.Chand Publi., Delhi	29.	Beaker 50, 100, 500, 1000 ml 07 Nos.
17.	Dryden's outline of Chemical Technology, M. Gopalrao, Marshall Stings, East-west Publications	30 .	No. Hot Air Oven 01
18.	Shreve's Chemical Process Industries, J. Austin, Mc. GrowHill, New Delhi.	31.	No. Heating Furnace 01
LIST OF APPARATUS AND EQUIPMENTS FOR A BATCH OF 20STUDENTS FOR B.S.C. I, II, III PETROCHEMICAL SCIENCE			
Sr			
No.	Item	Quantity	
1.	Burette	20 Nos.	
2.	Pipette 10ml, 25ml	20 Nos. each	
3.	Mohr pipette 2ml, 5ml	10 Nos. each	
4.	Conical flask with stopper	50 Nos.	
5.	Standard volumetric flask	20 Nos.	
6.	Density Bottle	20 Nos.	
7.	Balance (Electronic/Digital)	02 Nos.	
8.	Aniline Point Apparatus	01 No	
9.	U-tube viscometer of different capillary size	02 Nos.	
10.	Thermometer (0 to 110°C I P Grade)	10 Nos.	
11.	Thermometer (0 to 360°C I P Grade)	10 Nos.	
12.	Test tube (20 and 50 ml with rubber cork)	50 Nos.	
13.	Smoke Point Apparatus (I P Grade)	01 No.	
14.	Abel Flash Pont apparatus (I P Grade)	01 No.	
15.	Pensky Marten's Flash Point apparatus	01 No.	
16.	Cleveland Open Cup Flash point Apparatus	01 No.	
17.	Porceline dish	10 Nos.	
18.	Constant Temperature bath	02 Nos.	
19.	Hot Plate	01 No.	
20.	Air condenser	20 Nos.	
21.	Glass tubing 6mm, 10mm	20ft. Each	
22.	Glass rod 4mm, 8mm	20 ft. Each	
23.	Stop watches	04 Nos.	
24 .	LPG Cylinder with regulator	01 No.	
25.	Refractometer	01 No.	
		37.	Spectrophotometer 01 No.
		38.	Oxygen Cylinder with pressure regulating valve 01 No.
		39.	No. Vacuum Pump 01
		40.	No. Air source 01
		41.	No. Air Flow meter 01
		42.	Nos. Dessicators 06
		43.	Nos. Water Suction 04
		44.	Buckner Funnel 100,250ml, 500ml Filtration Flask with 20 Nos.
		45.	Nos. Heating Mental 06
		46.	apparatus ASTM Distillation 01 No.
		47.	Constant temperature bath Viscometr and 01 Set of viscometer
		48.	Apparatus for oil determination in given sample as per I P norm 01 No.
		49.	Vapor Pressure Apparatus with const. Reid 01 No.

4

7.

BOTANY

3S-

BOTANY

ANGIOSPERMSYSTEMATICS,ANATOMY&EMBRYOLOGY

UNITII: Angiosperm Systematics and Biodiversity.

- 1.1 Angiosperms: Origin and Evolution (Pteridospermean and Bennittitalean Theory)
- 1.2 Botanical Nomenclature: Principles of rules, Taxonomic Ranks, Type concept, Valid publication.
- 1.3 Herbarium – Concept & significance, Royal Botanical Garden, Kolkata.
- 1.4 Concept of biodiversity, Ex situ and In situ conservation
- 1.5 Concept & importance of Biodiversity.

UNITIII: Angiosperm Systematics

- 2.1 Systems of Classification: Bentham and Hooker's System, Engler and Prantle's system.
- 2.2 Systematic studies & economic importance of following Families
Dicotyledons (Polypetalae) : Malvaceae, Brassicaceae, Leguminosae, Apiaceae,

UNITIII: Angiosperm Systematics

- 3.1 Systematic studies & economic importance of following Families
Dicotyledons (Gamopetalae): Asteraceae, Asclepiadaceae, Apocynaceae, Solanaceae, Verbenaceae, Lamiaceae.
- 3.2 Dicotyledons (Monoclamydeae): Euphorbiaceae.
- 3.3 Monocotyledons: Liliaceae, Poaceae.

UNITIV:Anatomy

- 4.1 Types of Tissues:
Meristematic – Types of meristems Permanent – Simple and complex.
- 4.2 Characteristics of growth rings, Sapwood and heartwood.
- 4.3 Anatomy of root: Primary structure in dicot and monocot root, normal secondary growth in dicot root.

4

UNITV: Anatomy

- 5.1 Anatomy of stem: Primary structure in monocot and dicot

4

- stem, normal secondary growth in dicot stem.
 5.2 Anomalies in primary structure in *Boerhavia* stem, secondary structure in *Bignonia* and *Dracaena* stem.
 5.3 Leaf Anatomy: Internal structure in *Nerium* and *Maize* leaf.

UNITVI : Embryology

- 5.1 Microsporangium, microsporogenesis, development of male gametophyte.
 5.2 Megasporangium, types of ovules, megasporogenesis, development of female gametophyte (monosporic, Bisporic & tetrasporic).
 5.3 Double fertilization and triple fusion.
 5.4 Embryo – Classification of embryo.
 5.5 Endosperm types & significance, Suspended animation

LABORATORY EXERCISES

- 1) Embryology of Angiosperms:
 - i) Observation of wide range of flowers available in the locality and methods of their pollination.
 - ii) Study through permanent slides of T.S. of anthers, microsporogenesis, L.S. of ovule, types of endosperms and embryo of *Capsella*.
 - iii) Mounting of T.S. of anthers, Pollen grains and pollinia.
- 2) Anatomy of angiosperms : Preparation of double stained slides of root, stem and leaves of angiosperms mentioned in the syllabus.
- 3) Taxonomy : Description of ten plants belonging to different families in technical language and identification upto family level.
- 4) Long and short excursion is essential

Note : Field tour reports should be supported by exhaustive field notes and photographic representation of plant species studied

Brassicaceae- *Brassica*, **Malvaceae-** *Hibiscus*, *Sida*, *Malvastrum*,
Fabaceae- *Crotalaria*, *Indigifera*, *Tephrosia*, **Caesalpinoidae-**
Caesalpineae, *Cassia*, **Mimosoidae-** *Prosopis*, *Acacia*, **Apiaceae-**
Corindrum,

4

Apocynaceae- *Vinca*, *Thevetia*, **Asclepiadaceae-**
Cryptostegia, *Calatropis*, **Solanaceae-** *Datura*, *Solanum*, *Withania*,
Euphorbiaceae- *Croton*, *Jatropha*, *Euphorbia*, **Lamiaceae-** *Oscimum*,
Hyptis, **Asteraceae-** *Tridax*, *Lagasca* **Verbanaceae** – *Lantana*,
Clerodendron

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PRACTICALEXAMINATION

Time:- 5 Hours **Max. Marks- 50**

- Q.1 Preparation of double stained permanent micropreparation of given angiospermic Material Identification with reasons 10 Marks
- Q.2 Description of given angiospermic plant in technical language, identification up to family, floral formula, floral diagram (two Plants) 20 Marks
- Q.3 Spotting (taxonomy-1, anatomy-2, Embryology-2) 10 Marks
- Q.4 Class record, Excursion report with plant photographic submission 06 Marks
- Q.5 Submission of micropreparation and viva voce 04 Marks

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) Bhojwani & Bhatnagar : Embryology of Angiosperms.
- 5) Chandurkar : Plant Anatomy
- 6) Cutter E.G., 1971 : Plant Anatomy Experiment and Interpretation Part-II, Organs, Edward Arnold, London.
- 7) Davis P.H., and Heywood V.H., 1993 : Principles of Angiosperm Taxonomy : Oliver and Boyd, London.
- 8) Eames E.J. : Morphology of vascular Plants. edition, prentice Hall of India Pvt.Ltd. New Delhi.
- 9) Esau K. : 1977, Anatomy of seed plant, 2nd Edition, John Wiley and Sons, New York.
- 10) Gangulee & Kar : College Botany Vol.II
- 11) Gangulee Das and Dutta : College Botany, Vol I
- 12) Giford E.M. and Foster A.S., 1988 : Morphology and Evolution of Vascular Plants, W.H. Freeman & Company, New York.
- 13) Hartmann H.T. and Kestler D.E., 1976 : Plant Propagation

4

Principles and practices, 3rd

- 14) Heyhood V.H. and Moore D.M. (Eds) 1984 : Current concepts in plant Taxonomy. Academic Press, London.
- 15) Jeffrey C., 1982 : An introduction to Plant Taxonomy, Cambridge University Press, Cambridge, London.

16)

4S-BOTANY

CELLBIOLOGY, GENETICS AND BIOCHEMISTRY

Unit – I : Cell Biology

- 1.1 Cell concept – Prokaryotic and Eukaryotic cell
- 1.2 Cell wall – Structure and Functions
- 1.3 Plasma membrane – Structure (models) and Functions
- 1.4 Nucleus – Ultra structure (nuclear membrane, nucleopore complex and nucleolus) and functions
- 1.5 Chloroplast- Structure and Functions

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4

Unit-II : Cell Biology Structure and functions of-

- 2.1 Endoplasmic Reticulum
- 2.2 Golgi complex
- 2.3 Vacuole
- 2.4 Ribosome
- 2.5 Perixysome
- 2.6 Mitochondria
- 2.7 Cell cycle: Mitosis and Meiosis

Unit-III : Genetics

- 3.1 Chromosome- Morphology, Types, Centomere & Telomere
- 3.2 Chromosomal aberrations –
 - 3.2.1 Structural aberrations: Deletion, Duplication, Inversion and Translocation
 - 3.2.2 Numerical aberrations: Euploidy and aneuploidy

Unit-IV: Genetics

- 4.1 Mendellism: Mendel's law of Dominance, Segregations and Independent assortment, Incomplete dominance
- 4.2 Interaction of genes- Complimentary, Supplementary and Epistasis
- 4.3 Problems based on Mendelism and Interaction of Genes

Unit-V Genetics

- 5.1 Linkage – Concept, Types and theories
- 5.2 Crossing over: Concept, Types and theories
- 5.3 Gene mutations- Spontaneous and Induced
- 5.4 Extra-nuclear Genome- Mitchondrial DNA and Chloroplast DNA

Unit-VI Biochemistry

- 6.1 Nomenclature of Enzymes
- 6.2 Characteristics of Enzymes
- 6.3 Concept of holoenzymes, coenzymes and cofactors
- 6.4 Theories for Mechanism of action of Enzymes
- 6.5 Structure and functions Carbohydrates: Monosaccharides (Glucose), Disaccharides (Galactose) and Polysaccharides (Starch)

5

PRACTICAL :

I Cell Biology (Any Two)

1. Isolation of mitochondria from plants
2. Isolation of chloroplast
3. Squash preparation for the study of various stages of mitosis
4. Smear preparation for the study of various stages of meiosis.

II Genetics

1. To prove Mendel's Monohybrid ratio.
2. To prove Mendel's Dihybrid ratio.
3. Problems based on Interaction of genes

III Biochemistry

1. To study the enzyme activity of catalase.
2. To demonstrate test for glucose in grapes, & sucrose in cane sugar / beet root.
3. To demonstrate test for protein.
4. To demonstrate the lipid test in oily seeds.
5. To demonstrate the test for starch / cellulose.
6. To demonstrate the activity of enzyme amylase from germinating Wheat grains.

B. Sc. II : Semester

- IV Practical

Schedule

Time : 4 hours **Marks : 50**

Q.1 : Squash/Smear preparation for study 10

Marks of Mitosis/Meiosis stages

Q.2 : Genetics : To perform given experiment 10 Marks

Q.3 : Genetics problem 05 Marks

Q.4 : Biochemistry : To perform given test (Any Two) 10

Marks

Q.5 : Spotting 05 Marks

Q.6 : Class record and viva-voce 10 Marks

Suggested Readings :

- 1) **Ahluwalia K.B** 2005 (First Edition). Genetics. New Age International Private Ltd. Publishers, New Delhi.
- 2) **Buchanan B.B, Gruissem W. and Jones R.L.** (2000). Biochemistry and Molecular Biology of Plants. American Society of Plant Physiologists Maryland, USA.
- 3) **Dalela & Verma** : Cytology.

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- 4) **Darnell J.** 2000. Molecular Cell Biology (Fourth Edition). W.H.Freeman and Company, New USA.
 - 5) **De-Robertis** EDP: Cell Biology.
 - 6) **Devi P.** 2008-Principle and Methods of plant Molecular Biology. Biochemistry and Genetics Agrobios, Jodhpur, India.
 - 7) **Gardner and Simmons Snaustad** 2005 (Eighth Edition). Principles of Genetics, John Wiley and Sons, Singapore.
 - 8) **Gerald Karp** 1999 Cell and Molecular Biology- Concept and Expts. John Wiley and Sons Inc., USA.
 - 9) **Gupta P.K** (1995) Genetics and Cytogenetics. Rastogi Publications, Meerut.
 - 10) **Leninger A.C** (1987). Principles of Biochemistry, CBS Publishers and Distributors (Indian Reprint)
 - 11) **Lodish Etal** 2004 (Fifth Edition). Molecular Cell Biology, W.H.Freeman and company, New York.
 - 12) **Moore T.C.** 1989. Biochemistry and Physiology of Plant Hormones Springer – Verlag, New York, USA.
 - 13) **P.S.Verma & Agrawal V.K.** : T.B. of Cytology.
 - 14) **Pawar C.B** 2003 (First Edition). Genetics Vol I and II. Himalaya Publishing House, Mumbai.
 - 15) **Pawar C.B** 2005 (Third Edition). Cell Biology, Himalaya Publishing, Mumbai.
 - 16) **Roy S.C and KKDe** 2005 (Second Edition). Cell Biology, New Central Book Agency Private Ltd., Kolkata.
 - 17) **Sharma J.R** 1994 Principles and practices of Plant Breeding. Tata McGraw-Hill
 - 18) **Shrivastav H.N.** - Cell Biology and Genetics - New Millennium Edition - Pradip's.
 - 19) **Singh B.D** 2004. Genetics. Kalyani Publication, Ludhiana.
 - 20) **Strickberger** 2005. (Third Edition). Genetics. Prentice Hall of India Pvt. Ltd., New Delhi.
 - 21) **Veerbala Rastogi** : Introduction to cytology.
 - 22) **Verma P.S and Agarwal V.K** 2006 Cell Biology, Genetics, Molecular Biology, Evolution, Ecology. S.Chand and Company, New Delhi.
 - 23) **Verma P.S. and Agarwal V.K.** (1991), Genetics. S Chand Comp.Ltd. Ramnagar, New Delhi.
 - 24) **Verma S.K. and Mohit Verma** 2007. A.T.B of Plant Physiology.

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Biochemistry and Biotechnology, S.Chand Publications.	
25) Verma S.K. and Verma Mohit (2007). A.T.B of Plant Physiology, Biochemistry and Biotechnology, S.Chand Publications.	
26) Modern Practical Botany, Volume-I, Dr.B.P.Pande, S.ChandPublication, NewDelhi.	
27) Modern Practical Botany, Volume-II, Dr.B.P.Pande, S.ChandPublication, NewDelhi.	
28) Modern Practical Botany, Volume-III, Dr.B.P.Pande, S.ChandPublication, NewDelhi.	
8. ENVIRONMENTAL SCIENCE 3S- ENVIRONMENTAL CHEMISTRY	
UNITI: A. Fundamentals of Environmental Chemistry-	
(15 Lectures) Laws of Thermodynamics, Chemical potential, chemical equilibrium, acid base reaction, solubility of gases in water, saturated and unsaturated hydrocarbons.	
B. Chemistry of biologically important elements- sources, role and effects	
(1) Energy exchange elements – Oxygen, Hydrogen	
(2) Activators and Inhibitors – Na, K, P, Ca	
(3) Trace elements – Ni, Mg, Mo, Cu, Fe.	
UNITII : Chemistry of Biomolecules –	(15 Lectures)
(1) Carbohydrates – Biological importance, classification, structure of Glucose & Sucrose	
(2) Oils & Fats (Lipids)- Biological importance, Fatty acids, properties of fatty acids	
(3) Proteins - Biological importance, types of proteins, Amino acids, properties of amino acids.	
(4) Enzymes – definition, classification, properties, mechanism of action	
UNITIII: Toxicology-I	(15 Lectures)
UNITIV: Toxicology-II	
(15 Lectures)	
(1) Routes of exposure, mode of actions and physiological effects of – (a) aldrin, (b) DDT, (c) DDT, (d) Synthetic detergents	
(2) Xenobiotics – definition & mechanism of Detoxification	
(3) Bioremediation – definition, types.	
UNITV: Chemistry of Water :	(15 Lectures)
(1) Chemical structure of water, Physico-chemical properties of water.	
(2) Chemical speciation of heavy metals – Hg – Distribution and Identification. Pb- Distribution and Identification.	
UNITVI: Renewable Energy Resources :	(15 Lectures)
(1) Solar Energy – Concept, Solar Collectors, Photovoltaics, Solar Water Heater, Solar Cooling, Solar Ponds, Solar Chimney	
(2) Hydropower - Concept & Mechanism, Significance	
(3) Wind Energy- Concept & Mechanism, Significance	
(4) Bioenergy – Biomass, Bioalcohol, Biogas	
(5) OTEC – Principles, mechanism and significance.	
Practical On paper 3S:-	
1. Estimation of trace elements by paper chromatography.	
2. Estimation of molarity, normality of given sample.	
3. To study the property of enzyme by demonstrating any test.	
4. Estimation of carbohydrates.	
5. Estimation of proteins.	
6. Estimation of amino acids by Ninhydrin test.	
7. Demonstration of immobilization of enzyme.	
8. Study of Bioaccumulation of pesticides in aquatic animals.	
9. Study of Bioaccumulation of detergents in aquatic animals.	
10. Demonstration of non-conventional energy sources by working models.	
(i) Solar cells, (ii) Solar cooker, (iii) Wind mills, (iv) Solar Heaters.	
11. To study the activity of amylase.	
Note : Visit to non conventional energy plant.	

5

Distribution of Practical Marks. (Max. Marks. – 50) Time : 6 Hrs.

Q.1	Any one major experiment based on environmental Chemistry	10
Q.2	Any one minor experiment based on environmental Toxicology	09
Q.3	Any one experiment based on environmental Biochemistry	12
Q.4	Experiment on Renewable Energy	05
Q.5	Practical record.	05
Q.6	Viva – voce	04
Q.7	Visit Report	05

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Total Marks :50

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Books Recommended :

1. Environmental Chemistry by- Ayodhya Singh
2. Environmental Chemistry by- Reddy
3. Environmental Chemistry by- S.S. Dara
4. Environmental Chemistry by- H. Kaur.
5. Chemistry for Environmental Engg. And Science by – C. N. Swayer , P.L. Macclly, G. F. Parkin.
6. Environmental Chemistry by- Chandrashekhar Reddy.
7. Environmental Science – by S.C. Santra.
8. Environmental Chemistry by B.K. Sharma.
9. Environmental Chemistry by – A. K. Dey.
10. Concept of Environmental Chemistry – G. S. Soudhi ; Narosapublishing, New Delhi.
11. Environmental Chemistry by – R. C. Rsswell ; Edward Armolic Press.
12. Elements of Environmental Chemistry by – H. V. Jadhav.; Himalaya pub. House.

**4S-ENVIRONMENTAL
POLLUTION**

5

UNIT I : Air pollution – Classification , sources of air pollution, major air pollutants, types of air pollution, effects of air pollutants on plants, , effects of air pollutants on human, effects of air pollutants on materials, status of air pollution in India.

(15 Lectures)

5

UNITII : Water pollution – Definition, sources of water pollution, major pollutants, types of water pollution – fresh water (rivers, streams, ponds, lakes and underground water resources), marine water (coastal and estuarine), effects of water pollution on plants, animals and human beings, eutrophication, water pollution status in India, drinking water quality standards. (15 Lectures)

UNITIII : Land pollution – Definition, causes of soil pollution, major soil pollutants, effects of soil pollutants on plants and animals, nutrients in soil (NPK), domestic, municipal, industrial, and agricultural wastes and their relation with soil degradation, soil salination (15 Lectures)

UNITIV : Noise pollution – Definition, sources, effects of noise pollution, psychological and physiological effects of noise pollution, unit of noise, monitoring of noise pollution, noise pollution standards, techniques of measurements of noise pollution, Indian scenario of noise pollution. (15 Lectures)

UNITV : Radiation pollution – Definition, sources, major radioactive isotopes, nuclear fusion & fission reactions, units of radiations, application of radioactive isotopes in various field, effects of radioactive pollution, effects of nuclear weapons, radioactive fallout, health and environmental effects of radioactive fallout. (15 Lectures)

UNITVI : Major Environmental Issues :

(A) Global Warming - causes, consequences and control measures.

Ozone depletion - mechanism, consequences and control measures.

(B) Case Studies and Episodes

- (a) Bhopal Gas Tragedy
- (b) London Smog
- (c) Fluoride Pollution in India
- (d) Chernobyl Nuclear Disaster.

5

Experiments based on papers 4S :

1. To estimate settleable particulate matter, RSPM in industrial area.
2. Measurement of noise level by noise level meter.
3. Determination of physical and chemical properties of Solid waste from industries.
4. Determination of chlorides in waste water sample.
5. Qualitative analysis of coal.
6. Analysis of chloride.
7. Analysis of Sulphate
8. Estimation of oil and grease.
9. Determination of Hardness.
10. Determination of D.O.
11. Determination of Phosphate
12. Identification and enumeration of bacteria from air and water.
13. Determination of calorific value of biodegradable waste.
14. Determination of available phosphorous by spectro photometric method.
15. Determination of available phosphorous by spectro photometric method.
16. Determination of Nitrogen from soil by Kjeldhals Method.
17. Estimation of CO₂ and CO from air.

Note : (i) Visit to different industries.
(ii) Study of pollution status in local area.

Distribution of Practical Marks : (Duration 5 Hours)

Q. 1 - Experiment on water pollution	10
Q. 2 – Experiments on air pollution	10
Q. 3 – Experiment on Noise pollution.	05
Q. 4 – Experiment on Soil pollution.	10
Q. 5. – Practical record .	05
Q. 6- Tour Diary	05
Q. 7 – Viva- voce	05

Total Marks - 50

Books Recommended:

1. Ecology and Environment – P.D. Sharma
2. Environmental Chemistry – V.P. Khudesia
3. Environmental Chemistry – B.K. Sharma
4. Environmental Chemistry – Kaur.

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5. Industrial Chemistry – B. K. Sharma
6. Environmental Biology & Toxicology – P. D. Sharma
7. Environmental Toxicology – Mido,
8. Biochemistry- Leninger
9. Biochemistry- Satyanarayan
10. Environmental Engineering – S. S. Deswal
11. Water supply & Sanitary Engineering – Rangawala
12. Environmental pollution control Engineering – C. S. Rao, Newage international publication
13. Solar Energy – Sukhatme.
14. Indian Industry – A Geographical perspective- K. Siddhartha, S. Mukherjee
15. Renewable Energy – 2nd edition- Godfrey Boyle (Oxford)
16. Shreve's Chemical Process industries- George T. Austin
17. Environmental Chemistry – Chhatwal Anand
18. Plant Physiology – Salisbury & Ross
19. Non Conventional energy Resources – G. D. Rai
20. Experimental Methods For General & Environmental Chemistry – Dr. Anita Rajor
21. Environmental Guidelines and Standards in India – P. K. Goel & K. P. Sharma, Techno Science Publications, Jaipur
22. Environmental Sciences, Daniel Botkin & Edward Keller, John Wiley & sons, New York
23. Environmental Sciences, Eldon D. Enger and Bradley F. Smith, WCB Publishers, Boston
24. Environmental Chemistry – A. K. De, Wiley Eastern Ltd. New Delhi
25. Physico Chemical Examination of Water, Sewage, and Industrial Effluent, Pragati prakashan, Meerut

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9.

SEED TECHNOLOGY (VOCATIONAL)

Semester-III

3S : 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 duration.

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

Hybrid Seed Production and Vegetable Seed Production

Unit-I : Introduction:

Definition of heterosis and inbreeding depression and brief history of the development of these concepts.

Genetic, physiologic and Biochemical basis of heterosis. Exploitation of heterosis at commercial scale in Crops : Maize, Pearl millet, Sorghum, Sunflower, Pigeonpea and Cotton.

Fixation of heterosis – an approach.

Apomixes and its exploitation Hybrid Sorghum, Rice.

Unit-II : Devices for Hybrid Seed Production :

Genetic male sterility and hybrid seed production. Advantages and disadvantages of genetic male sterility.

Role of marker genes linked with genetic male sterility.

Procedure of hybrid seed production and maintenance of seed parent – Pigeonpea, cotton and sunflower.

Cytoplasmic and Genetic male sterility.

Introduction to the system. Synchronisation

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Unit-III : Hybrid Seed Production in Different Crops :

Floral biology, seed production planning, Land and isolation requirement, wild pollinators, special agronomic practices, maintenance of varietal purity, field inspection, harvesting and threshing in the following crops-

(1) Maize, (2) Pearl millet, (3) Sorghum, (4) Sun flower, (5) Pigeonpea, (6) Cotton, (7) Hybrid Rice, (8) Hybrid Mustard, (9) Safflower.

Economics of hybrid seed production. Seed Planning.

Unit-IV : History and Objectives of Vegetable

Breeding : History of vegetable crop improvement.

Objectives of vegetative breeding.

Reproduction, pollination control mechanisms. A – Asexual reproduction.

- Vegetable propagation
- Apomixis
- Artificial seeds.

B - Sexual Reproduction

Male gamete formation, female gamete formation, fertilization.

C. Pollination Control Mechanisms :

- a) Flowering habit : Cucurbits, Asparagus, Spinach.
- b) Selfincompatibility
Gametophytic : in *Lycopersicon* sp and *Solanum* sp
Sporophytic : Heteromorphic, Homomorphic
- c) Male Sterility
Genetic male sterility in tomato, brinjal and muskmelon.

Unit-V : Hybridization Techniques in Vegetables.

Raising of crop, equipment required, emasculation and use of gametocide.

Pollination Methods in Vegetables –

6

Hand Pollination, rubbing and hooking – use of electric bees.

5

Breeding Methods in Vegetables –

1. Role of introduction and their utilization collection, maintenance, evaluation, storage.
2. Selection : (a) Pureline selection – Definition, method, achievements.
(b) Single Plant Selection – Procedure, achievements.
(c) Clonal Selection – Collection of clones, testing of clones, achievements.
3. Hybridization with reference to vegetable crops crosses between parents, single cross, double cross, back crosses, triple cross.
Selection procedure in segregation progenies.
Pedigree selection, Bulk method, pure line family method (PLF), single seed descent method.

Unit-VI : Vegetables Seed Production :

Introduction, importance, present status and future prospectus.

Classification of vegetable crops.

Root crops, Bulbous crops, leafy crops, flowering and fruit crops.

Methods of seed production of the under mentioned crops dealing with the aspect of –
Land requirement, seedling/root production, nursery management, planting cultural practices. Breeding method used, plant protection, seed harvesting vegetable cum seed production, drying, grading, seed extraction method, wet-dry methods.

- (a) Tropical Crops :-
Solanaceous : Brinjal, Potato, Chillies,
Tomato. Root Crops :- Radish, Carrot,
Colocacea.
Leaf Vegetable – Spinach (Palak), Trigonella (Methi) etc.
Bulb Crops – Onion etc.
- (b) Temperate Vegetables : Cauliflower, cabbage.

Practicals :

6

Hybrid Seed Production :

- (i) Studies on inflorescence, floral arrangement floral morphology of some important crop plants cotton, pigeonpea, pearl millet, and maize.

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- 6
- (2) Artificial emasculation and pollination studies in maize and cotton.
(3) Studies on protogynous and protandrous nature of flowers in Pearl millet and Sunflower.
(4) Studies on synchronisation problems in Pearl millet, maize and Sunflower.

Vegetable Seed Production :

- (1) Raising of nursery and planting. Nursery requirement and management for different vegetables. Seedling age for transplanting, precautions, irrigation etc.
(2) Floral Biology of Vegetables : Time for opening of flower, time for another maturity, Dehiscence of another hermaphrodite flower.
(3) Study of Pollen grains of Vegetable : Collection of pollen, germination of pollen grains in water, sugar solution, pollen gelly.
(4) Selfing and Crossing techniques in vegetables, cucurbits, solanaceous crops, onion, carrot.
(5) Identification of vegetable seeds. Temperate vegetable, tropical vegetables, temperate-tropical vegetables.
(6) Visit to vegetable breeding farm. Experiments on vegetable seed production. Collection of seeds, separation from pulp, drying etc.

Practical Examination :

Distribution of Marks :

Marks : 50

- | | |
|---|----|
| 1. Describe in details the floral biology of the specimen 'A' classify upto family level. | 10 |
| 2. Raise a nursery bed for the given vegetable sample and describe. | 05 |
| 3. Identify and describe vegetable seeds, specimen and equipments A, B, C, D, E. | 10 |
| 4. Study of pollen germination in Sugar Solution. | 10 |
| 5. Submission of field report | 05 |
| 6. Submission seed specimen and viva-voce. | 05 |
| 7. Record book | 05 |

Books Recommended :-

1. Principles of Plant Breeding field crops : R.W.Allard
2. Plant Breeding : B.D. Singh
3. Practices in Plant Breeding : M.M.Bhandari

4. Cytogenetics and Plant Breeding : Chandrasekharan andParthasarathi
5. Male Sterility in higher Plants : M.L.H.Kaul.
6. Heterosis reappraisal theory and Practice : R.Frankel.
7. Sun flower Science and Technology : Jack F.Carter.
8. Seed Production manual : N.S.C. and Rock feller Publication.
9. Seed Technology : R.L.Agrawal
10. Vegetable Breeding : Bassett M.J. (1986)
11. Vegetable Breeding : Kaloo R.P. (1985)

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Practicals :- Seed Testing :

1. Obtaining working sample, making separation, weighing, identification of purity components and reporting results.
2. Testing of germination substrata and determination of moistureholding capacity of sand.
3. Plotting the seeds for germination, seedling evaluation and re-orting of the results.
4. Tetrazolium testing of agricultural, vegetable and forestry seeds.
5. Moisture testing by oven drying method.
6. Handling of moisture meter and determination of relative efficacy of moisture meter.

Seed Quality Control :

1. Filling of application form for seed certification.
2. Exercise in field area measurement and field map preparation.
3. Checking of seed source, isolation requirements.
4. Observation in field inspection.
5. Identification of objectionable weed plants and inseparable othercrop plants.
6. Study of varietal purity through examination of seeds, seedling and plants, recording of data and filling result forms.

Practical Examination :

Distribution of Marks : Marks : 50

- | | |
|---|----|
| 1. Filling of seed certification form in detail. | 10 |
| 2. Moisture testing by oven dry method / seed germination test. | 10 |
| 3. Identify and describe specimen A, B, C, D and E. | 10 |
| 4. Determination of physical purity of seeds | 05 |
| 5. Preparation of seed samples by using seed triers. | 05 |
| 6. Submission of field visit report and viva-voce. | 05 |
| 7. Record book | 05 |

Books Recommended :-

1. Seed Technology : R.L.Agrawal
2. Seed Biology : K.K.Kozlowski
3. Seed Production Manual : National Seed Corporation and Rockefeller publication.
4. Techniques in seed science and technology : P.K.Agrawal and

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5. A Handbook of Seed Inspectors : Central Seed Committee Ministry of Agriculture.
 6. Indian Minimum Seed Certification Standards : N.S.Tunwar,S.V.Singh.
 7. Principles of Seed Certification and Testing : N.P.Nema.

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BSc.II Semester III
10.ZOOLOGY

There shall be the following paper and practical for B.Sc. Part-II Semester III 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 theory paper of 3 hours duration, as stated below and a practical examination extending for four hours. Every examinee shall offer the following paper of 100 marks (80 for written examination and 20 marks for internal assessment) and a practical examination of 50 marks. Candidates are required to pass separately in theory and practical examination.

Semester III

1)	Paper-I: Life and diversity of Chordata and concepts of evolution	Marks Allotted	
	Written examination.....	80	
	Internal assessment.....	20	
2)	Practical:	50	
	Total:	150 Marks	

Paper -3 S-Zoology

LIFE AND DIVERSITY OF CHORDATA AND CONCEPT OF EVOLUTION

Unit I : Phylum Chordata;

Origin of Chordata.

Protochordates:– Type study: Amphioxus: Habits and habitat , External Characters - Digestive system and feeding, Excretory organs, gonads- Affinities of Amphioxus.

<p style="text-align: center;">6</p> <p>Affinities of Agnatha: Series Pisces: Type study: <i>Scoliodon sarrokavah</i> (Dogfish) – Habits and habitat, External Characters, Digestive system: alimentary canal and digestive glands, Respiratory system: respiratory organ and mechanism of respiration, circulatory System: Structure and working of Heart, major arteries and veins, Lateral line receptors, Migration in fishes-Types, causes and significance.</p> <p>Unit II : Class Amphibia: Type Study – <i>Rana tigerina</i>, Habits and habitat, external characters. Respiratory organs- Circulatory system; Structure of Heart, major arteries and veins, urinogenital system. Parental care in amphibia.</p> <p>Class Reptilia: Type study- <i>Calotes versicolor</i>- Habits and habitat, External characters, circulatory system- Structure of Heart, major arteries and veins. Urinogenital system, snake venom and anti-venom.</p> <p>Unit III : Class Aves: Type study: Pigeon-<i>Columba livia</i> Habits and habitat, External characters, Respiratory system, urinogenital system. Flight adaptations, Migration in birds.</p> <p>Class Mammalia: Primitive mammals: salient features of Prototheria and Metatheria, Morphology of mammalian endocrine glands. Aquatic mammals.</p> <p>Unit IV : Evolution: Meaning and scope, Indirect Evidences of evolution: Evidences of organic evolution- morphological and anatomical, physiological and biochemical, embryological.</p> <p>Unit V : Evolutionary Processes: Natural selection: Darwinism, Lamarckism. Speciation - definition of species – mode of speciation – Allopatric and Sympatric speciation. Modern concept of organic evolution- Neo Darwinism. Population Genetic : Hardy – Weinberg equilibrium, Gene pool, Gene frequency, Genetic drift, Convergent, Divergent and Parallel evolution, Coevolution</p> <p>Unit VI : Adaptive radiations in mammals. Evolution of Man- brief accounts of Parapithecus, Dryopithecus, Ramapithecus, Australopithecus, Homo creatus Neanderthal man, Cro-Magnon man and modern man. Evolution of heart, aortic arches, and urinogenital systems of vertebrates</p>	<p style="text-align: center;">6</p> <p>Animal Adaptation: Desert aquatic and terrestrial.</p> <p>REFERENCE BOOKS:</p> <ol style="list-style-type: none"> 1. Integrated Principles of Zoology, 7th Edition, Hickman, C.P. Jr., F.M. Hickman and L.S. Roberts, 1984. Times Mirror/Mosby College Publication. St. Louis. 1065 pp. 2. A life of Vertebrate – K.Z. Young, ELBS Oxford University Press. 3. A Text Book of Chordates – H.S. Bharmah and Kavita Juneja. 4. Modern Text Book of Zoology Vertebrate – R.L. Kotpal, Rastogi Publication Meerut. 5. A Text Book of Chordates – A. Thangamani, S. Prasannakumar, L.M. Narayanan and Arummugam Saras Publication, Nagercoil. 6. A Text Book of Chordate Zoology – R.C. Dalela – Jaiprakashnath Publication Meerut. 7. Chordate Zoology – E.L. Jordan and P.S. Verma, S. Chand and Company New Delhi.
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9. A Text book of Practical Zoology Vertebrate – S.S.Lal, Rastogi. Publication, Meeru
10. Manual of Zoology Vol. II (Chordata), S. Viswanathan (Printers and Publishers) Pvt Ltd., Madras, 891p.

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11. Chordate Zoology and Elements of Animal Physiology, Jordan, E.K. and P.S. Verma, 1995. 10th edition, S. Chand & Co Ltd., Ram Nagar, New Delhi, 1151 pp.
12. Zoology of Chordates, Nigam, H.C., 1983. Vishal Publications, Jalandhar - 144 008, 942.
13. The Phylum Chordata, Newman, H.H., 1981. Satish Book Enterprise, Agra - 282 003, 477 pp.
14. Text Book of Zoology, Vol. II (Chordata), Parker and Haswell, 1964. A.Z.T.B.S. Publishers and Distributors, New Delhi - 110 051, 952 pp
15. Chordate Structure and Function, Waterman, Allyn J. et al., 1971. Mac Millan & Co., New York, 587 pp.
16. Simpson, G.C. 1967 - The meaning of Evolution. Revised Edition – New Haven, Yale University Press.
17. Colbert, E.H. 1969 - Evolution of Vertebrates, Wiley, New York.
18. Mayr, Ernst, 1973 - Animal Species and Evolution. The Belknap Press of Harvard University, Cambridge.
19. Dobzansky, T. 1976 - Genetics and the Origin of Species. Oxford and TBH Publishing Co. New Delhi.
20. Savage, J.M. 1976 - Evolution. Amerind Publishing Co. Pvt. Ltd. New Delhi.
21. Elic. Minkoff, 1983 - Evolutionary Biology, Addison Wesley.
22. Life, Origin, Evolution and Adaption (2002) - Sanjib Chattopadhyay. Books and Allied (p) Ltd.
23. P.S. Verma & V.K. Agrawal. (2008) Cell Biology, Genetics, Molecular Biology, Evolution & Ecology – S. Chand Publications.
24. Dhabade. D.S. I. A. Raja. R.A. > Gulhane. A.P. Charjan. A.K. Patki., And P.S. Patil., A Text Book of Evolution: Sanket Publication. Washim
25. Zoology for Degree Students, Prof. Dr. V.K. Agrawal.

Practical:-

Two practical per week of 3 periods duration. Examination shall be of 5Hrs duration and of 50 marks.

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- A) Taxonomy of Chordata:**
1. General characters and classification of Phylum Chordata:
 2. General characters and Classification up to orders of the following chordates or as per the availability in the laboratory from the major orders, (Specimens or Models):
Protochordata: Herdmania, Doliolum Salpa, Amphioxus.
Agnatha: Petromyzon, Myxine.
Pisces: Scoliodon, Torpedo, Acipenser, Exocoetus, Hippocampus
Amphibia: Ichthyophis, Salamander, Bufo, Hyla.
Reptilia: Varanus, Phrynosoma, Chameleon, Cobra, krait, Russell's viper, Typhlops, Hydrophis
Aves: Duck, Woodpecker, Kingfisher, Parrot.
Mammalia: Mongoose, Squirrel, Manis, Bat., monkey.
- B) Dissections:**
1. Dissection - afferent and efferent branchial vessels, cranial nerves, internal ear of scoliodon.
 2. Dissection - Digestive system, Arterial system, venous system, reproductive system of rat.
 3. Permanent micro-preparations. a. Fish scales. b. Ampullae of Lorenzini. c. Eyeball muscles.
 4. Observations of air bladder in air breathing fishes.
- C) Osteology.** Rabbit, Varanus (excluding loose bones of skull).
- D) Evolution:**
1. Study of fossils, including living fossils.
 2. Study of Evidences of evolution.
 - i) Analogous and Homologous organs.
 - ii) Connecting links (Peripatus, Archaeopteryx, Limulus)
 - iii) Embryological evidences
 3. Application of Hardyweinberg's law
 4. Study of Mesozoic Reptiles (By Models/Charts).
 5. Mimicry, coloration in animals.
 6. Beak and Leg modifications with reference to: Parrot, Woodpecker, Kingfisher, Heron, Duck, Sparrow/Pigeon Hawk/Kite, Owl.

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E) Histological Slides :- Amphioxus, Frog, Rat

Slides :

Amphioxus: T.S, Oral hood, Pharynx, Tail

Frog :- T.S. lung, Stomoch, Kidney, T.S. Intestine,

Rat :- T.S. Liver, Pancrease, Ovary, Testies, Pituitary, Thyroid, Adrenal

**DISTRIBUTION OF
MARKS FOR
PRACTICAL EXAMINATION.**

1. Dissection -	10
2. Permanent stained micro preparation.	05
3. Spotting. (Specimens, Slides, bones, fossil)	10
4. Practical on evolution -	10
5. Class record	05
6. Viva - Voce	05
7. Submission of study tour report.	05

Total Marks: 50

**BSc.II
Semester IV
ZOOLOGY**

There shall be the following paper and practical for B.Sc. Part-II Semester IV 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 theory paper of 3 hours duration the semester, as stated below and a practical examination extending for four hours. Every examinee shall offer the following paper of 100 marks (80 for written examination and 20 marks for internal assessment) and a

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Distribution of marks for the practical examination.	
Q1 Identification of spots I to X	15 Marks
Q2 Water analysis experiment.	10Marks
Q3 Dissection of pituitary gland OR Preparation and administration of pituitary extract	10 Marks
Q4 Identification of fish pathogens.	05 Marks
Q5 Record and field diary	05 Marks
Q6 Viva voce	05 Marks

Total: 50	
Marks	

REFERENCES	
<ol style="list-style-type: none"> 1. Principles and practices of pond aquaculture. A state of the art review. Lemman, J.F.,R.O., Smitherman and G.Tehobanglous (Eds.), 1983, Oregon State University, U.S.A. 2. Giant Prawn farming, New, M.B.(Ed.) Elsevier Scientific Publishing Co.,Amsterdam. 3. Freshwater prawn farming : A manual for the culture of M.Rosenbergii new, M.B. and S.Sngholka, 1982, FAO, Fish.Tech.Pap225,FAO,Rome. 4. The Biology and culture of Tilapias, Pullin, R.S.V. and R.H. Lowe-Mcconel (Eds.), 1982. ICLARM Conference Proceedings, 7, ICELARM, Manila, Philippines. 5. Standard methods for the examination of water and waste water. APHA, 1981, American Public Health Association, Washington, D.C. 6. The theory and practice of induced breeding in fish. Harvey, B.J. and W.S. Hoar, 1979, IDRC-TS 21e. IDRC, Ottawa, Canada. 7. Bivalve Culture in Asia and the Pacific. Davy, F.B. and M.Graham (Eds.) 1982, IDRC-200e. IDRC-Asia Regional Office, Singapore. 8. Fish and Fisheries of India, Jhingran V.G.,1982. Hindustan Publishing Corporation, New Delhi. 9. Coastal aquaculture in the Indo-Pacific region, 1972. Pillay, T.V.R.(Ed.), Fishing News. 10. Handbook of Tropical aquaculture. Bard, J.1976. Centre Technique Forestier Tropical. Nogent-Sur-Marne,France. 11. Farming Marine fishes and shrimps; a multidisciplinary treatise. Korringa, P. 1976. Elsevier Scientific Publishing company, Amsterdam. 	<ol style="list-style-type: none"> 12. Prawn farming today: Opportunities, techniques and development. Wickins, J.F.1986. Outlook on Agriculture, 15(2):52-60. 13. Fish Pathology. Robers, R.J.(Edd.) 1978. Bailliere Tindall, London. 14. Parasites and diseases of fish cultured in the tropics. Kabata,Z. 1985. Taylor and Frances, London. 15. Integrated agriculture farming systems. Pullin, R.S.V. and Z.H.Shehades (Eds.), 1980. ICLARM Coonference Proceedings, 4, ICLAR. Manila, Philippines. 16. A hatchery manual for the common Chinese and Indian major carps. Jhingran, V.G. an R.S.G.Pullin, 1985, ICLARM. Studies and Reviews 11, ICLARM, Manila, Philippines. 17. Principal diseases of marine fish and shellfish. II Edition, 1990, Vol. 1. Diseases of marine fish, Vol.2. Diseases of marine shellfish. Sindermann, C.J.Academic Press, London. 18. Wyonarovich, E. and L.Horvath, 1980. The artificial propagation of warm water fin fish - A manual for extension. FAO Fisheries Technical paper- 201. 19. Advances in aquaculture, 1979. Food and Agriculture Organization. Fishing News. 20. Planning of aquaculture developement - an introductory guide, 1977, FAO, Fishing News. 21. Handbook of Mariculture: Crustacean aquaculture, 1986. McVey James, P.(Ed.), CRC, Florida. 22. Selection, Hybridization and genetic engineering in aquaculture, 1987. Tiews, K.(Ed.), Heenemann, Berlin. 23. Aquaculture in Asia, 1990. AFSIB, Mangalore. 24. Fish culture, 1962. Hickling, C.F.Faber & Faber. 25. Practical approach to Fresh Water Culture,1985, Malu R.A.,Bharati Publication, Akola. 26. Aquaculture; Farming and husbandry of freshwater and marine organism, 1972. Bardach, J.E.Wiley. 27. Cage aquaculture, 1987. Beveridge, M.C.M. Fishing News. 28. Backyard fish farming, 1990. Bryant, P. and others. Prism Press. 29. Aquaculture, 1979. Reay, P.J.Edward. 30. Perspective in aquaculture development Southeast Asian and Japan, 1988. South Asian Fisheries Development Centre, Aquaculture Deptt. Soafdec.

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Unit-V : Mari culture-culture of edible oysters, mussels, clams, cockles, sea urchins, sea cucumber, etc. Pearl oyster culture. Culture of sea weeds. Important species of cultivable penaeid and non-penaeid.

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<p style="text-align: center;">8</p> <p>Unit-VI : prawns. Tiger prawn culture, fresh water prawn culture. Polyculture of prawns with finfish. Air-breathing fish culture.</p> <p>PRACTICALS</p> <ol style="list-style-type: none"> 1) Collection and analysis of soil and water, samples for physicochemical characteristics; 2) Study of food cycle in a pond, 3) Collection and identification of fish food organisms. 4) Visits to farms to study different systems of aquaculture. 5) Maintenance of brood fish. 6) Preparation of Nursery, rearing and stocking ponds, 7) Identification of aquatic insects, weeds and predators and their control. 8) Water quality analysis, 9) Feed preparation and feeding. Identifications of seed of cultivable fish species. 10) Seed stocking. 11) Examination of plankton from culture ponds. 12) Fish growth, survival and production analysis. 13) Identification of important species of brackish water fishes and shellfishes and their seed. 14) Collection and rearing of brackish water shrimps and fishes. 15) Identification of cultivable species of prawns oysters, mussels, clams, sea weeds, etc. 16) Visits to prawn hatcheries and marine culture centers. <p>Practical Examination Practical Examination will be of six hours duration and for total 50 marks.</p> <p>Distribution of marks for the practical examination.</p> <table style="width: 100%; border-collapse: collapse;"> <tr> <td style="width: 80%;">Q1 Identification of spots I to X</td> <td style="text-align: right;">-15Marks</td> </tr> <tr> <td>Q2 Soil analysis experiment.</td> <td style="text-align: right;">- 10 Marks</td> </tr> <tr> <td>Q3 Identification. of plankton from culture ponds</td> <td style="text-align: right;">- 10 Marks</td> </tr> <tr> <td>Q4 Submission of collection, food preparation, permanent slides</td> <td style="text-align: right;">-05 Marks</td> </tr> <tr> <td>Q5 Record and field diary</td> <td style="text-align: right;">-05 Marks</td> </tr> <tr> <td>Q6 Viva voce</td> <td style="text-align: right;">-05 Marks</td> </tr> <tr> <td colspan="2" style="text-align: right; border-top: 1px dashed black;">-----</td> </tr> <tr> <td colspan="2" style="text-align: right;">Total : 50 Marks</td> </tr> </table>	Q1 Identification of spots I to X	-15Marks	Q2 Soil analysis experiment.	- 10 Marks	Q3 Identification. of plankton from culture ponds	- 10 Marks	Q4 Submission of collection, food preparation, permanent slides	-05 Marks	Q5 Record and field diary	-05 Marks	Q6 Viva voce	-05 Marks	-----		Total : 50 Marks		<p style="text-align: center;">8</p> <p>EQUIPMENTS AND FACILITIES</p> <table style="width: 100%; border-collapse: collapse;"> <tr><td>1. Earthen ponds (0.05-0.1ha)</td><td style="text-align: right;">- 2</td></tr> <tr><td>2. Cement cisterns (25 m2)</td><td style="text-align: right;">- 4</td></tr> <tr><td>3. Portable Chinese hatchery</td><td style="text-align: right;">- 1</td></tr> <tr><td>4. Breeding haps</td><td style="text-align: right;">- 4</td></tr> <tr><td>5. Hatching haps</td><td style="text-align: right;">- 6</td></tr> <tr><td>6. Drag net</td><td style="text-align: right;">- 1</td></tr> <tr><td>7. Hand nets</td><td style="text-align: right;">- 3</td></tr> <tr><td>8. Compound microscopes</td><td style="text-align: right;">- 4</td></tr> <tr><td>9. Ocular micrometers</td><td style="text-align: right;">- 4</td></tr> <tr><td>10. Centrifuge</td><td style="text-align: right;">- 2</td></tr> <tr><td>11. Homogenizers</td><td style="text-align: right;">- 6</td></tr> <tr><td>12. Syringes</td><td style="text-align: right;">- 12</td></tr> <tr><td>13. Needles</td><td style="text-align: right;">- 24</td></tr> <tr><td>14. Catheter</td><td style="text-align: right;">- 3</td></tr> <tr><td>15. Droppers</td><td style="text-align: right;">- 12</td></tr> <tr><td>16. Beakers (assorted)</td><td style="text-align: right;">- 12</td></tr> <tr><td>17. Enamel trays</td><td style="text-align: right;">- 6</td></tr> <tr><td>18. Plastic drays</td><td style="text-align: right;">- 6</td></tr> <tr><td>19. Refrigerator</td><td style="text-align: right;">- 1</td></tr> <tr><td>20. Hot air oven</td><td style="text-align: right;">- 1</td></tr> <tr><td>21. Hand mince</td><td style="text-align: right;">- 1</td></tr> <tr><td>22. Water analysis kit</td><td style="text-align: right;">- 1</td></tr> <tr><td>23. pHmeter</td><td style="text-align: right;">- 1</td></tr> <tr><td>24. O₂ analyzer</td><td style="text-align: right;">- 1</td></tr> <tr><td>25. Spectrophotometer</td><td style="text-align: right;">- 1</td></tr> <tr><td>26. Colorimeter</td><td style="text-align: right;">- 1</td></tr> <tr><td>27. Plankton nets</td><td style="text-align: right;">- 3</td></tr> <tr><td>28. Plastic pools</td><td style="text-align: right;">- 6</td></tr> <tr><td>29. Sieves for soil texture analyses</td><td style="text-align: right;">- 1 set</td></tr> <tr><td>30. Sedgwick Rafter Cells</td><td style="text-align: right;">- 2</td></tr> <tr><td>31. Glass troughs</td><td style="text-align: right;">- 12</td></tr> <tr><td>32. Pressure cooker</td><td style="text-align: right;">- 1</td></tr> <tr><td>33. Millipore filters</td><td style="text-align: right;">- 6</td></tr> <tr><td>34. Autoclave</td><td style="text-align: right;">- 1</td></tr> <tr><td>35. Phase contrast microscope</td><td style="text-align: right;">- 1</td></tr> <tr><td>36. Microtome</td><td style="text-align: right;">- 1</td></tr> </table> <p>Facility for tissues block making, staining and mounting, glassware for Analysis of carbon dioxide, alkalinity and ammonia, petri dishes, test tubes, etc.</p>	1. Earthen ponds (0.05-0.1ha)	- 2	2. Cement cisterns (25 m2)	- 4	3. Portable Chinese hatchery	- 1	4. Breeding haps	- 4	5. Hatching haps	- 6	6. Drag net	- 1	7. Hand nets	- 3	8. Compound microscopes	- 4	9. Ocular micrometers	- 4	10. Centrifuge	- 2	11. Homogenizers	- 6	12. Syringes	- 12	13. Needles	- 24	14. Catheter	- 3	15. Droppers	- 12	16. Beakers (assorted)	- 12	17. Enamel trays	- 6	18. Plastic drays	- 6	19. Refrigerator	- 1	20. Hot air oven	- 1	21. Hand mince	- 1	22. Water analysis kit	- 1	23. pHmeter	- 1	24. O ₂ analyzer	- 1	25. Spectrophotometer	- 1	26. Colorimeter	- 1	27. Plankton nets	- 3	28. Plastic pools	- 6	29. Sieves for soil texture analyses	- 1 set	30. Sedgwick Rafter Cells	- 2	31. Glass troughs	- 12	32. Pressure cooker	- 1	33. Millipore filters	- 6	34. Autoclave	- 1	35. Phase contrast microscope	- 1	36. Microtome	- 1
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3. Freshwater prawn farming : A manual for the culture of *M. Rosenbergii* new, M.B. and S.Sngholka, 1982, FAO, Fish.Tech.Pap225, FAO, Rome.
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14. Parasites and diseases of fish cultured in the tropics. Kabata, Z. 1985. Taylor and Frances, London.
15. Integrated agriculture farming systems. Pullin, R.S.V. and Z.H.Shehades (Eds.), 1980. ICLARM Coonference Proceedings, 4, ICLAR, Manila, Philippines.
16. A hatchery manual for the common Chinese and Indian major carps. Jhingran, V.G. an R.S.G.Pullin, 1985, ICLARM. Studies and Reviews, 11. ICLARM, Manila, Philippines.
17. Principal diseases of marine fish and shellfish. II Edition, 1990, Vol.1. Diseases of marine fish, Vol.2. Diseases of marine shellfish. Sindermann, C.J. Academic Press, London.
18. Wyonarovich, E. and L.Horvath, 1980. The artificial propagation of warm water fin fish - A manual for extension. FAO Fisheries Technical paper- 201.
19. Advances in aquaculture, 1979. Food and Agriculture Organization. Fishing News.
20. Planning of aquaculture development - an introductory guide, 1977, FAO, Fishing News.
21. Handbook of Mariculture: Crustacean Aquaculture, 1986. McVey James, P.(Ed.), CRC, Florida.
22. Selection, Hybridization and Genetic Engineering in Aquaculture, 1987. Tiews, K.(Ed.), Heenemann, Berlin.
23. Aquaculture in Asia, 1990. AFSIB, Mangalore.
24. Fish Culture, 1962. Hicking, C.F. Faber & Faber.
25. Practical Approach to Fresh Water Culture, 1985, Malu R.A., Bharati Publication, Akola.
26. Aquaculture: Farming and husbandry of freshwater and marine organism, 1972. Bardach, J.E. Wiley.
27. Cage Aquaculture, 1987. Beveridge, M.C.M. Fishing News.
28. Backyard Fish Farming, 1990. Bryant, P. and others. Prism Press.
29. Aquaculture, 1979. Reay, P.J. Edward.
30. Perspective in Aquaculture Development Southeast Asian and Japan, 1988. South Asian Fisheries Development Centre, Aquaculture Deptt. Soafdec.
31. Commercial fish farming; with special reference to fish culture in Isreal, 1981. Hefher, B. and Y.Prunigin John Wiley and Sons.
32. Fish and Shellfish farming in coastal waters, 1972. Milne, P.H. Fishing News.
33. Coastal aquaculture in India, 1990. Santhanam, R. & Others, CBS Publications.

34. Project report on breeding of carps with ovaprim in India. Nandeesh, M.C. & Others. AFSIB, Mangalore.
35. Salmon and trout farming, 1988. Laird, L.M. and T. Needham (Eds.), John Wiley & Sons.
36. Trout farming handbook, 1990. Sedgwick, S.D. Fishing News.
37. Culture of Bivalve Molluscs 50 years experience at Conway, 1974. Walne, P.R. Fishing News.
38. Aquaculture of Fresh water Prawns/Macrobrachium species, Goodwin, H.J. and I.A. Hanson. United States Department of Commerce, NTIS.
39. Handbook of shrimp farming, 1991, MPEDA, Cochin.
40. Problems in prawn culture, 1978. Shigeno, K. Amerind Publications.
41. Pond culture of the Malaysian Prawn, Macrobrachy Rosenbergii. Theodore, I.J.S. and Others, USDC, NTIS.

12.

BIOLOGICAL TECHNIQUES AND SPECIFIC MEN PREPARATION (VOCATIONAL)

There shall be a following paper and practical for B.Sc. Part-II Semester III 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 6 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.

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

**Paper 3 S. BTSP.
LABORATORY TECHNIQUES**

- UNIT-I :** Distilled Water - Types of distilled water and their uses, distillation stills, construction and functioning of metal stills, solar stills and glass stills (including triple distilled water stills) proper collection and storage. Amount and types of impurities. What are ion-exchanges and how they work; regeneration of ion exchangers, uses of ion-free water.
- Unit-II :** Cleaning agents (composition) for various types of dirty glassware: pipette cleaners (construction and proper use); removal of hard water marks from glassware; storing of glassware. What is standard joint equipment; proper usage and cleaning; Utility of standard joint equipment.
- Unit-III :** Methods of sterilization of glassware and storage of sterilized glassware. Sterilizable disposable plastic petridishes and injection syringes and their uses. Glass blowing-equipment for glass blowing-safety in handling; cutting and glass blowing.
- Unit-IV :** Solutions- Definition of solute, solvent, molar, molal, normal, weight percent, ppm/ppb; calculation of molecular weight, interconversion between percent molar and normal; methods of dilution and sources of error. pH-What is pH? Methods of determining pH; pH paper; pH indicators and their range and uses in the Biology laboratory. Buffer Solutions-theory of buffering; some standard buffers Acetate, Phosphate, TRIS, TRIS glycine calculation of pH of buffer-solutions.
- Unit-V :** Balances:- Chemical, Physical, analytical, beam, single pan, double pan, top pan, torsion, electrical, spring, parts and working, degree of accuracy and sources of errors. Temperature sensing control devices: thermometer, thermocouples, thermostat-construction,

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PRACTICAL COURSE

1. Preparation of various grades of distilled water.
2. Cleaning of glass wares, microscope slides etc.
3. Use and maintenance of standard joint equipment
4. Sterilization of glassware
5. Glass blowing, cutting glass plates, tubes and rods, bending tubes, drawing Capillary, sealing vials.
6. Use and care of balances.
7. Preparations of solutions, buffers as per theory.
8. Use and care of pH meter.
9. Acid base titration.
10. Preparation and maintenance of aquarium, terrarium.
11. Maintenance of living organisms, plants & animals.
12. Maintenances of museum and herbarium.
13. Water analysis DO, CO₂, BOD, COD, pH, Salinity, Chlorides, nitrates, phosphates, fluorine, silicates, Alkalinity, hardness.
14. Analysis of heavy metals in soil and water -Hg, Cd, Pb.
15. Estimation of plant and animal population in aquatic and terrestrial Ecosystem.
16. Use and maintenance of colorimeter, spectrophotometer and flame photometer

DISTRIBUTION OF MARKS FOR PRACTICAL EXAMINATION

Q 1. Estimation of heavy metals in Soil/water	12
Q 2. Water analysis, any one DO, CO ₂ , alkalinity, Hardness, pH, salinity, Chlorides, Phosphates, nitrates.	10
Q 3. Identification of Phytoplankton/Zooplanktons OR Acid-base titration OR Glass blowing, cutting glass plates	10
Q 4. Minor experiment on Colorimeter/photometer	08
Q 5. Practical record	05
Q 6. Viva-Voce	05
Total :	50

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BOOKS RECOMMENDED

1. Limnology: Welch, McGraw Hill Book Co. N.Y. 2. Principles of Biochemistry: Lehninger A.L., Warth Publisher N.Y.
2. Methods for Physical and Chemical analysis of Fresh waters: Golterman, Clymo and Ohnstand, IBP hand book No. 8 Blackwell Scientific Publications.
3. Fresh water animals of India (An ecological approach): G.T.Tonapi, Oxford & IBH Publishing Co. New Delhi.
4. Text Book of Physiology and General Biology: Dr. R.R.Dhande and G.N.Vankhede, Bajaj Publications, Amravati.
5. Work book on Limnology: A.D.Adoni, Publication MAB Committee, Department of Environment, Govt. of India.
6. Fundamentals of Aquatic Ecosystem: Barnes, A.K. & K.H.Mann., Balckwell scientific Publications, Oxford.
7. Quantitative inorganic analysis: A.I.Vogel, ELBS publisher.
8. Essentials of plant techniques: Dwivedi J.N., Scientific Publishers, Jodhpur.
9. Introduction to plant tissue culture: Dey Dalyankumar, Central Book Agency, Calcutta.
10. Plant Cell and tissue culture: Narayan Swami S. Tata McGraw Hill.
11. An introduction to plant tissue culture: Razdan M.K., Oxford & IBH, New Delhi.
12. Plant Biotechnology: Trevan M.D., TMH, Delhi.
13. Biotechnology: Trehan Keshao, Wiley Est. Ltd.
14. Fundamentals of Biotechnology: Purohit S.S., Agro Biotechnical Publisher, Bikaner.
15. Elements of Biotechnology: P.K.Gupta, Rastogi Publications.

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BSc. Part II. Semester IV BIOLOGICAL TECHNIQUES AND SPECIMEN PREPARATION (VOCATIONAL)

There shall be a following paper and practical for B.Sc. Part-II Semester-IV 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).

List of Books : 4S

- 1) Goon A.M. Gupta M.K. Dasgupta B. (1991): Fundamentals of Statistics, Vol. I World Press, Calcutta
- 2) Gupta S.C. and Kapoor V.K. : Fundamentals of Mathematical Statistics, Sultan Chand.
- 3) J.D. Gibbons : Non-parametric Statistical Inference.
- 4) Croxton F.E. and Cowden D.J. (1969) : Applied General Statistics, Prentice Hall of India.
- 5) Goon A.M., Gupta M.K. Dasgupta B. (1986): Fundamentals of Statistics, Vol.II, World Press Calcutta.
- 6) Guide to current Indian Official Statistics : Central Statistical Organisation. Govt of India, New Delhi.
- 7) Saluja M.P.: Indian Official Statistical Systems, Statistical Publishing Society, Calcutta
- 8) Shrivastava O.S. (1983) : A Textbook of Demography, Vikas Publishing.
- 9) Gupta S.C. and Kapoor V.K. : Fundamentals of Applied Statistics, Sultan Chand.
- 10) Gupta and Mukhopadhyay P.P. : Applied Statistics, Central Book Agency.

List of Practicals : 4S

- 1) Test of significance based on t-test
- 2) Test of significance based on F-test
- 3) Large sample test for single mean and difference of means
- 4) Large sample test for single proportion and difference of proportions
- 5) Non-Parametric Test : Sign test for Univariate and Bivariate distributions.
- 6) Non-Parametric Test : Wilcoxon-Mann-Whitney test.
- 7) Non-Parametric Test : Run test and Median test
- 8) Non-Parametric Test : Kolmogorov- Smirnov Test
- 9) Computation of index number by simple aggregate and Weighted average method.
- 10) Construction of price and quantity index numbers by Laspeyre's Passche's and Fisher's Method
- 11) Applications of time reversal test and factor reversal test
- 12) Construction of cost of living index numbers

- 13) Measurement of linear trend by—
 - i) Graphical Method
 - ii) Method of Semi averages.
 - iii) Method of least squares
 - iv) Method of moving averages
- 14) Measurement of seasonal variations by-
 - i) Method of simple averages
 - ii) Ratio to trend method
 - iii) Ratio to moving average method
 - iv) Method of link relative
- 15) Estimation of price elasticity of demand, income elasticity of demand and cross elasticity of demand.

List of Equipments and instruments required for a batch of students at under graduate statistics laboratory for B.Sc. I, II & Final

- | | |
|---|-----------|
| 1) Twelve digits desk model electronics calculator | – 25 |
| 2) Biometric tables Vol.I and Vol.II | – 05 each |
| 3) Seven figure logarithmic tables | – 10 |
| 4) Statistical Tables (Compiled) | – 10 |
| 5) Random number tables | – 10 |
| 6) A mathematical typewriter | – 01 |
| 7) A duplicating machine | – 01 |
| 8) Personal Computer | – 05 |
| 9) Printer | – 01 |
| 10) Statistical posters and charts | – 01 |
| 11) Software packages, Like Stata, Stat Lab., SPSS/OR other useful packages may be provided in laboratory for practical purpose | |

14. COMPUTER

SCIENCE/COMPUTER APPLICATION/INFORMATION TECHNOLOGY

The examination in Computer Science/Computer Application /Information Technology will comprise one theory paper and practical examination for each semester. The theory paper will be of 3 hour duration and carry 80 marks. The Practical examination will be of 4 Hrs. duration and carry 50 marks.

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

- | | |
|--|----------|
| 1. Programm writing/execution (on group A & B) | 30 Marks |
| 2. Practical Record | 10 Marks |
| 3. Viva-Voce | 10 Marks |

Total : 50 Marks

3S- COMPUTER SCIENCE/COMPUTERAPPLICATION/ INFORMATIONTECHNOLOGY

Object-Oriented Programming with C++ and Web Technology.

Unit-I : Concept of OOP, Comparison with POP, features of OOP, advantages and applications of OOP, Introduction to C++, structure of C++ program, tokens, keywords, identifiers, basic data types & user defined data types, Constants, variables, declaration of variables, dynamic initialization of variables, types of symbolic constants.

Unit-II : Operators : Scope resolution operator, member dereferencing operator, implicit & explicit conversions.

Control structures : if, switch, do..while, while, for statements
Functions: Function prototype, Function calling and returning, their types, inline functions, default arguments, constant arguments, function overloading.

Unit-III : Classes and objects : Data abstraction and, Encapsulation, Data Hiding, class specification, defining objects, accessing class member, defining member functions, Nesting of member function, friend functions, passing objects as arguments, Returning objects from functions.

Constructors : Defining constructor, parameterized constructor, multiple constructors in a class, constructor with default argument, copy constructor,

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destructor.

Unit-IV : Basic elements of communication system, Network concept, advantages, goals, network topologies : Star, ring, completely connected N/W, Hybrid N/W, multipoint n/w, LAN, WAN, OSI model.

Unit-V : HTML: Introduction, Need of HTML application of HTML, Basic structure of HTML, HTML tags and attributes : Adding tags, include attributes < HTML >, < HEAD >, < TITLE >, < BODY >, < P >, < Br >, < HR >, Heading tags, table tags, < LINK >, < IMG >, < ROWSPAN >, < COLSPAN

>, < MARQUEE >, <

BLOCKQUOTE >, < A >, < I >, < B >, list tag, Attributes : align, background colour, text color.

Unit-VI : Style sheet : advantages of style sheet & applications of style sheet, CSS : Introduction, CSS stylesheet properties : Units, classes and ID attributes. Properties : Text, font, colour, background, border, display, height, line, margin, width, CSS with HTML.

Book recommended :

- 1) Object Oriented Programming with C++ : E Balgurusamy TMH.
- 2) Mastering C++ : K.R. Venugopalan
- 3) Programming with C++ : Robert Lafore
- 4) Programming with C++ : R.S. Nisar Ali
- 5) Computer Fundamental and Networking : P.K. Sinha
- 6) Local Area Network : Keiser, TMH, Publication
- 7) Computer Networks : Andrew S. Tanenbaum, PHI.
- 8) HTML in 21 days : Tech media publication
- 9) HTML4 for dummies Mastering by Ed Tittel, IDG Publications.
- 10) HTML4 Unleashed, Professional Reference Edition by Rick Darnell
- 11) C++ for beginners : by B.M. Harwani, SPD Publications

Practicals : Minimum 16 practicals based on

- A. Unit - I, II, III (Minimum 8 practicals)
- B. Unit - IV, V, VI (Minimum 8 practicals)

**4S: COMPUTERSCIENCE /
COMPUTERAPPLICATION /
INFORMATIONTECHNOLOGY
Advanced C++ and Web Designing**

Unit I : Arrays and Pointers : one-dimensional, two-

dimensional arrays, Defining Pointers, arrays of objects, Pointer to objects, this pointer operator overloading : Defining operator overloading, overloading arrays, Binary, and assignment operators, rules for overloading operators.

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Unit-II : Inheritance : Introduction, derived classes, Single inheritance, multiple inheritance, Hierarchical and Hybrid inheritance.

Templates : Function, class, members and Function templates.

Unit-III : Virtual Functions and Polymorphism :- Introduction, Pointer to derived class, dynamic binding, definition of Virtual Function, pure Virtual Functions, Rules For Virtual Functions.

Working with Files : Introduction, Hierarchy of File Stream Classes, opening and closing of Files, File modes, File pointers and their manipulations, File Input/Output with Fstream class.

Unit-IV : Introduction to XML : History of Markup languages, features of XML, Simple XML document, logical structure of XML elements,

Components of XML documents : The document prolog and document instance. CSS with XML.

Unit-V : Document type Definition (DTD): Introduction, need of DTD, declaring elements, element content models, declaring attributes, attribute types : internal and external DTD, entities and their types.

Unit-VI : XML Schemas : Introduction, features, Comparison with DTD, Schema elements, element type element attributes, XML schema data types, converting DTD to schema, Namespaces : Introduction, declaration, default & prefix namespaces, scope of namespaces collision & Applications.

Books Recommended :-

1. Object Oriented Programming with C++ : E Balguruswamy- THM
2. Mastering C++ : K.R. Venugopalan
3. Programming with C++ : R.S. Nisar Ali
4. Mastering XML, Ann Navaro, Chuck White, Linda Burman, BPB Publication.
5. Applied XML Solutions, BPB Publications.
6. Inside XML, BPB Publication
7. Essential XML. Box
8. XML and Related Technology, Kahate
9. XML How to Program Deitel.

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Practicals :-		
Group A: Minimum 08 practicals based on Unit I to III. Group B:	Minimum 08 practicals based on Unit IV to VI	
15. COMPUTERAPPLICATION(VOCATIONAL)		
The examination in Computer Application (Vocational) will comprise one theory paper and practical examination for each semester. The theory paper will be of 3 hour 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 will be as follows :		
1. Practical based on Computer Lab I	15 Marks	
2. Practical based on Computer Lab II	15 Marks	
3. Viva-Voce (based on lab I & II)	10 Marks	
4. Record/Practical Journal	10 Marks	
Total : 50 Marks		
3S: COMPUTERAPPLICATION(VOCATIONAL)		
Visual Basic and RDBMS		
Unit-I : Introduction to VBm, Integrated Development, Environment, Tool bar, Menu Bar, Project explorer, tool box, Property window, form designers, form layout, Immediate windows, Project Objects, Event Properties and Methods.		
Unit- II : Selecting and using controls, command buttons, text box, labels, option buttons, list box, check box, combo box, image object, picture box, line object data control.		
Unit- III : Working with variables, storage of variables, operators, order of operators, conditional and logical operators, Control Structures : IF--then, ENOZF, IF-- ELSE, nested if..Else, SELECT case, goto, I I F (), do loop, for loop, Nested for loop.		
Unit-V : SQL: Components of SQL, Data types, DDL Commands : create, Alter, Drop, for tables and Views, DML Commands : Select, Insert, Update, Delete, DCL Command : Commit, Rollback, ORDER By, GROUP By and Having clause.		
Unit-VI : Functions : Numeric Functions, Character Functions, Conversion Functions, Group Functions. Joins : Equi-join, Non-equi join, Selfjoin, Outerjoin, Unions. Data Integrity : Types of Integrity Constrains, Displaying integrity Constraints:		
Books		
i) Guide to VB - Peternorton-Techmedia		
ii) Mastering VB - Evangelous Petroustos		
iii) Visual Programming 6.0 -Microsoft press programming guide.		
iv) Introduction to DBMS : Majumdar & Bhattacharya		
v) Database Concepts and : Ivon Bayross System for students.		
vi) Programming with SQL : Ivon Bayross		
vii) Understanding Oracle : James Perry, J.Q. Lateer.		
Practicals : Minimum 08 practicals on Unit I to Unit III and Minimum 08 practicals on Unit IV to VI.		
4S: COMPUTERAPPLICATIONS(Vocational)		
Advance VB and RDBMS		

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Unit-I : VB Programms : Programme structure, procedure & Functions, priavate and public procedure, virables Code, Passing data by reference and value, passing control as argument, design time and runtime properties.

Unit-II : Interacting with Data; Database and Visual basic, data Control, advance data Control usage, advanced database control using VB application Wizard.

Unit-III : Printing output in VB : Printing information using print collection, controlling output, scalling output, formatting with fonts, simple VB programs, connection with database.

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Unit-IV : PL SQL, PL SQL block, architecture, data types, type declarations, Control Structure.

Cursor : Types of Cursors, Creating, Opening and fetching cursors, cursor attributes, closing cursors.

Transaction : SET TRANSACTION Command, Savepoint and Rollback segments.

Unit-V : Security concepts, Types of Security, User ID, Security Object, Privileges : types of privileges : GRANT, REVOKE privileges, column passing privilege, Database triggers, procedures.

Unit-VI : Dynamic SQL : Limitations of Static SQL, Basic concept of Dynamic SQL, Dynamic statement execution, Dynamic Queries.

SQL *Forms; creating forms, entering data, running forms, editing forms, creating and running reports.

Books Recommended :

- i) Introduction to DBMS : Mujumdar & Bhattacharya.
- ii) Database Concepts and: Ivan Bayros Systems for students
- iii) Programming with SQL: Ivon Bayros
- iv) Understanding oracle : James Perry, J.Q. Lateer.
- v) Visual Programming 6.0 : Microsoft press Programming guide.
- vi) Guide to VB : Peternorton (Techmedia)
- vii) Mastering VB : Evangelous Petroustos - BPB.

Practicals : Minimum 08 practicals on Unit I to Unit III and Minimum 08 practicals on Unit IV to Unit VI.

16.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.

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- (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.

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<p style="text-align: center;">10</p> <p>(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).</p> <p>Part B</p> <p>(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.</p> <p>(ii) Distribution of 50 marks assigned to practical for (Semester I to V) is as under-</p> <table style="margin-left: 20px;"> <tr> <td>1. Experiment (Construction, testing and performance)</td> <td style="text-align: right;">:</td> <td style="text-align: right;">30 Marks</td> </tr> <tr> <td>2. Practical record</td> <td style="text-align: right;">:</td> <td style="text-align: right;">10 Marks</td> </tr> <tr> <td>3. Viva-voce</td> <td style="text-align: right;">:</td> <td style="text-align: right;">10 Marks</td> </tr> </table> <p style="text-align: center; margin-left: 40px;">Total : 50 Marks</p> <p>(iii) Project will be given to a group of not more than four students.</p> <p>(iv) Teacher may adopt any innovative practice for demonstration of practicals on the aspects given.</p> <p>(v) College/ Department may prepare laboratory manuals of experiments</p> <p style="text-align: center;">3S-Electronics Electronic Devices and Circuits</p> <p>Unit I : Hybrid-parameters & Cascaded amplifiers:</p> <p style="margin-left: 20px;">Hybrid-parameters, transistor equivalent circuit of CE,CB, Analysis of small signal CE amplifiers. Concept of cascaded amplifier, Types of coupling, RC Coupled Amplifier, Single Tuned amplifiers.</p> <p>Unit II : Power Amplifier:</p> <p style="margin-left: 20px;">Classification of power amplifier, Class A, Class B, Class C and Class AB amplifiers, Class A - transformer coupled amplifier, Class-B push-pull amplifier (Construction, working and efficiency of each). Distortion, complementary symmetry Class-B push-pull amplifier.</p> <p>UNITIII: Feedback amplifiers and Oscillators:</p> <p style="margin-left: 20px;">Concept of feedback, feedback theory, positive and negative feedback, advantage of negative feedback,</p>	1. Experiment (Construction, testing and performance)	:	30 Marks	2. Practical record	:	10 Marks	3. Viva-voce	:	10 Marks	<p style="text-align: center;">10</p> <p>physical idea of feedback.(Block diagram only),concept</p>
1. Experiment (Construction, testing and performance)	:	30 Marks								
2. Practical record	:	10 Marks								
3. Viva-voce	:	10 Marks								

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of oscillator, basic elements of oscillator, Barkhausen Criteria of oscillation, concept of tank circuit. RC oscillator-Phase shift and Wein bridge oscillator, LC oscillator- Colpitts and Hartley oscillator, Crystal oscillator.

UNITIV: Operational amplifier and applications:

Difference amplifier(concept, construction and working), block diagram of operational amplifier, characteristics of ideal op amp, concept of virtual ground, parameter of op amp (input impedance, output impedance, open loop gain, close loop gain, CMRR, slew rate, input offset voltage and current, input bias current). Applications: Op amp as inverting and non inverting amplifier, adder, Subtractor, Differentiator and Integrator.

UNITV : Advance applications of Op-Amp:

Solution to simultaneous equation, differential equation for harmonic, damped harmonic oscillator, regenerative comparator, logarithmic amplifier, Astable, Monostable and Bistable multivibrator and its time period (construction and working).

UNITVI: A/D and D/A converter:

Need of A/D and D/A converter.
D/A converter: R-2R ladder type, Weighted resistor, sample and hold circuit, IC ADC, DAC specification.

A/D converter: Single and Dual slope, counter type, successive approximation type, specification, Numerical based on A/D and D/A Converter

Books Recommended:

1. Integrated Electronics by Millman Halkias
2. Principle of electronics by V.K.Mehta
3. Element of electronics by Bagde and Singh
4. Linear integrated Circuits by Ramakant Gaikwad
5. Digital principle and application by Malvino and Leach

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6. Basic electronics by B.L. Thereja (S.Chand and Company)
7. Op-Amp Theory and application by Ramakant Gaikwad

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

1. CE, CB and CC amplifiers, cascaded amplifiers.
2. Power amplifiers.
3. Oscillators.
4. Op-Amp applications.

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5. Op-Amp in Astable, Monostable and Bistable mode.
6. ADC and DAC converter

4S-Electronics

Communication Electronics & Microprocessor 8085

Unit I : Modulation and Demodulation:

Need for modulation, AM theory, Power relation, Theory of FM, Numerical on AM and FM Systems, frequency spectrum of FM. Generation of AM and FM. Collector modulator, diode reactance modulator. Demodulator: diode detector, slope detector.

Transmitter and receiver: Block diagram and working of AM and FM transmitter and receiver.

UNIT III : Fiber Optic Communication :

Introduction, advantages of OFC, types of fibers, internal reflections, numerical aperture. Optical Sources : Semiconductor injection LASER, LED, (power and efficiency characteristics). Optical detectors : Photodiode, PIN diode, Phototransistor.

Optical fiber connection : Jointer and coupler, fiber alignment and joint losses, connector couplers.

UNIT III : Pulse Modulation and Digital Communication

Pulse Modulation, Sampling Theorem PAM, PWM, PPM and PCM (Bandwidth of PCM, Quantizing Noise), application of PCM, Multiplexing Principles : TDM and FDM, Comparison of FDM and TDM.

UNIT IV : Architecture and timings of 8085:

Evolution of microprocessor, microcomputer (Block diagram with function of each block), architecture of Intel 8085 microprocessor, function of each block of 8085, Functional pin diagram and function of all pins of 8085, instruction format. Instruction cycle, fetch and execute operation, machine cycle and state, timing diagram of MOV and MVI instructions.

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UNIT V : Instruction and programming of 8085:

Addressing mode, classification of instruction set of 8085 with examples, concept of stack and stack pointer, PUSH and POP instruction, Concept of subroutine: CALL and RET instruction, Delay subroutine (using one register and register pair).

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