



SHRI SHIVAJI EDUCATION SOCIETY, AMRAVATI'S  
**SHRI SHIVAJI SCIENCE COLLEGE, AMRAVATI**



NAAC Accredited by Grade A with CGPA 3.13 (3rd Cycle)  
UGC awarded status of College with Potential for Excellence (2nd Phase)  
ISO 9000:2015 Certified College

Identified by DST , Govt. Of India for FIST & Sant GadgeBaba Amravati University as Lead College



**4<sup>TH</sup> Cycle  
Assessment & Accreditation by NAAC**

**Criterion-I  
CURRICULAR ASPECTS**

**Curricular Enrichment**

**Q<sub>n</sub>M – 1.3.2**

**Average percentage of courses that include  
experiential learning through project work/field  
work/internship during last five year**

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Accredited by NAAC with 'A' grade with a CGPA of 3.13  
UGC Awarded College with Potential for Excellence ISO 9000:2015 certified College  
Identified by DST for FIST and SGB Amravati University as Lead College

## Shri Shivaji Science College

Shivaji Nagar, Morshi Road, Amravati - 444 603 M.S.

❖ *Founder* : Dr. Panjabrao Alias Bhausahb Deshmukh  
❖ *President* : Hon. Shri Harshwardhan P. Deshmukh  
❖ *Principal* : Dr. G. V. Korpe

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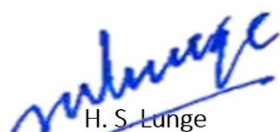
Ref. No.: SSSC/6471/IQAC/2021

Date: Nov. 22<sup>nd</sup>, 2021

### Declaration

The information, reports, true copies of the supporting documents, numerical data, etc. furnished in this file is verified by IQAC and found correct.

Hence this certificate.

  
H. S. Lunge

IQAC Coordinator  
Shri Shivaji Science College  
Amravati



  
G. V. Korpe

Chairman IQAC and Principal  
Shri Shivaji Science College,  
Amravati

## B.sc Direction 2010

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SANT GADGE BABA AMRAVATI UNIVERSITY, AMRAVATI  
DIRECTION

No. : 16/2010 Date : 11/06/2010

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

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

AND

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

AND

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

AND

Whereas, the faculty of Science in its emergent meeting held on 11<sup>th</sup> May, 2010 vide item No.26, has considered, accepted and recommended to Academic Council, the policy decision regarding introduction of Semester pattern and the draft syllabi of B.Sc. Part-I (Semester-

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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).

AND

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

AND

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

AND

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

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

1. This Direction may be called, "Examinations leading to the Degree of विज्ञान स्नातक (Bachelor of Science) (Three Year Degree Course-Semester Pattern), 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 विज्ञान स्नातक (Bachelor of Science) in the faculty of Science-
  - (1) The विज्ञान स्नातक भाग १, सत्र १ व २ (B.Sc. Part-I, Sem-I & II) Examination;
  - (2) The विज्ञान स्नातक भाग २, सत्र ३ (B.Sc. Part-II, Semester-III) Examination;
  - (3) The विज्ञान स्नातक भाग २, सत्र ४ (B.Sc. Part-II, Semester-IV) Examination;
  - (4) The विज्ञान स्नातक अन्त्य, सत्र ५ (B.Sc. Final, Semester-V) Examination; and

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(5) The विज्ञान स्नातक अन्वय, सत्र ६  
(B.Sc. Final, Semester-VI) Examination.

- (ii) The period of Academic Session shall be such as may be notified by the University.
4. (i) The theory examination of Semester-I & II shall be simultaneously conducted by the University at the end of Semester-II in Summer.
- (ii) The examination of Semester-III, IV, V & VI shall be conducted by the University and shall 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. (f) **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 form the following group be selected.

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

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

of examination leading to the degree of Bachelor of Science (additional) in that subject, subject to the following condition.

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

- (B) On securing not less than minimum marks prescribed for the subject / subjects shall be issued a certificate of having passed the examination in the additional subject/subjects as the case may be.
- (C) The application for admission to the examination under (A) above shall be submitted to the Registrar not less than three months before the date of commencement of the examination.”

22. As soon as possible after the examinations the Board of Examination shall publish a list of successful examinees at the B.Sc Part-I, Sem-I & II; B.Sc. Part-II, Sem-III & IV and B.Sc. Final Sem-V & VI Examinations. Such list at the विज्ञान स्नातक अन्त्य (B.Sc. Final) Examination shall be arranged in three Divisions. The names of the examinees passing the examination as a whole in the minimum prescribed period and obtaining the prescribed number of places in First or Second Division shall be arranged in Order of Merit as provided in the Examinations in General Ordinance No. 6.

23. No Person shall be admitted to B.Sc Part-I, Sem-I & II; B.Sc. Part-II, Sem-III & IV and B.Sc. Final Sem-V & VI Examinations, if he has already passed the corresponding or an equivalent examination of any other Statutory University.

24. Successful Examinees at the विज्ञान स्नातक भाग १, सत्र १ व २ (B.Sc. Part-I, Sem-I & II) and the विज्ञान स्नातक भाग २, सत्र ३ व ४ (B.Sc. Part-II, Sem-III & IV) Examination shall be entitled to receive a Certificate signed by the Registrar and successful examinee at the end of विज्ञान स्नातक अन्त्य सत्र ६ (B.Sc. Final, Sem-VI) Examination, shall on payment of the prescribed fees, receive a Degree in the Prescribed form, signed by the Vice-Chancellor.

**Examination Scheme**

विज्ञान स्नातक भाग-१

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

Sr. No.	Subject	Examination Scheme						Total Theory, Pract. & Int.Ass.
		Theory				Practical		
		Max. Mar. Theory Papers	Max. Marks Int. Ass.	Total	Min. pass Marks	Max. Marks Practical	Min. Pass Mar.	
1	Compulsory English	40	10	50	18	—	—	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

**Grand Total of Semester-I: 450+100**

विज्ञान स्नातक भाग-१

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

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

**Grand Total of Semester-I: 450+100**

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Appendix-C

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

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

Grand Total of Semester-III : 450

Appendix-D

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

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

Grand Total of Semester-IV : 450

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Appendix-E

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

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

Grand Total of Semester-V : 450

Appendix-F

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

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

Grand Total of Semester-VI : 450

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

**Appendix-G**

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

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

- 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.



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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 (Appendix-H), examinee shall not be allowed to appear for the practical examination.)

Amravati  
Date : 11/6/2010

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

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Sang Gadge Baba Amravati University, Amravati

DIRECTION

No. : 37 / 2011

Date : 26.7.2011

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

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

AND

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

AND

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

AND

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

AND

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

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

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

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2. This direction shall come into force from the date of its issuance.
3. From the Academic Session 2011-12, theory and practical examinations of each Semester shall be conducted separately at the end of each semester.

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

Amravati  
Date : 26/7/2011

\*\*\*\*\*

**DIRECTION**

No. : 1 / 2012 Date : 23.1.2012

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

Whereas, the Direction No.16 of 2010 in respect of Examinations leading to the Degree of (Bachelor of Science) (Three Year Degree Course – 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 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

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

AND

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

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

1. This Direction may be called "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".

UG Syllabus  
Dept. of Botany

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

Prospectus No. 2017121

संत गाडगे बाबा अमरावती विद्यापीठ  
SANT GADGE BABA AMRAVATI UNIVERSITY

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(FACULTY OF SCIENCE)

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

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**13. BOTANY**

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

1.	Paper – 1		Marks
	a. Theory	-	80
	b. Internal Assessment	-	20
2.	Practical	-	50
		-----	
		<b>Total</b>	<b>150 Marks</b>

**1S – BOTANY****Diversity & Applications of Microbes and Cryptogams****UNIT-I : Plant Diversity (15)**

- 1.1 Cyanobacteria and its impact on origin of life
- 1.2 Introduction to Plant Kingdom: Cryptogams
- 1.3 Diversity of plants with respect to habitat, form, nutrition and ecological status
- 1.4 General Account of Viruses and structure of TMV and HIV
- 1.5 Bacteria: structure, Nutrition and reproduction
- 1.6 Role of microbes in Agriculture, Medicine and Industries

**UNIT-II: Algae (15)**

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

**UNIT-III : Fungi (15)**

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

**Unit-IV : Bryophyte (15)**

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

**Unit-V : Pteridophyte (15)**

- 5.1. Pteridophytes as First Vascular Plants.
- 5.2. Classification according to G. M. Smith
- 5.3. General characters of the following classes with special reference to examples mentioned –
  - 5.3.1. Sphenopsida – Equisetum
  - 5.3.2. Filicopsida – Marsilea
- 5.4. Stele types in pteridophytes
- 5.5 Heterospory and Seed Habit in Pteridophytes

**Unit-VI : Application of Microbes Cryptogams (15)**

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

**LABORATORY EXERCISE :****I ALGAE**

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

**II. FUNGI AND PLANT PATHOLOGY**

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

**III. BRYOPHYTES**

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

**IV. PTERIDOPHYTES**

Study of Pteridophyte external and anatomy features of vegetative and reproductive parts of following genera – Lycopodium, Equisetum, Osmunda, Selaginella, Adiantum, Marsilea and any one fossil specimen

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

**BOOKS RECOMMENDED**

1. Dube, H. C. (1990). An Introduction to Fungi. Vikas Pub. House Ltd. New Delhi.
2. Gangulee, H. C. and Kar, A.K. (2001). College Botany Vol. II. Books and Allied Press Ltd. Kolkata.
3. Krushnamurthy, K. V. (2007). An advanced Text Book on Biodiversity: Principles and Practice. Oxford and IBH Publishing Kumar, H.D. (1988). Introductory Phycology. Affiliated East-West Press Ltd. New Delhi.
4. Kumar, H. D. and Singh, H.N. (1976). A Text Book of Algae. Affili-

**Field Work.**

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

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

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

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

**13. BOTANY****2S – BOTANY****Gymnosperm, Morphology of Angiosperms and Utilization of Plants****UNIT-I : Palaeobotany (15)**

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

**UNIT-II : Gymnosperms (15)**

- 2.1. Classification according to D. D. Pant
- 2.2. General account: morphology, anatomy, life cycle and taxonomic position of Pinus and Gnetum
- 2.3. Affinities with pteridophytes and angiosperms
- 2.4. Economic importance of Gymnosperms

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

- 3.1. Diversity in Plants habits – Annual, biannual, perennials
- 3.2. Roots – Types of root : tap and adventitious, modification of root : for food storage, respiration, and supports.
- 3.3. Stem – Types of Stem, Characteristic features, branching, modification of Stem – Underground

**7. BOTANY****3S- BOTANY****ANGIOSPERMSYSTEMATICS,ANATOMY & EMBRYOLOGY****UNIT I: Angiosperm Systematics and Biodiversity.**

- 1.1 Angiosperms: Origin and Evolution (**Pteridospermean and Bennititalean 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.

**UNIT II: 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,

**UNIT III: 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.

**UNIT IV: 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.

**UNIT V: Anatomy**

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



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.

#### UNIT VI : 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*, **Caesalpinoideae-** *Caesalpineae*, *Cassia*, **Mimosoideae-** *Prosopis*, *Acasia*, **Apiaceae-** *Corindrum*,

**Apocynaceae-** *Vinca*, *Thevetia*, **Asclepiadaceae-** *Cryptostegia*, *Calatropis*, **Solanaceae-** *Datura*, *Solanum*, *Withania*,

**Euphorbiaceae-** *Croton*, *Jatropha*, *Euphorbia*, , **Lamiaceae-** *Oscimum*, *Hyptis*, **Asteraceae-** *Tridax*, *Lagasca* **Verbanaceae –** *Lantana*, *Clerodendron*

**PRACTICAL EXAMINATION****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 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.

## B.Sc. Final Year, Semester-V 7: BOTANY

The examination in Botany of fifth Semester shall comprise of one theory paper, internal assessment and practical examination. Theory Paper will be of 3 Hrs. duration and carry 80 marks. The internal assessment will carry 20 marks. The practical examination will be of 4 hours duration and carry 50 marks.

The following syllabi is prescribed on the basis of six lecturers 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-V (8 marks).

### 5S - BOTANY

#### PLANT PHYSIOLOGY AND ECOLOGY

##### Unit - I: Plant Water Relations

- 1.1 Importance of water to plant life.  
Imbibition , Diffusion, Osmosis, Plasmolysis.
- 1.2 Active and passive Absorption of water.
- 1.3 Ascent of sap - Root Pressure and Transpiration Pull Theory.
- 1.4 Transpiration - Types of transpiration, Stomatal movements, Mechanism of transpiration (Starch ) sugar hypothesis), Significance. Antitranspirant, Guttation.
- 1.5 Mineral uptake - Active uptake - Career Concept, Passive up take - Ion Exchange.

**Unit – II: Metabolism-**

- 2.1 Photosynthesis - Introduction, Role of Light, Photosynthetic Apparatus and Pigments, Two Pigment Systems, Photophosphorylation, C3 and C4 cycle, CAM Pathway.
- 2.2 Respiration - Introduction, Mitochondria as a Respiratory centre, Types of Respiration - Aerobic and Anaerobic, Mechanism of aerobic respiration- Glycolysis, Krebs cycle, Electron transport system and Chemiosmotic ATP generation, Respiratory Quotient.

**Unit – III: Metabolism and growth**

- 3.1 Nitrogen Metabolism- Sources of nitrogen, Symbiotic nitrogen fixation, Role of Nitrate reductase.
- 3.2 Growth - Phases of growth, Growth curve, Physiological role of growth hormones ( Auxins, Gibberellins, Cytokinins, Absciscic acid, and Ethylene).
- 3.3 Physiology of Senescence and Abscission.

**Unit – IV: Plant responses**

- 4.1 Photoperiodism - Concept of Florigen, Role of Phytochrome,
- 4.2 Vernalization- Concept and Significance.
- 4.3 Plant movement- Tropic (Phototropic and Geotropic) and Nastic (Epinasty, Hyponasty and Seismonasty)
- 4.4 Stress physiology- Concept, Types of stress, Water and Salinity stress.

**Unit – V: Ecology and Environment:**

- 5.1 Concept of environment, Concept and scope of ecology.
- 5.2 Ecological factors- Climatic- Light, Temperature and Water.
- 5.3 Atmosphere and its composition.
- 5.4 Edaphic factor- Process of soil formation, soil profile, soil biota and their role.
- 5.5 Ecological Adaptations - Morphological and Anatomical adaptation in Hydrophytes, and Xerophytes.

**Unit – VI: Ecosystem:**

- 6.1 Population Ecology- Natality and Mortality, Community characteristics – Frequency, Density and Abundance
- 6.2 Ecological Succession - Hydrosere and Xerosere
- 6.3 Ecosystem – Definition, Structure and Function,

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Food chain, Food web, Energy flow model (Single channel model)

6.4 Types of Ecosystem- Pond ecosystem, Desert ecosystem.

**LABORATORY EXERCISE :****Plant Physiology: Major experiment (Any Seven)**

1. To study the effect of temperature and organic solvent on permeability of plasma membrane.
2. To study osmotic pressure of cell sap by plasmolytic method.
3. To determine water potential of plant tissue.
4. To determine the path of water (ascent of sap)
5. To determine the rate of transpiration by Ganongs photometer.
6. To determine rate of photosynthesis under varying quality of light and CO<sub>2</sub> concentration.
7. To study the rate of photosynthesis in terrestrial plants with the help of Ganongs Photosynthometer.
8. Separation of chloroplast pigments by paper chromatography/ solvent extraction method.
9. Separation of amino acids by paper chromatography method.
10. To determine R.Q. using different substrates.
11. To determine the rate of respiration by Ganongs respirometer.
12. To study antagonism of salts.
13. To study phenomenon of adsorption.
14. To study effect of IAA and Gibberellins on seed germination.
15. Test for secondary metabolites- Alkaloid, Phenolics, Tannin, Flavonoids and Lignin
16. To study Endo and Exo-osmosis by egg membrane osmoscope

**Plant Physiology: Minor experiment- (Any Three)**

1. To demonstrate fermentation.
2. To demonstrate exo and endosmosis
3. To demonstrate transpiration by Bell jar.
4. To demonstrate light is necessary for photosynthesis
5. To demonstrate anaerobic respiration in germinating seeds.
6. To demonstrate the evolution of CO<sub>2</sub> in respiration.
7. To demonstrate the phenomenon of nastic movement with help of *Mimosa pudica* / or *Biophytum sensitivum*.

**Ecology: Major experiment (Any Three)**

1. Study of morphological and anatomical adaptations in hydrophytes – *Hydrilla*, *Eichhornia*, *Typha*, *Vallisneria* and *Nymphaea* (any two)

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Study of morphological and anatomical adaptations in xerophytes -*Asparagus, Nerium, Casuarina, Euphorbia, Cycas, Opuntia* (any two)

3. Study of community characteristics by quadrat method.
4. Determination of water holding capacity of different soils.
5. To determine the texture of different soils by sieve method.

**Ecology: Minor experiment (Any Two)**

1. To determine the porosity of soil.
2. To determine the transparency and temperature of water bodies.
3. Estimation of salinity of different water samples
4. Determination of pH of different soils and water samples by pH papers/ pH meter.
5. Study of meteorological instruments -Rain gauge, Hygrometer, Barometer

**PRACTICAL EXAMINATION**

**Time: 4 Hours Marks: 50**

Q. 1 -	Physiology- major experiment-	15
Q. 2 -	Comment one Minor Physiology experiment-	5
Q. 3 -	Ecology major experiment.	10
Q. 4 -	Ecology minor experiment.	5
Q. 5 -	Viva – voce	5
Q.6 -	Class record.	5
Q. 7 -	Co-curricular Activity Report	5

**Co-curricular Activity Report**” which mean the report on the activity

Such as Study Tour, Industrial visit to Research Institute, Excursion Tour to be submitted by the students at the time of practical examination.

**Books Recommended:**

**Plant Physiology and Ecology:**

1. Curtis & Clark. : Introduction of Plant Physiology.
2. H.N.Shrivastav. : Plant Physiology
3. Devlin R.M. : Plant Physiology
4. Salisbury F.B and Ross C.W. (1992).: Plant physiology (Fourth Edition) Wadsworth Publishing Company, California,USA.
5. William G. Hopkins. (1995): Introduction to Plant Physiology, Published by – John Wiley and Sons, Inc.
6. V.Verma : Plant Physiology Verlag, New York. Vol. II.

28. Cunningham.W.P. and Saifo S.W. 1997. Environmental Science: A Global Concern WCB. McGraw Hill.
29. Dash M.C. 1993. Fundamentals of Ecology. Tata McGraw Hill Publishing Co. Ltd., New Delhi.
30. Kumar.H.D. 1996. Modern Concepts of Ecology (3rd edition). Vikas Publishing House Pvt., Ltd. Delhi.
31. Kumar.H.D. 1997. General Ecology. Vikas Publishing Pvt. Ltd., Delhi.
32. Miller.W.R. and Donahue. R.L. 1992. Soils-An Introduction to Soil and Plant Growth (6th edition). Prentice Hall of India Pvt. Ltd., New Delhil.
33. Odum.E.P. 1996. Fundamentals of Ecology. Natraj Publishing, Dehradun.
34. Pickering.K.T. and Owen L.A. 1997. An Introduction to Global Environmental Issues (2nd edition). Butter and Tanner Ltd., Great Britain.
35. Smith L.R. and Mith T.M. 1998. Elements of Ecology. (4th edition). Animprint of Addison Wesley, Longman ink. California.
36. Smith.L.R. 1996. Ecology and Field Biology(5th edition). Harper Collns
37. Tyler. M.G. Jr. 1997. Environmental Science: Working with Earth (6<sup>th</sup> edition). Wordsworth Publishing Co.
38. Weaver. J.E. and Clements. S.E. 1966. Plant Ecology. Tata McGraw publishing Co. Ltd. Bombay.
39. Chaudhari M.A. and Gupta K.K. 2009. Practical plant physiology. New Central Book agency Ltd. Kolkata.
40. Bendre: Practical Botany for B.Sc.III year. Rastogi Publications, Meerut.

## Semester-VI

### 6S Botany

The examination in Botany of sixth Semester shall comprise of one theory paper, internal assessment and practical examination. Theory Paper will be of 3 Hrs. duration and carry 80 marks. The internal assessment will carry 20 marks. The practical examination will be of 4 hours duration and carry 50 marks.

The following syllabi is prescribed on the basis of six lecturers

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-VI (8 marks).

## **SEMESTER VI – MOLECULAR BIOLOGY AND BIOTECHNOLOGY**

### **Unit-I : DNA the genetic material :**

- 1.1 Historical account – Giffith 's Expt, Hershy and Chase Expt.
- 1.2 DNA– Chemical composition and Double Helical model,
- 1.3 DNA replication in Eukaryotes;
- 1.4 DNA Packaging - Nucleosome and Solenoid
- 1.5 Satellite, Repetitive DNA and Transposable element in plants (AC-DS system)

### **Unit-II : Gene Structure and Expression -**

- 2.1 Concept of gene, Fine structure of Gene
- 2.2 Gene Expression –  
Central Dogma, Types of RNA, Genetic code, Ribosome as a translation machine
- 2.3 Transcription in Eukaryotes – Mechanism of Transcription and RNA Processing
- 2.4 Translation in Eukaryotes.
- 2.5 Endomembrane system (Flow of Peptide)

### **Unit – III : Regulation of Gene Expression**

- 3.1 Regulation of Gene Expression in Prokaryotes – Operon concept with special reference to Lac Operon
- 3.2 Regulation of gene expression of Eukaryotes – Britton Davidson Model
- 3.3 Protein Folding Mechanism and Structure (Primary, Secondary, Tertiary and Quaternary)
- 3.4 Protein Sorting – Targeting to proteins to organelles
- 3.5 Protein Trafficking

### **Unit-IV : Genetic Engineering -**

- 4.1 Tools and techniques of recombinant DNA technology,
- 4.2 Restriction Enzymes – Nomenclature and Types
- 4.3 Cloning vectors – Plasmids, Phages, Cosmids
- 4.4 Gene Source- Genomic and c-DNA library



- 4.5 Gene Transfer Techniques –  
 Direct - (1) Chemical method, (2) Electroporation, (3) Gene gun method  
 Indirect – Agrobacterium mediated gene transfer
- 4.6 Gene Amplification - \_Polymerase Chain Reaction (PCR)

#### **Unit-V : Plant Tissue Culture -**

- 5.1 Basic aspects of plant tissue culture
- 5.2 Laboratory Requirement –  
 Infrastructure,  
 Instruments (laminar air flow, autoclave, growth chamber),  
 Culture Media (MS Media),  
 Growth Hormone (Auxin, Cytokinin and Gibberellins)  
 Sterilization Techniques
- 5.3 Tissue Culture Technique - Cellular totipotency, differentiation and morphogenesis; Callus Culture; Micro propagation

#### **Unit-VI : Applications of Biotechnology -**

- 6.1 Agriculture – Haploid plant production (Anther and Pollen Culture); Protoplast Culture and Somatic Hybridization; Transgenic Plant - BT Cotton, Synthetic seed. Salient achievements of crop biotechnology
- 6.2 Industry – Fermentation Technology- Bakery Products and Alcohol Productions.
- 6.3 Health Care – Edible Vaccines
- 6.4 Conservation – Cryopreservation, Genetically Modified Organisms: - Pros and Cons

#### **LABORATORY EXERCISE**

##### **1) Molecular biology (Major) (Any One)**

1. Isolation of DNA by crude method
2. Estimation of DNA by Diphenylamine method
3. Estimation of RNA by Orcinol method

##### **2) Molecular biology (Minor) (Any One)**

1. Demonstration of DNA Electrophoresis,
2. Demonstration of double helical model of DNA
3. Demonstration of AC-DS System in Maize kernel
4. Demonstration of Centrifugation

##### **3) Biotechnology (Any Six)**

1. Working Principle and application of Autoclave

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2. Working Principle and application of Laminar Air Flow
3. Cleaning and Sterilization of Glassware
4. Sterilization of Explant
5. Inoculation of Explant
6. Demonstration of in vitro culture techniques – anther and pollen culture
7. Isolation of Protoplast by Mechanical Method
8. Isolation of Protoplast by Enzymatic Method
9. Demonstration of technique of Micropropagation
10. Preparation of Artificial Seed
11. Demonstration of hardening of tissue culture plant
12. Preparation of Tissue culture media
13. Pollen viability test.

**Note:** Visit to molecular biology, biotechnological research institute/  
industry

### **PRACTICAL EXAMINATION**

**Time : 4 hours.**

**Marks : 50**

- |   |          |
|---|----------|
| Que.1 : To perform given Molecular Biology experiment | 15 Marks |
| Que.2 : Comment on minor molecular Biology Experiment | 05 Marks |
| Que.3 : To perform given Biotechnology experiment     | 15 Marks |
| Que.4 : Comment on any one Biotechnology Experiment   | 05 Marks |
| Que.5 : Visit report                                  | 05 Marks |
| Que.6 : Class record/ and viva-voce                   | 05 Marks |

1. Pradip's Botany Vol. V, Biochemistry and Biotechnology- New Millenium Edition
2. Alberts, B.Bray, D.Lewis, J.Raff, M.Roberts, K. and Watson, I.D. 1999. Molecular Biology of Cell - Garland Publishing Co. Inc New York, U.S.A.
3. Gupta, P.K. 1999 : A Text book of Cell and Molecular Biology, Rastogi Publication, Meerut, India.
4. Wolfe, S.L. 1993. Molecular and Cell Biology. Wordsworth Publishing Co., California, U.S.A.
5. Faku, K. and Nakayama S. 1996. Plant Chromosomes. Laboratory Methods. CRC Press, Boca Raton, Florida.
6. Sharma, A.K. and Sharma, A. 1999. Plant Chromosomes : Analysis; Manipulation and Engineering. Harwood Academic Publishers, Australia.
7. Bhojwani, S.S. 1990. Plant Tissue Culture : Applications and Limi-

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

**Fundamentals of Environmental Science – Definition, scope, principles and environmental ethics.**

**Components of Environment: Atmosphere - Definition, structure and composition.**

**Hydrosphere – Definition, distribution of water, hydrological cycle, and global water balance.**

**Lithosphere - Definition, internal structure of earth. Rocks - types and their formation.**

**Biosphere - Definition, boundaries of biosphere.**

(Lectures-14)

**UNIT – II. A. Natural Resources- Definition, classification.**

a). **Water Resources (Freshwater) - types, availability, demand utilization and conservation.**

b). **Forest resources - Distribution, Indian types, utilization and conservation.**

c). **Mineral resources – types, availability, distribution, utilization and conservation.**

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

(Lectures-14)

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

**Solar radiation - concept of insolation and heat budget.**

**Temperature – Horizontal distribution, lapse rate, temperature inversion. Humidity -definition and types.**

**Wind - origin and Earth's surface wind system (doldrums, trade wind belt, prevailing westerlies, and polar easterlies).**

(Lectures-14)

**UNIT – IV. Environmental meteorology-II.**

**Atmospheric pressure, Vapor pressure, saturated vapor pressure, concept of fog.**

**Clouds- definition, formation and types.**

**Precipitation- types (orographic, convectional, cyclonic), forms of precipitation (rain, drizzle, sleet, hail, snow).**

**Monsoon- Meaning origin, Indian monsoon (Bay of Bengal branch and Arabian Sea branch) and significance.**

El-Nino- concept and mechanism.

(Lectures-14)

**UNIT – V. Environmental Geosciences.**

- a. Climatic types and their distribution - Tropical Rainforest, Savanna, Taiga and Tundra with respect to their temperature, wind pattern, precipitation and vegetation.
- b. Geological hazards- Earth quakes, Floods, Volcano's, Cyclones (causes, distribution types and effects).

(Lectures-14)

**UNIT – VI Marine Environment**

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

(Lectures-14)

**Note-**

Visit to:

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

**BOOKS FOR REFERENCE:**

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

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- 37) Vyas Purohit Garg : A Text Book of Gymnosperms.  
 38) Walton : An Introduction & Study of fossil.

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

Time : 4 hours

Marks : 50

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

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

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

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Negative – Parasitism and predation.

(Lectures-14)

UNIT III

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

Characters used in community structures-

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

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

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

UNIT IV

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

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

UNIT V

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

Methods of measurement of productivity- Chlorophyll, O<sub>2</sub>, CO<sub>2</sub> and radioactive.

b) Ecological succession – Definition, causes, types. General process of succession. Hydro sere, xerosere as a succession models. Ecological niche, Ecotone. -144 (Lectures-14)

UNIT VI

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

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

NOTE :-

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

#### BOOKS FOR REFERENCE:

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

- 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, 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.Chand Publication, New Delhi.**
- 27) **Modern Practical Botany, Volume-II, Dr.B.P.Pande, S.Chand Publication, New Delhi.**
- 28) **Modern Practical Botany, Volume-III, Dr.B.P.Pande, S.Chand Publication, New Delhi.**

### & ENVIRONMENTAL SCIENCE

#### 3S- ENVIRONMENTAL CHEMISTRY

- UNIT I: 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.
- UNIT II : 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

**UNIT III: Toxicology-I**

(15 Lectures)

- (1) Definition, Scope, toxicants – definition, sources.
- (2) Factors influencing toxicity (acute, chronic and sub chronic exposures)
- (3) Evaluation of toxicity – acute toxicity –  $LC_{50}$ ,  $LD_{50}$   
Sub acute toxicity test, chronic toxicity test
- (4) Biomagnification, biotransformation and Bioaccumulation.

**UNIT IV: Toxicology-II**

(15 Lectures)

- (1) Routs of exposure, mode of actions and physiological effects of –(a) aldrin, (b) BHC (c) DDT, (d) Synthetics detergents
- (2) Xenobiotics – definition & mechanism of Detoxification
- (3) Bioremediation –definition, types.

**UNIT V: 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.

**UNIT VI: Renewable Energy Resources :**

(15 Lectures)

- (1) Solar Energy – Concept , Solar Collectors, Photovoltaics, Solar Water Heater, Solar Cooling, Solar Ponds, Solar Chimney
- (2) Hydro power - 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.
5. 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.



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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.**

**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. Maccly, 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 ; Narosa publishing, New Delhi.
11. Environmental Chemistry by – R. C. Rsswell ; Edward Armofic Press.
12. Elements of Environmental Chemistry by –H. V. Jadhav; Himalaya pub. House.

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**4S- ENVIRONMENTAL POLLUTION**

- 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)
- UNIT II :** **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)
- UNIT III :** **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)
- UNIT IV :** **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)
- UNIT V :** **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)
- UNIT VI :** **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.

**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 CO<sub>2</sub> 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
<b>Total Marks -</b>	<b>50</b>

- tations, Elsevier Science Publishers, New York. U.S.A.
8. P.K.Gupta Biotechnology.
  9. Lea, P.J. and Leegood, R.C. 1999. Plant Biochemistry and Molecular Biology. John Wiley & Sons, Chichester, England.
  10. Old, R.W. and Primrose, S.B. 1989 : Principles of Gene Manipulation. Blackwell Scientific Publications, Oxford, U.K.
  11. Vasil, I.K. and Thorpe, T.A. 1994. Plant Cell and Tissue culture, Kluwer Academic Publications, the Netherlands.
  12. Devi, P. 2000. Principles and Methods of Plant Molecular Biology, Biochemistry and Genetics, Agrobios, Jodhpur, India.
  13. Smith, R.H. 2000. Plant Tissue Culture; Techniques and Experiments. Academic Press, New York.
  14. Satyanarayan- Biotechnology.
  15. An introduction to industrial Microbiology- Dr. P.K. Sivakumar & Dr. M.M. Joe & Dr. K. Sukesh- S. Chand publication.
  16. Practical Biotechnology and plant tissue culture- Prof. Santosh Nagar & Dr. Madhavi Adhav- S. Chand Publication.
  17. Modern practical Botany (Volume-III)- Dr. B.P.Pandey- S. Chand publication.
  18. Molecular Biology and Biotechnology- K.G. Ramawat & Dr. Shaily Goyal- S. Chand publication.
  19. Comprehensive Biotechnology- K.G. Ramawat & Shaily Goyal- S. Chand publication.
  20. Botany for degree students - B.P. Pandey- S. Chand publication.
  21. A Textbook of Biotechnology- R.C. Dubey- S. Chand publication

#### Semester-V

**8 : Environmental Science**

**5S : Environmental Science**

**(Pollution control technology)**

#### **UNIT-I : General approaches of air pollution.**

- A. Sampling- Ambient and indoor, techniques. Analysis - Cox, Nox, Sox, Spm. Air quality standards, emission standards.
- B. Integrated approach of air pollution control: City planning, zoning, source correction methods. National and International steps to control green house gases.

**UNIT-II: Air Pollution control Techniques.**

- A. Control devices : Gravitational settling chambers; cyclone separators; fabric filters; electrostatic precipitators; wet collectors and scrubbers. Combustion-flaring, thermal incineration, catalytic oxidation. Control of other gaseous pollutants-odour, VOCs, oxides of sulphur and nitrogen emissions.
- B. Auto Gaseous Emission Control - Control of auto-exhausts emissions. Use of after burners, catalytic converters, engine modifications; tuning, importance of good maintenance and driving habits. Alternative fuels.

**Unit-III : Physico-chemical Waste Water Treatment Processes :**

- A. (i) Physical Process - Screening, grit chamber, aeration, oil and grease removal, sedimentation, coagulation, flocculation.  
(ii) Chemical Process - Neutralization, chemical precipitation, adsorption, demineralization.  
(iii) Biological Process - Activated sludge process, trickling filter, UASB (upflow anaerobic sludge blanket).
- B. Sludge - Origin, nature, type, characteristics, treatment and disposal.

**Unit-IV : Solid Waste Disposal**

- A. Management of municipal solid wastes (MSW): Sources, physical composition and characteristics.
- B. Disposal methods; Open-dumping and sanitary landfills. Reduction, reuse and recycling of materials. Optional technologies for processing of MSW: Incineration, gasification, pyrolysis
- C. Hazardous wastes: Sources and characteristics. Safe storage, transport. Treatment of hazardous waste-Stabilization. Disposal of hazardous wastes. Introduction to Biomedical waste-Concept & classification.
- D. Radioactive waste: sources, classification, health and safety aspects. Management of radioactive wastes.

**UNIT-V : Biomedical and Radioactive Waste Treatment**

- A. Biomedical - Introduction, concept, classification, treatment and disposal (Pit, composting and Incineration).
- B. Radioactive waste - Handling, storage and disposal.
- C. Case Studies

**UNIT-VI : Indoor Safety**

- A. Definition and concepts: Precautions in the processes and operations involving explosives, flammables, toxic substances.
- B. Health Safety : Respiratory personal protective equipment (RPPE) & non respiratory personal protective equipment (NRPPE). Selection, use care and maintenance of non respiratory protective equipment. NRPPE: head protection , ear protection , face and eye protection , hand protection, foot protection and body protection.

**Practical – 5**

1. Preparation of windrose diagram of an area.
2. Determination of  $\text{NO}_x$ ,  $\text{SO}_2$  in an ambient air .
3. Measurement of Smoke Density.
4. Elemental analysis of sludge.
5. Estimation of organic matter from soil/sludge.
6. Determination of  $\text{CO}_2$  in the atmosphere by volumetric method.
7. Determination of energy content of plants by Bomb Calorimeter.
8. Determination of physical parameters of
  - i) well water                      ii) Industrial or given type of effluent
  - iii) River Water                  iv) Sea wa
9. Determination of heavy metals (Fe/ Cr /Cu ) by spectrophotometric methods from waste water.
10. Detection/ estimation of Cr (VI) in presence of Cr III
11. Determination of hydrocarbon from fuel gas using Orsat's apparatus
12. Determination of Chemical Oxygen Demand value for industrial waste effluent.
13. Determination of  $\text{NO}_2$  from the atmosphere by colorimetric method using high volume sampler
14. Estimation of mixed liquor suspended solids (MLSS) in activated

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- sludge.
15. Reduction of hardness by ion exchange method.
  16. Estimation of fluoride in waste water.
  17. Determination of energy content in biomass (Bomb Calorimetry).
  18. Estimation of Na<sup>+</sup> and K<sup>+</sup> in water / effluent samples using flame photometer
  19. Calibration of air sampling equipments.
  20. Noise, illumination, ventilation and heat stress measurements - Industry.
  21. Preparation of Material Safety Data Sheet for laboratory chemicals.

**Note:**

1. Visit to Drinking / effluent treatment plant.
2. Industrial visit

**Distribution of practical Marks (Duration 6 hours)**

1. Long Experiments (Water & air)-	20
2. Short Experiment-	10
3. Study visit-	10
4. Practical record-	05
5. Viva-voce-	05

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**Total                    50**

**Equipments :-**

- 1) Flame photometer
- 2) Orsat Apparatus
- 3) COD Reflux assembly
- 4) High volume sampler
- 5) Bomb Calorimeter
- 6) Noise level meter
- 7) Lux meter.

**Reference Books:**

1. Environmental Sciences - Jackson and Jackson
2. Environmental Sciences - Tuckeer (1990)
3. Introduction to Environmental Chemistry – A.K.De
4. Pollution control in process industries – S.P.Mahajan. Tata McGraw Hill pub. New Delhi
5. Water and Waste water technology – M.J.Hammer, John Wiley & sons, New York 1986.
6. Introduction to wastewater treatment process – R. S.Ramalho.

10. Air quality management by Stern, A.C. (Ed) 1974
11. Air pollution theory by Crawford.
12. Land pollution , causes and control by Harrusson and Laxon.
13. Soil and water conservation engineering by Schwab, S.D. Prevent. R.K. Edminster, T.W. and Barns, John Willey and sons.
14. Standard Methods for the Examination of water and waste water (1984)APHA,

**Semester-VI**  
**Environmental Science**

**6S : Environmental Science**  
**(ENVIRONMENTAL CONSERVATION & MANAGEMENT)**

- Unit-I** : A) **Environmental Education**: Definition, need, principles and objectives of environmental education, Types of environment education (Formal & Non Formal), stages of environment education, current status of environment education in India.
- B) **Environmental Education & Awareness**: Concept of environmental awareness, methods of environmental awareness, role of environmental education in awareness programmes, Role of NGO's in environmental education; environmental awareness thorough mass media.
- Unit-II** : A) **Mining Environment** : A)Types of mining, issues related with mining management, strategies for conservation of minerals.  
Land Use Pattern, land degradation and land management.
- B) Conservation of wetland, wastelands and mangroves
- Unit-III** : A) **Wild Life Management** - Wild life as a resource. Threats to wild life. Indian board for wild life (IBWL). WWF, Wild life institutes in India. Wildlife poaching. Wild Life Protection Act, 1972, Environmental Protection Act, 1986.
- B) **Biodiversity Conservation** :  
Need of conservation; National policy and goals; methods of biodiversity conservation - in situ conservation (sanctuaries, national parks and bio-



sphere reserve); ex situ conservation (zoo, botanical gardens) convention on biological diversity (CBD), Biodiversity Act 2002.

**Unit-IV : Role of National and International Organization in Environmental Protection :**

- A) IUCN, UNEP, Man and Biosphere Programme (M.B.P.), State Pollution Control Board . Ministry of Environment and Forest (MOEF) .
- B) **Environmental Impact Assessment** - Concept, scope and objectives, EIS, Public participation in EIA, advantages and disadvantages of Public participation.

**Unit-V : A) Environmental Audit :** Definition, purpose, advantages, general approach to environmental audit.

**B) Introduction to Remote Sensing :** Study of Aerial Photographs and Satellite Images. Geographical Information System (Concept and Advantages).

**Unit-VI : A) Sustainable Development:** Concepts and principles of sustainable development.

**B) Statistical Methods :** Mean, mode, media, standard deviation, tabulation of data, types of data, diagrammatic representation and graphical representation of data, regression analysis.

**Practicals based on Papers :**

**A) Experiments on Biodiversity:**

- 1) Determination of Shannon Weiner Species diversity index to terrestrial animal communities.
- 2) Determination of Margalef diversity index to terrestrial animal communities.
- 3) Determination of Kothe's Species Deficit index to aquatic organisms.
- 4) Photographic submission of flora and fauna.

**B) Experiments on Environmental Management :**

- 1) Characterization of wasteland soil.
- 2) Characterization of wetland water.
- 3) Characterization of wetland sediments.
- 4) Visit to nearby mine / quarry
- 5) Survey of Environmental literacy in nearby community.

**C) Experiments on GIS & Remote Sensing:**

- 1) Study of Satellite Images or Aerial Photographs.
- 2) Study and Applications of GPS
- 3) Marginal information of Topo sheet.
- 4) Indexing of Topo sheet.
- 5) To study the conventional signs and symbols from Topo sheet.
- 6) Interpretation of Topo sheet.
- 7) To study of conventional signs and symbols from weather map.
- 8) Interpretation of weather map.
- 9) Scale determination of aerial photograph.
- 10) Mapping of the land use patterns with the help of aerial photographs.
- 11) To study the change in land use pattern of an area with help of aerial photographs and survey if India Topo sheet.

**D) EXPERIMENTS ON EIA:**

- 1) Evaluation of impact of refuses on soil quality.
- 2) Impact of air pollutants on plants leaves.
- 3) To examine the effects biofertilizers versus chemical fertilizers on root ramification and plant growth.
- 4) To evaluate the impact of traffic density on environment.

**Reference Books:**

- 1) Environmental economics for sustainable development – Kumar
- 2) Ecology and economics: an approach to sustainable development – Sengupta
- 3) Environment, Development and sustainability – Bhaskar nath
- 4) Water technology management challenges and choices – A.K. Barua. Biodiversity and environment – S. K. Agarwal
- 5) The Biological Diversity Act. 2002 and Biological Diversity rules 2004 – National Biodiversity Authority India. 475, 9th South cross street, Kalpalocwar Nagar, Neelangarai, Chennai – 600041.
- 6) Biodiversity measurement and estimation – D. L. Hawks
- 7) Biodiversity conservation – Global agreements and national concerns. RAMSAR sites CBD, Quarantine, Regulation, National Forestry policy, Biodiversity Act, Wild life protection Act.
- 8) Environmental Problems and Solutions by Asthana D.K.
- 9) Environmental Management by G.N.Pande
- 10) Pollution Management in Industries by R.K.Trivedi.

9. Sound Level Meter
10. Water Sampler
11. Louvered Box
12. Air Sampler - Tilak
13. Zincondroff Apparatus
14. Stereo Scope
15. Aerial Photograph.

### **Instructions for Project Work :**

The objective of assigning of project work to student is to provide an opportunity to understand and appreciate environmental problems and explore probable solutions based on Empirical Studies. With a view to achieve these objectives. It is Expected that students in consultation with the concerned member of teaching faculty identifies an environmental problem and under take studies during specific period. While defining aim and the scope of the project, feasibility in terms of available time should be duly considered. It would be desirable that the initiation of project work begins in first session by under taking library work under the guidance of concerned teacher. The theme of project should be finalize in all respects at a convenient.

A student is expected to carry out studies as preplanned by going on periodic field visits and carry experimental studies. It is visualize that continuous to the teacher and consultations with him is the essence of successful work on completion of the field work and laboratory work, the



## Shri Shivaji Science College, Amravati

*Accredited by NAAC with A grade with a CGPA of 3.13 (3<sup>rd</sup> Cycle)  
UGC Awarded “College with Potential for Excellence” (Second Phase)  
Identified by DST for “FIST” & SGB Amravati University as “Lead Colleges”*



### **Syllabus** **of** **Skill Based Education** **under** **National Skill Qualification Framework** **by UGC**

**B.Voc. Courses**  
**(Three Year Degree Course)**  
**Forensic Science**  
**Second year (Semester-III)**  
**&**  
**Second year (Semester-IV)**  
**NSQF level- 6 (Advanced Diploma in Forensic Science)**

**Approved by**



**Sector Council**  
**Management & Entrepreneurship and Professional**  
**Skills Council, Delhi**  
**(MEPSC)**  
**&**  
**Sant Gadge Baba Amravati University, Amravati**

**SANT GADGE BABA AMRAVATI UNIVERSITY, AMRAVATI**  
**TEACHING & EXAMINATION SCHEME**  
**DEPLOMA (ONE YEAR), ADVANCE DEPLOMA (TWO YEAR),**  
**BACHELOR OF VOCATION (B.VOC.)**  
**(THREE YEAR DEGREE COURSE - SEMESTER PATTERN)**

**Forensic Science**

**NSQF level- 6**

General Educational Component Credits: **12**

Skill Development Component Credits: **18**

APPENDIX – C

**Semester – III**

Sr. No	Subject Code	Subjects	Teaching Scheme (Hrs/Week)			Credits	Examination Scheme					
			Th.	Pr.	Total		Duration (in Hrs)	Max. Marks			Min. Passing Marks	
								External Marks	Internal Marks	Total Marks	Theory	Practical
1	3 BVCFS 1:	English and Communication Skill -III	3	-	3	3	3	40	10	50	20	
2	3 BVCFS 2:	Applied Computer Skill - III	3	-	3	3	3	40	10	50	20	
3	3 BVCFS 3:	Basics of Forensic Biology-I	3	-	3	3	3	40	10	50	20	
4	3 BVCFS 4:	Basics of Technological Methods in Forensic Science	3	-	3	3	3	40	10	50	20	
5	3 BVCFS 5:	English and Communication Skill -III Lab (Practical)	-	6	6	3	6	25	25	50		20
6	3 BVCFS 6:	Applied Computer Skill - III Lab (Practical)	-	6	6	3	6	25	25	50		20
7	3 BVCFS 7:	Basics of Forensic Biology-I Lab (Practical)	-	6	6	3	6	25	25	50		20
8	3 BVCFS 8:	Basics of Technological Methods in Forensic Science Lab (Practical)	-	6	6	3	6	25	25	50		20
9	3 BVCFS 9:	On the job Training (OJT) Internship / Training / Project	-	10	10	6	9	65	85	150		70
		<b>Total</b>	<b>12</b>	<b>34</b>	<b>46</b>	<b>30</b>	<b>45 Hrs</b>	<b>325</b>	<b>225</b>	<b>550</b>	<b>80</b>	<b>150</b>

**Semester – IV**

APPENDIX – D

Sr. No	Subject Code	Subjects	Teaching Scheme (Hrs/Week)			Credits	Examination Scheme					
			Th.	Pr.	Total		Duration (in Hrs)	Max. Marks			Min. Passing Marks	
								External Marks	Internal Marks	Total Marks	Theory	Practical
1	4 BVCFS 1:	Communication Skills - IV	3	-	3	3	3	40	10	50	20	
2	4 BVCFS 2:	Soft Skill Development -I	3	-	3	3	3	40	10	50	20	
3	4 BVCFS 3:	Basics of Forensic Biology-II	3	-	3	3	3	40	10	50	20	
4	4 BVCFS 4:	Application of Forensic Chemistry	3	-	3	3	3	40	10	50	20	
5	4 BVCFS 5:	Communication Skills - IV Lab (Practical)	-	6	6	3	6	25	25	50		20
6	4 BVCFS 6:	Soft Skill Development -I Lab (Practical)	-	6	6	3	6	25	25	50		20
7	4 BVCFS 7:	Basics of Forensic Biology-II Lab (Practical)	-	6	6	3	6	25	25	50		20
8	4 BVCFS 8:	Application of Forensic Chemistry Lab (Practical)	-	6	6	3	6	25	25	50		20
9	4 BVCFS 9:	On the job Training (OJT) Internship / Training / Project	-	10	10	6	9	65	85	150		70
		<b>Total</b>	<b>12</b>	<b>34</b>	<b>46</b>	<b>30</b>	<b>45 Hrs</b>	<b>325</b>	<b>225</b>	<b>550</b>	<b>80</b>	<b>150</b>

**Notes:**

1. Th = Theory; Pr = Practical; WS= Workshop; LB= Labs; FW= Field Work; IA= Internal Assessment
2. Minimum marks for passing will be 40% of the total marks allotted to that paper/practical.
3. Credit/Calculations:  
 One credit would mean equivalent of 15 periods of 60 minutes each for Theory & Practical.  
 For internship / field work, the Credit Weight are for equivalent hours shall be 50% of that for lectures.  
 The strength of batch of Practical/Workshop/Internship/Field visit/Production for under graduate class shall be 10 with an additional; of 10% with the permission of Hon'ble Vice-Chancellor.



## APPRENTICESHIP CURRICULUM for BVoC (Forensic Science)

Name of the College : **Shri Shivaji Science College,**  
with Pin Code **Shivaji Nagar, Morshi Road,**  
**Amravati - 444603 (M.S.)**

Name of the Affiliating : **Sant Gadge Baba Amravati University**  
**University, Amravati – 444603**  
**(Maharashtra)**



### National Apprenticeship Promotion Scheme

The B.Voc. Program in **Forensic Science** shall be for duration of three years consisting of six semesters and is a judicious mix of skills relating to professional education and general education on credit based system.

The successful students will be awarded Certificate/Diploma/Advanced Diploma/Degree in both Skills and General education components of the Curriculum. All the candidates continuing to diploma courses or further will be treated at par from the second semester onwards.

Students may exit after six months with certificate (NSQF Level 4) or may continue for diploma or advance diploma level courses.

Cumulative credits awarded to the learners in skill based vocational courses:

NSQF level	Skill Component Credits	General Education Credits	Total Credits for Award	Normal Duration	Exit Points / Awards
4	18	12	30	One Sem	Certificate
5	36	24	60	Two Sem	Diploma
6	72	48	120	Three & Four Sem	Advanced Diploma
7	108	72	180	Five & Six Sem	B Voc degree

**SANT GADGE BABA AMRAVATI UNIVERSITY, AMRAVATI**

SYLLABUS PRESCRIBED FOR GENERAL EDUCATION COMPONENT

**B. Voc. PART-II (VOCATION)****Semester - III****General Paper - I****SUBJECT: 3 BVCFS 1: English and Communication Skill -III****Unit-I)** Revisiting English Grammar: Forming questions, Using conditionals, Question tags**Unit-II)** Written Skills: Paragraph writing, Writing newspaper reports**Unit-III)** Comprehension Skills: Converting verbal information into non-verbal and vice-versa Interpreting graphs, charts and diagrams**Unit-IV)** Communication Skills: Short situational conversions, Self-introduction, Short talks**PRACTICALS: 3 BVCFS 5:**

Practical based on above units

**Recommended Books:**

- 1) Bhaskaran & Horsburgh, *Strengthen Your English*, OUP (Unit-1)
- 2) Patil, Valke, Thorat & Merchant, *English for Practical Purposes*, Macmillan (Unit- 2 & 3)
- 3) Dwivedi & Kumar, *Macmillan Foundation English*, Macmillan
- 4) Taylor, Grant, *English Conversational Practice*, Tata McGrw-Hill

**General Paper - II****SUBJECT: 3 BVCFS 2: Applied Computer Skill - III****Unit-I) MIS-Systems Concepts:** Systems approach, Characteristics, Types of Systems, Elements-input, output, environment, Boundary Interface, Feedback & Control**Unit-II) System Life Cycle:** MIS, TPS, OAS, DSS, KWS, Value of information, Information life cycle, Data Vs Information, Components of MIS, characteristics of MIS.**Unit-III) System Analysis & Design:** System development life cycle, Modeling the required system**Unit-IV) E-R diagrams:** ELHs, ECDs, User view of processing, Modeling input-output data.**PRACTICALS: 3 BVCFS 6:**

Practical based on above units

**Recommended Books:**

- 1) Microsoft Office-2008: Gini Courter, Annelte Marquis BPB
- 2) IT Today(Encyclopedia): S. Jaiswal
- 3) A First Course in Computers: Sanjay Saxena
- 4) First Test Book of Information Technology: Srikant Patnaik
- 5) Guide To Microsoft Access: Carl Townsad
- 6) An Introduction To Database Management System: BipinC. Desai (Galgotia Pub.)
- 7) Database Management Design: CSV Murthy (Himalaya)
- 8) Management Information System: Goyal
- 9) Management Information System: Jawadekar (TMH)

**B. Voc. FORENSIC SCIENCE**  
**Semester III – Theory**  
**Skill Development Component Paper - I**

**3 BVCFS 3: Basics of Forensic Biology-I**

Total Marks	Lecture Per Week	Credit
50	3	3

Units with Description	Total Lectures
<b>SEMESTER – III</b>	
<b>UNIT: I – CELL BIOLOGY, ORGANIC AND BIOCHEMICAL COMPOUNDS:</b>	12 Lectures
Cell theory, Cell Structure and Function in Prokaryotes and Eukaryotes. Unicellular and Multicellular organisms Composition of blood, study of blood components and its functions and body fluid analysis. Properties, Classification and function of carbohydrates, proteins, nucleic acids and lipids.	
<b>UNIT: II – PLANT MORPHOLOGY AND ANATOMY:</b>	12 Lectures
Principles of Taxonomy and systems of classification of Angiosperms (Bentham and Hooker) and Gymnosperms (Chamberlain) Mechanical and conducting tissue systems in plants Morphology of root, leaf, stem, flowers Anatomy of mono and dicot roots, leaves and stems - secondary growth, growth rings, calculation of life of wood	
<b>UNIT: III - HUMAN PHYSIOLOGY AND ANATOMY</b>	12 Lectures
Nutrition - BMR, Calorie value, balanced diet, obesity, digestive system. Skeletal Muscle physiology and Nervous system Physiology, coordination systems, brain functions and receptor organs Respiratory system physiology - exchange of gases, process of pulmonary respiration Mechanism of blood circulation, cardiac mechanism. Morphological study of human body parts and regions Microbe-Human interaction	

**Semester III - Practical**

**3BVCFS 7: Basics of Forensic Biology-I -Lab**

Total Marks	Lecture Per Week	Credit
50	6	3

**Practical: - Basic of Forensic Biology-I**

Sr. No.	Name of experiment
1	Qualitative analysis of sugar, proteins, lipids and nucleic acids
2	Study of morphological types of red blood cells
3	Preparation of media and sterilization
4	Study of morphological plant parts any one angiosperm
5	Study of anatomical features of secondary growth in angiospermic
6	Study of conducting tissue, -xylem and phloem elements in angiosperms and Gymnosperms as seen in L.S. and R.C.S.

**Note:** Minimum 05 experiments should be conducted.



**Skill Development Component Paper - II****3BVCFS 4: Technological Methods in Forensic Science**

Total Marks	Lecture Per Week	Credit
50	2	2

Units with Description	Total Lectures
<b>SEMISTER - III</b>	
<b>UNIT: I – INSTRUMENTATION:</b>	12 Lectures
Sample preparation for chromatographic and spectroscopic evidence. Chromatographic methods. Fundamental principles and forensic applications of thin layer chromatography, gas chromatography and liquid chromatography. Spectroscopic methods. Fundamental principles and forensic applications of Ultraviolet-visible spectroscopy, infrared spectroscopy, atomic absorption spectroscopy, atomic emission spectroscopy and mass spectroscopy. X-ray spectrometry. Colorimetric analysis and Lambert-Beer law. Electrophoresis – fundamental principles and forensic applications. Neutron activation analysis – fundamental principles and forensic applications.	
<b>UNIT: II – MICROSCOPY:</b>	12 Lectures
Fundamental principles. Different types of microscopes. Electron microscope. Comparison Microscope. Forensic applications of microscopy.	
<b>UNIT: III – FORENSIC PHOTOGRAPHY:</b>	12 Lectures
Basic principles and applications of photography in forensic science. 3D photography. Photographic evidence. Infrared and ultraviolet photography. Digital photography. Videography. Crime scene and laboratory photography.	

**3BVCFS 8: Technological Methods in Forensic Science Lab**

Total Marks	Lecture Per Week	Credit
50	6	3

**Practical: Technological Methods in Forensic Science Lab**

S. No.	Name of the experiment
1	To determine the concentration of a colored compound by colorimetry analysis.
2	To carry out thin layer chromatography of ink samples.
3	To carry out separation of organic compounds by paper chromatography.
4	To identify drug samples using UV-Visible spectroscopy.
5	To take photographs using different filters.
6	To take photographs of crime scene exhibits at different angles.
7	To record videography of a crime scene.

**Note:** Minimum 05 experiments should be conducted.

**SANT GADGE BABA AMRAVATI UNIVERSITY, AMRAVATI****SYLLABUS PRESCRIBED FOR GENERAL EDUCATION COMPONENT  
B. Voc. PART-II (VOCATION)****Semester - IV****General Component Paper - I****SUBJECT: 4 BVCFS 1: English and Communication Skill –IV**

**Unit-I) Grammar:** Use of modal auxiliaries, Use of passive voice

**Unit-II) Writing:** Summarizing articles and passages, Writing short reviews

**Unit-III) Vocabulary:** Synonyms, Antonyms, Idioms and phrases, Converting idiomatic into plain English and vice versa.

**Unit-IV) Communication Skills:** Group discussion, Short presentations.

**PRACTICALS: 4 BVCFS 5**

Practical based on above units

**Recommended Books:**

- 1) Narayanswamy, K. R., *Success with Grammar and Composition*, Orient Longman (Unit-1 & 2)
- 2) Dwivedi & Kumar, *Macmillan Foundation English*, Macmillan (Unit-3)
- 3) Bhaskaran & Horsburgh, *Strengthen Your English*, OUP (Unit-2)
- 4) Patil, Valke, Thorat & Merchant, *English for Practical Purposes*, Macmillan (Unit-2)
- 5) Taylor, Grant, *English Conversational Practice*, Tata McGraw-Hill

**General Component Paper - II****SUBJECT: 4 BVCFS 2: Soft Skill Development - I**

**Unit-I) Introduction to business communication:** Introduction to sound system of English, Introduction to effective writing, Non-verbal communication.

**Unit-II) Self management techniques:** Self concept, self image & self esteem, Building self confidence, Personal planning and success attitude, Creating the master plan, Active positive visualization and positive attitude, Spot analysis.

**Unit-III) Self motivation & Communication:** Levels of motivation, Power of irresistible enthusiasm, etiquettes and manners in a group, Public speaking, oral and written communication, Body language, Importance of listening and responding, Tips for technical writing.

**Unit-IV) Etiquettes & Team dynamics:**

**Etiquette:** Office etiquettes, mail etiquettes, telephone etiquettes, goal setting and time managements

**Team dynamics:** Introduction to team work, working in teams, personal attitude, conflicts and its resolutions, assertiveness, diversity, Role of career planning in personality development, How to face personal interviews and group discussions.

**Note:**

Self paced learning,  
Industry Awareness  
Assignments and discussions.

**PRACTICALS: 4 BVCFS 6:**

Practical based on above units

**Recommended Books:**

- 1) Personality Development by Rajiv K. Mishra, Rupa & Co.

**B. Voc. FORENSIC SCIENCE**

**Semester IV – Theory**

**Skill Development Component Paper - I**

**4BVCFS 3: Basics of Forensic Biology-II**

Total Marks	Lecture Per Week	Credit
50	3	3

Units with Description	Total Lectures
<b>SEMISTER – IV</b>	
<b>UNIT: I – MICROBIOLOGY AND BIOTECHNOLOGY:</b>	12 Lectures
Microscopy - Principles and types, Historical introduction to microbiology, Basics of Microbiology and concepts of Pure culture techniques. Broad classification of micro-organisms, Western and Southern Blot techniques. Study of pollen grain in forensic science Study of fungi in criminal investigation	
<b>UNIT: II – EVOLUTION AND GENETICS:</b>	12 Lectures
Geological time scale (In short) fossil record and biochemical evidences. Genetic Materials - Structural organization and functions Mendelian Principles, Mendels Laws and Ratio Sex linked inheritance, sex determination and crossing over- DNA and RNA structural types	
<b>UNIT: III – IMMUNOLOGY:</b>	12 Lectures
Immunity and Immune System Structure and interaction of antigens and antibody Virology and Bacteriology - structure, genetics and diseases B cell / T cell development, diversity and recognition Immunoglobulins structure - transplantation and types, immune system disorders. Various types of microbial cultures Failures of Body defenses	

**Semester IV - Practical**

**4BVCFS 7: Basics of Forensic Biology-II Lab**

Total Marks	Lecture Per Week	Credit
50	6	3

<b>Practical: Basic of Forensic Biology-II</b>	
Sr. No.	Name of the experiment
1	Antigen-antibody reaction (blood groupings)
2	Study of body fluids
3	Radial immune diffusion analysis
4	Isolation of chromosomal DNA
5	To study pollen morphology
6	Chromatography- separation of Amino acids, sugars, lipids using paper chromatography and thin layer chromatography, determination of RF values

**Note:** Minimum 05 experiments should be conducted

**Skill Development Component Paper – II****4BVCFS 4: Application of Forensic Chemistry**

Total Marks	Lecture Per Week	Credit
50	2	2

Units with Description	Total Lectures
<b>SEMISTER – IV</b>	
<b>UNIT: I - PETROLEUM AND PETROLEUM PRODUCTS:</b> Distillation and fractionation of petroleum. Commercial uses of different petroleum fractions. Analysis of petroleum products. Analysis of traces of petroleum products in forensic exhibits. Comparison of petroleum products. Adulteration of petroleum products.	12 Lectures
<b>UNIT: II - CASES INVOLVING ARSON:</b> Chemistry of fire. Conditions for fire. Fire scene patterns. Location of point of ignition. Recognition of type of fire. Searching the fire scene. Collection and preservation of arson evidence. Analysis of fire debris. Analysis of ignitable liquid residue. Post-flashover burning. Scientific investigation and evaluation of clue materials. Information from smoke staining.	12 Lectures
<b>UNIT: III – EXPLOSIVES:</b> Classification of explosives – low explosives and high explosives. Homemade explosives. Military explosives. Blasting agents. Synthesis and characteristics of TNT, PETN and RDX. Explosion process. Blast waves. Bomb scene management. Searching the scene of explosion. Mechanism of explosion. Post blast residue collection and analysis. Blast injuries. Detection of hidden explosives.	12 Lectures

**4 BVCFS 8: Application of Forensic Chemistry Lab**

Total Marks	Lecture Per Week	Credit
50	6	3

**Practical: Application of Forensic Chemistry**

S.No.	Name of the experiment
1	To carry out analysis of gasoline.
2	To carry out analysis of diesel.
3	To carry out analysis of kerosene oil.
4	To analyze arson accelerators.
5	To prepare a case report on a case involving arson.
6	To carry out analysis of explosive substances.
7	To separate explosive substances using thin layer chromatography.
8	To prepare a case report on bomb scene management.

**Note:** Minimum 05 experiments should be conducted

**List of Books: B.Voc. Forensic Science: Second Year B.Voc.****Basics of Forensic Biology:**

1. Principles of Biochemistry by Lehninger
2. Harper's Biochemistry by Murray
3. Physical Chemistry by Atkins
4. Physical Chemistry by Castellan
5. Biological Spectroscopy by Lalcowicz
6. Analytical Biochemistry by Holme
7. Enzyme Kinetics by Plowman
8. Enzyme Structure and Mechanism by Ferst
9. Biophysical Chemistry by Upadhyay
10. Biochemistry by Satyanarayam
11. Microbiology by Pelczar
12. Microbiology by Devis
13. General Microbiology by Powar- Dagainawala
14. Cell Biology by Powar
15. Principles of genetics by Gardner
16. DNA Cloning by Glover
17. Molecular Cloning by Maniatis
18. Fundamental Immunology by Paul
19. Essential Immunology by Roitt
20. Molecular Biology of Gene by Watson
21. Transgenic animals by Grosveld
22. Transgenic Plants by Hiatt
23. Industrial Microbiology by Casida
24. Nucleic acid and protein sequence analysis- A practical approach by Bishop
25. Gymnosperms by Chamberlein
26. Flora of Bentham by R. Hooker
27. Genes and Evolution by Jha
28. Plant Anatomy by Faha
29. Ecology by Odum

**Technological Methods in Forensic Science:**

1. Analytical Techniques in Biochemistry & Molecular biology By Rajan Katoch
2. D.A. Skoog, D.M. West and F.J. Holler, Fundamentals of Analytical Chemistry, 6th Edition, Saunders College Publishing, Fort Worth (1992).
1. W. Kemp, Organic Spectroscopy, 3rd Edition, Macmillan, Hampshire (1991).
2. J.W. Robinson, Undergraduate Instrumental Analysis, 5th Edition, Marcel Dekker, Inc., New York (1995).
3. D.R. Redsicker, The Practical Methodology of Forensic Photography, 2nd Edition, CRC Press, Boca Raton (2000).

**Application of Forensic Chemistry:**

1. Analytical Techniques in Biochemistry & Molecular biology By Rajan Katoch
2. J.D. DeHaan, .L rk'IJ VL1) JInv)L ligation, 3rd Edition, Prentice Hall, New Jersey (1991).
3. A.A. Moenssens, J. Starrs, C.E. Henderson and F.E. Inbau, Scientific Evidence in Civil and Criminal Cases, 4th Edition, The Foundation Press, Inc., New York (1995).
4. R. Saferstein, Criminalistics, 8th Edition, Prentice Hall, New Jersey (2004).
5. W.J. Tilstone, M.L. Hastrup Lln GL.G &LlFisher's, GTechniques of Crime Scene Investigation, CRC Press, Boca Raton (2013).
6. S. Ballou, M. Houck, J.A. Siegel, C.A. Crouse, J.J. Lentini and S. Palenik in Forensic Science, D.H. Ubelaker (Ed.), Wiley-Blackwell, Chichester (2013).

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**SEMESTER-IV**  
**4S : GEOLOGY**  
**STRUCTURAL GEOLOGY, TECTONICS AND GEOMORPHOLOGY**

- UNIT I :** Attitude of bed. Clinometer and Brunton compass and its use, Outcrop in relation to topography and structure. Erosional structures – Unconformity: formation, types and recognition. Recognition of unconformities in field and map; Outlier-inlier, onlap, offlap, windows and klippe. Nappe.
- UNIT II :** Stress and strain: definition and types; Interrelationship of Types of deformation plastics, elastic, brittle stress-strain and time, Mohr's Circle, Determination of strain by using initial spherical objects, Deformed conglomerate and bilateral symmetrical fossils.
- UNIT III :** Fold: Definition and terminology; classification – genetic and geometric; recognition of fold in field and map, causes of folding.. Faults: definition and terminology; classification of faults; causes of faulting, recognition of fault in field and map. Foliation and lineation – kinds and origin. Joints : definition and terminology; classification of joints; significance of joints
- UNIT IV :** Isostasy, Geosyncline - Definition, classification and evolution of mountains. Continental drift - evidences of drift. Plate tectonics - types of plate margins, causes of plate movement, evidences of plate tectonics. Sea floor spreading, Palaeomagnetism. Types of mountain and their process of formation.
- UNIT V :** Scope and aim of geomorphology. Fundamental concepts, Exogenic and endogenic processes, Fluvial cycle. Drainage patterns and their significance. Morphometric analysis of drainage basin and their significance.
- UNIT VI :** Soil formation and soil profile ,Concept of morphometric regions, karst topography, fluvial landforms, aeolian landforms, glacial landforms; Brief idea about applied geomorphology. Tools of geomorphologist.

**PRACTICALS:**

1. Use of Clinometer and Brunton compass
2. Outcrop- its true and apparent thickness, width of outcrop; problems on dip, strike, thickness of beds and width of outcrop (at least 30 problems).
3. Completion of outcrop - problems for conformable series and its structures (at least 10 maps).
4. Section drawing- Identification and interpretation of various landforms, geological successions, structures and geological history. Geological section drawing and interpretation for conformable series (at least 20 maps with different structures).
5. Geomorphology: Computation of gradient of a stream. Morphometric Analysis from topographic maps - determination of linear, aerial and relief aspects

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**SANT GADGE BABA AMRAVATI UNIVERSITY GAZETTE - 2018 - PART TWO - 53**


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**PRACTICAL EXAMINATION:**

The Practical Examination will be four hour duration and carries 50 marks. The distribution of marks will be as follows-

I. Problems on Dip, Strike, Thickness of Beds and width of outcrop maps (One problem)	06 Marks
II. Completion of outcrop maps (One map)	06 Marks
III. Section drawing and interpretation. (One section)	10 Marks
IV. Morphometric Analysis	08 Marks
V. <b>Field Work</b>	10Marks
VI. Viva Voce	05Marks
VII. Practical Record.	05 Marks
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	50 Marks.
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**Field work :** Field work is an Integral part of Geology Syllabus. Every student should attend field work for a short duration and submit field diary, geological specimen collected and a report.

**Reference Books:****Structural Geology:**

1. Bilings, M.P. (1997) Structural Geology. Prentice-Hall of India Pvt. Ltd., New Delhi.
2. Park, R.G. (1989) Foundations of Structural Geology. Blackie, New York.
3. Gokhale, N.W.(2001) Theory of Structural Geology. Blackie, New York.
4. Gokhale, N.W.(1991) A Manual of Problems of Structural Geology. CBS Publishers.
5. Lahi, F.H. (1987) Field Geology, CBS Publishers.
6. Gokhale, N.W. (2001) A Guide to Field Geology. CBS Publishers.
7. Chipkonkar G.W: Geological Maps, Dastane Ramchandra Publication, Pune

**Tectonics:**

1. Dynamic Earth - Skinner Potter - Pub.John, Wiley.
2. Dynamic Earth – Patwardhan A.M., E E.E Publications, New Delhi.
3. Dynamic Earth- Wiley, John Wiley and Sons, New York.
4. General Geology, Radhakrishnan N. ,V.V.P Pub, Vellore.

**Geomorphology:**

1. Savindrasingh (1998): Geomorphology, Prayag Pushpak Bhavan, Allahabad.
2. Thornbury William D.: Principles of Geomorphology, Wiley Eastern, Pune.
3. Negi B.S.: Geomorphology, Kedernath Ramnath, Meerut.
4. Sharma V.K.: Geomorphology, Earth processes and forms, Tata McGraw Hill Publishing Co., New Delhi.
5. Worcester P.G.: Text book of Geomorphology. Allied Publ.N.Delhi.

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**SEMESTER – VI****6S : GEOLOGY****HYDROGEOLOGY, REMOTE SENSING, ENGINEERING GEOLOGY AND GEOLOGICAL SKILL**

- UNIT I :** Concept of hydrology, hydrogeology and ground water, Hydrologic cycle and its components, Occurrence and distribution of ground water, Water Table; Aquifer and its types – confined, unconfined and semi-confined; Properties of aquifer- porosity, permeability, specific yield, safe yields, storage coefficient, storativity and transmissivity.
- UNIT II :** Recharge and discharge, Cone of depression, Influent and affluent seepages, Springs and its types. Ground water Provinces of India. Geophysical investigations for groundwater exploration, Groundwater and water quality services, Hydrochemical parameters of ground water (Acidity, Alkalinity, Hardness, pH, Conductivity). Recharge through wells and its types. Rain water harvesting,
- UNIT III :** Aerial photographs and its types, Satellite imageries. Methods of studying aerial photographs in the form of stereo-pairs and mosaic. Pocket and mirror stereoscopes, Overlap and sidelap, Drift and crab. Photogeology and elements of photorecognition- tone, texture, shape, size, pattern; Scale of photograph and vertical exaggeration. Guidelines for lithological, structural and geomorphic interpretations. Applications of photogeology. “Introduction and scope of photogeology”.
- UNIT IV :** Concept of remote sensing, types of remote sensing systems (active and passive), Elements of passive remote sensing system (data acquisition and data analysis); applications of remote sensing in studying the natural resources like minerals, ground water, soil and forests. Satellites and Satellite data - introduction and brief history, types of satellites, information obtained with reference to latest IRS & LANDSAT satellites. Sensors – types and their applications.
- UNIT V :** Engineering Geology – introduction, scope and significance; engineering properties of rocks - specific gravity, porosity, crushing strength, compressive strength, and tensile strength. Tunnels - terminology, geological conditions for tunnel sites, tunnels in folded rocks and bedded rocks. Dams – terminology, geological conditions for the selection of dam, Types of dams - Masonary dams (Gravity buttress and Arch types), earthen dams. Landslides - causes, types and prevention of landslides.
- UNIT VI :** Geological skill development - Role of geological expertise in local natural resources investigation, exploration and mining, beneficiation of minerals; Rocks and minerals thin section making, Civil engineering services, Environmental services, . Soil quality testing and conservation services, Laboratory and Research Technician. Geoheritage.

**PRACTICALS: SEMESTER – VI**

1. Plotting of ground water provinces on outline map of India.
2. Problems on determination of aquifer parameters, ground water table maps.
3. Interpretation of aerial photographs and satellite imageries.
4. Field work : Field work is an Integral part of Geology Syllabus. Every student should attend field work for a short duration and submit field diary, geological specimen collected and a report.



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**SANT GADGE BABA AMRAVATI UNIVERSITY GAZETTE - 2019 - PART TWO - 122**


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**PRACTICAL EXAMINATION:**

The Practical Examination will be four hour duration and carries 50 marks. The distribution of marks will be as follows-

I	Plotting of Ground water provinces on outline map of India.	08 Marks
II	Ground water table contour maps	06 Marks
III	Problems on determination of Aquifer Parameters.	10 Marks
IV	Interpretation of Aerial Photographs and Satellite Imageries.	06 Marks
VI	Field Work.	10 Marks
VII	Practical Record	05 Marks
VIII	Viva Voce	05 Marks

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50 Marks

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**Text Books for Sem VI :**

1. Todd, D.K. (1980) Ground Water Hydrology. John Wiley and Sons Inc. New York.
2. Karanth, K.R. (1989) Hydrogeology. Tata McGraw Hill Pub.Co.Ltd., New Delhi.
3. Nagabhushaniah, H.S. (2001) Groundwater in Hydrosphere (Groundwater Hydrology) CBS Publisher, New Delhi.
4. Karanth K.R. Groundwater, Assessment, Development and Management. Tata McGraw Hill Pub. Co. Ltd., New Delhi.
5. Raghunath : Ground Water Hydrology, New Age Publication, Pune.
6. P. Arul Murugan, R.R. Krishnamurthy, in groundwater targeting and coastal hydrogeological studies"
7. Pande, S.N. (1987) Principles and Applications of Photogeology . Wiley Eastern Limited.
8. . Sabish, F.F. (2000) Remote Sensing Principles and Interpretations. W.H. Freeman and Company, USA
9. . Lilesand, T.M. and Kiefer, R.W.(2000) Remote Sensing and Image Interpretation. John Wiley and Sons Inc.,New York.
10. Drury, S.A. (1997) Image Interpretaton in Geology. Chapman and Hall, London.
11. Dr.AFZAL An Introduction to Remote Sensing ;SHARIEFF ;Sarup book Publishers PVT.LTD. , New Delhi.
12. Text Book of Engineering Geology - Parbin Singh, Katson Publishing, Ludhina.
13. R B Gupte, Text Book of Engineering Geology,Published by Pune Vidyarthi Griha Prakashan
14. Hand book of analysis of water sample

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Dept. of Zoology

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

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

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

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

I-Life and diversity of Non-Chordata

1. Observation, Classification up to classes and sketching of the following animals, (Specimens or Models):

- Phylum Protozoa: Plasmodium trophozoite, Euglena, Entamoeba histolytica.
- Phylum Porifera: Sycon, Bath sponge, Euplectella.
- Phylum Coelenterata: Obelia, Aurelia, Tubipora.
- Phylum Helminthes: Fasciola, Taenia, Ascaris (male & female)
- Phylum Annelida: Nereis, Earthworm, Leech, Aphrodite
- Phylum Arthropoda: Prawn, Limulus, Aranea, Scolopendra, July Moth, Mosquito.
- Phylum Mollusca: Chiton, Pila, Dentalium, Unio, Octopus.
- Phylum Echinodermata: Antedon, Holothuria, Echinus, Sea slug, Brittle star
- Phylum Hemichordata: Balanoglossus

2. Study of Permanent slides:

L.S.Sycon, nematocyst, Ascaris egg, T.S. Ascaris and fasciola through gonads, T.S.Leech through crop, T.S.Cockroach gizzard, Compound eye of insect, T.S.Arm of Asterias, T.S.Balanoglossus through different body regions. Larval forms; Amphiblastula, Planula, Trochophore, Bipinnaria, Brachiolaria

3. Dissections: (Live/Preserved Animals)

- Leech/Earthworm: Alimentary canal, Reproductive system, Nervous system,
- i) Grasshopper/Cockroach: digestive system, Nervous system, Reproductive system
- ii) Pila: Nervous system.

4. Mounting :

- Earthworm: Setae, nephridium, nerve ring, spermatheca, ovaries
- Pila: Radula, osphradium, and gill lamella.
- Cockroach: Mouth parts, Salivary gland, trachea. Spiracles, gizzard.

**Distribution of Marks during Practical Examination:**

Time : 4 hrs.

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

iv)	Study tour diary - .....	4 Marks
v)	Permanent stained micro preparation Submitted by examinee - .....	4 Marks
vi)	Certified class record and animal collection - .....	5 Marks
vii)	Check-list of (20) locally available invertebrate fauna .....	2 Marks
vii)	Viva-voce - .....	5 Marks
Total :- .....		50 Marks

Note:

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

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

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

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.

**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	<b>Marks Allotted</b>
Written examination.....	80
Internal assessment.....	20
2) Practical:	50
<b>Total: .....</b>	<b>150 Marks</b>

**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.

**Affinities of Agnatha:**

**Series Pisces:**

Type study: *Scoliodon sarrokawah* (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.

**Unit II : Class Amphibia:**

Type Study – *Rana tigrina*, Habits and habitat, external, characters. Respiratory organs- Circulatory system; Structure of Heart, major arteries and veins, urinogenital system.. Parental care in amphibia.

**Class Reptilia:**

Type study- *Calotes versicolor*- Habits and habitat, External characters, circulatory system- Structure of Heart, major arteries and veins. Urinogenital system, snake venom and anti-venom,

**Unit III : Class Aves:**

**Type study:** Pigeon-*Columba livia* Habits and habitat, External characters, Respiratory system, urinogenital system. Flight adaptations, Migration in birds.

**Class Mammalia:**

Primitive mammals: salient features of Prototheria and Metatheria, Morphology of mammalian endocrine glands. Aquatic mammals.

**Unit IV : Evolution: Meaning and scope,**

**Indirect Evidences of evolution:** Evidences of organic evolution- morphological and anatomical, physiological and biochemical, embryological.

**Direct evidences of evolution:** Paleontological evidences: Fossils and fossilization: petrified fossils dead and preserve bodies cast and moulds, trails and foot prints, condition for fossilizations.–, Radioactive carbon dating of fossils - Living fossils. Importance of fossil record. Evidences from connecting links- Peripatus and Archaeopteryx.

- A) Taxonomy of Chordata:**
- General characters and classification of Phylum Chordata:**
  - 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:**
- Dissection - afferent and efferent branchial vessels, cranial nerves, internal ear of scoliodon.
  - Dissection - Digestive system, Arterial system, venous system, reproductive system of rat.
  - Permanent micro-preparations .a. Fish scales. b. Ampullae of Lorenzini. c. Eyeball muscles.
  - Observations of air bladder in air breathing fishes.
- C) Osteology.** Rabbit, Varanus (excluding loose bones of skull).
- D) Evolution:**
- Study of fossils, including living fossils.
  - Study of Evidences of evolution.
    - Analogous and Homologous organs.
    - Connecting links (Peripatus, Archaeopteryx, Limulus)
    - Embryological evidences
  - Application of Hardyweinberg` s law
  - Study of Mesozoic Reptiles (By Models/Charts).
  - Mimicry, coloration in animals.
  - Beak and Leg modifications with reference to: Parrot, Woodpecker, Kingfisher, Heron, Duck, Sparrow/Pigeon Hawk/Kite, Owl.

**D) 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 PRACTICALEXAMINATION.**

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 practical examination of 50 marks. Candidates are required to pass separately in theory and practical examination.

Marine ecosystem: Characteristics, salinity, temperature - pressure, zonation and stratification Estuarine ecology: Characteristics types, fauna and their adaptations.

**REFERENCE BOOKS:**

1. Cell Biology, Genetics, Molecular Biology, Evolution & Ecology – P.S.Verma & V.K.Agrawal.
2. Principles of Genetics – S.K.Jain
3. Genetics – P.K.Gupta
4. Applied Genetics – C.Pnmanuel.
5. Genetics: M.W.Strickberger, New York.
6. Principles of Genetics: Sinnot, Dunn and Dobzansky.
7. Principles of Genetics: Edidon Gardner.
8. Genetics. Verma, P.S. and V.K. Agarwal. S.Chand & co. New Delhi
9. Gene VI.Lewin, B. 1998. Wiley Eastern Ltd., New Delhi.
10. Human Genetics. Rothwell, N.V.1979. Prentice Hall of India, New Delhi

**Practical:-**

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

**A) Genetic experiments:**

1. Recording of Mendelian traits in man.
2. Detection of monohybrid and dihybrid cross with the help of plastic beads.
3. Culturing *Drosophila* using standard methods. *Drosophila* – male and female identification, Mutant forms (from pictures)
4. Demonstration of bar bodies.
5. Preparation of human Karyotypes from Xerox pictures.
6. Photo slides for, Turner’s syndrome, Klinefelter’s syndrome, Down’s syndrome
7. Detection of syndrome from chromosome spread picture.
8. Study of following human genetic traits and application of Hardy-Weinberg Principle to them – Baldness, length of index and ring Finger, attached and free earlobes, rolling of tongue, PTC taste. Other notable traits.

**B)Ecology**

1. Use of pH meter for estimation of pH in soil samples, b. Use of pH meter for estimation of pH in water samples
2. Estimation of Dissolved oxygen, salinity, pH, free CO<sub>2</sub>, carbonates and bicarbonates, calcium in water samples.
3. Adaptations of aquatic and terrestrial animals based on a study of museum specimens. Such as rocky, sandy, muddy shore animals, flying and burrowing animals.
4. Study of natural ecosystem and field report of the visit.
5. Field collection methods;
6. Identification of common animals - Soil invertebrate diversity, diversity of birds and mammals in parks / botanical gardens, threats to local biodiversity.
7. Construction of a food web diagram based on a field visit.
8. Mounting of plankton.
9. Qualitative analysis of fresh water plankton

**C)General:-**

1. Visit to a National park or sanctuary, and submission of report.

**DISTRIBUTION OF MARKS FOR PRACTICE EXAMINATION.**

1. Ecological: Estimations -/Analysis	10
2. Spotting. (2Spot from Sec. A & 3 Spot from Section B of 2 Marks each)	10
3. Micro preparation.	05
4. Genetic experiment -	10
5. Class record	05
6. Vīva - Voce	05
7. Submission of study tour report.	05

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**Total Marks : 50**  
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**B.SC. FINAL, SEMESTER-V****10 : ZOOLOGY**

There shall be the following paper and practical for B.Sc. Part-III Semester V 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 a compulsory theory paper of 3 hours duration, as stated below and a practical examination extending for five 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.

**Theory -5 S-ZOOLOGY:****(ANIMAL PHYSIOLOGY AND ECONOMIC ZOOLOGY)**

	Marks Allotted
1) Written examination .....	80
Internal assessment .....	20
2) Practical:	50
<hr/>	
Total: .....	150 Marks

**Paper 5 S-ZOOLOGY****(ANIMAL PHYSIOLOGY AND ECONOMIC ZOOLOGY)****Max. Marks - 100 Total****Period - 75****UNIT I : Respiration:**

Structure of respiratory organs: Gills and Lungs

Mechanism of respiration: regulation of ventilation in lungs, exchange of gases at respiratory surface, Respiratory pigments in animals: Haemoglobin, Haemocyanin, Haemerythrin, chlorocruorin. Transport of gases: O<sub>2</sub> and CO<sub>2</sub> transport, Neurophysiologic control of respiration,

**Circulation:**

Blood : Definition and its constituents, functions of blood. Heart: Structure of human heart, pace maker, Cardiac cycle. Blood coagulation factors, blood groups A, B, O system and Rh-factor.

**UNIT II: Muscle Physiology:**

Types of Muscles: striated, non-striated and cardiac muscles

E.M. Structure and **Chemical** Composition of striated muscle, Neuromuscular junction.

Mechanism of muscle contraction by Sliding filament theory

Physical and Chemical changes during muscle contraction: muscle twitch, tetanus, isometric and isotonic contraction, summation of Stimuli, all or none law, fatigue, rigor mortis.

**UNIT III : Nerve Physiology:** Neuron: E.M. Structure of neuron and Types : Myelinated and non-Myelinated nerve fibres.

Conduction of Nerve impulse, Resting potential, initiation and propagation of action potential, Saltatory transmission, Neurotransmitters (Acetylcholine, dopamine, GABA, Serotonin, Epinephrine, Nor-Epinephrine), Synapse and synaptic transmission

**Chemical co-ordination:** Endocrine system: Hormones and their physiological roles of-

Pituitary, Thyroid, Parathyroid, Adrenal, Islets of Langerhan's,

Hormonal disorders: Dwarfism, Gigantism, Acromegaly, Goiter, Myxoedema, Cretinism, Osteoporosis,

**UNIT IV : Reproductive Physiology:** Estrous and menstrual cycle, hormonal control of reproduction in males and female, Structure and physiology of mammalian Placenta.

**Homeostasis and conservative regulation:** Osmoregulation and ionic regulation in aquatic animals. Osmoregulation in terrestrial animals Ammonotelism, ureotelism and uricotelism.

Thermoregulation in Poikilotherms and Homeotherms.

**UNIT V : Agricultural Zoology: Economic importance of Insects**

**Beneficial insects** – Spider, Mantis, Ladybugs, Damsel bug, Mealybug destroyer, Soldier beetle,

Green lacewing, Syrphid fly, Tachinid fly, Ichneumon wasp

iii) Those Institutions which are already having Zoology museums should not procure museum specimens now onwards and should use charts / slides / models / photographs and digital alternatives in case of need. Those new institutions which are not having Zoology museum in their department should provide learning related to zoological specimens with the help of charts / slides / models / photographs and digital alternatives / and arrange visit of students to already established museums.

a) Spotting (A-F)	12
b) Description and Comments on Topic from Unit V and VI	08
04. Class record duly signed by teacher in charge and certified by H.O.D.	05
05. Study tour report.	05
06. Viva - voce	05

-----  
Total Marks 50  
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**Practicals:**

1. Detection of blood groups in human being.
2. Differential counts of blood.
3. Estimation of hemoglobin percentage with the help of haemometer.
4. R.B.C. count.
5. W.B.C. count.
6. Preparation of haemin crystals
7. Measurement of blood pressure.
8. Action of salivary amylase on starch.
9. Qualitative detection of nitrogenous waste products (Ammonia, urea, uric acid) in given sample.
10. Demonstration of kymograph unit, Respirometer through available resources.
11. Observation and identification of Insect Pests of local crops, and predator insects.
12. Life Cycles of Honey bee, Lac insect, Silk Moth.
13. Histological Slides of major organs of Respiratory systems, circulatory system, Nervous system, Different types of Muscles, Endocrine glands, testis, ovary.
14. Study of locally available fishes, Indian major carps, Exotic carps, Common carp.

**Distribution of marks for practical examination :**

Time: 5 Hrs.          Marks

01. Physiological Expt.	
a) Major.....	10
b) Minor .....	05
02. Economic Zoology & Histology	

**REFERENCES**

1. Prosser and Brown : Comparative Animal Physiology
2. Histological Slides of Respirator systems, circulatory system, Muscles, Nervous system Endocrine glands, Gonads, placenta
3. Guyton : Physiology
4. Best and Taylor : Physiological basis of Medical practice
5. C Hoar, W.S.. General and comparative Physiology. Prentice Hall of India.
6. Lehninger. L.. Biochemistry. W.H. Freeman & co.
7. Nagabushnam, R. Animal physiology. S.Chand & co.
8. Martin, D.W. P.A. Mayes and W.W. Rodwell, Harper's Review of Biochemistry large Medical Publications.
9. Prosser, C.L. and F.A. Brown Comparative Animal physiology. W.B. Saunders.
10. Rama Rao, A.V.S.S.. Biochemistry. UBSPD.
11. Stryer. L. Biochemistry Wiley International
12. Verma, P.S. and V.K. Agarwal.. Animal physiology. S.Chand & co.
13. Wilson, J.A., Principles of Animal Physiology, Macmillan
14. Chatterjee, C.J; Human Physiology (Vol-I and II)
15. Economic Zoology, G.S. Shukla, V.B. Upadhyay (2006)
16. Text Book of Applied Zoology, Pradip. V Jabde (2005).
17. Mac E. Hadley: Endocrinology, Prentice Hall, International Edition, 2000

**B.SC. FINAL, SEMESTER-VI  
ZOOLOGY**

There shall be the following paper and practical for B.Sc. Part-III Semester VI 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 a compulsory

**Syllabus of Bachelor of Computer Application**

B.C.A..Part-I,II & III  
(Sem-Ito VI)

Prospectus No. 20131221

संत गाडगे बाबा अमरावती विद्यापीठ  
SANT GADGE BABA AMRAVATI UNIVERSITY

विज्ञान विद्याशाखा  
(FACULTY OF SCIENCE)

PROSPECTUS  
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5SP3: LAB III: 5ST5-Minimum 16 Practical / Case Studies.

The distribution of marks in Practical examination is given as:

(1) Program writing/ execution based on 5ST6	15 marks.
(2) Case Studies based on 5ST6	15 marks.
(3) Practical Record	10 marks.
(4) Viva-Voce	10 marks.

50 marks.

**Syllabus for B.C.A. Sixth Semester**

**6ST1: .NET Using ASP**

- Unit-I** : **ASP.Net Introduction**-The .Net framework, The .Net Languages, CLR, Types, Objects and Namespaces, Settings for ASP.Net and IIS
- Unit-II** : **Developing ASP.Net Application** - Asp.Net Application, Differences between Web based and Windows based application, Web From fundamentals, Web Controls.
- Unit-III** : Explanation of C#.Net, Validation and Rich Control, State Management, Tracing , Logging and Error Handling
- Unit-IV** : Working With Data-Overview of ADO.Net, ADO.Net Data Access, Data Binding, The Data list ,Data Grid, and Repeater; Files , Streams, and E-Mails.
- Unit-V** : **Advanced ASP.Net**- Component-Based Programming, Custom Control, Caching and Performance Tuning, Implementing Security, Case Studies.

**Books :**

1. The Complete Reference ASP.NET, TATA McGRAW-HILL
2. ASP.NET Black Book.

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**6ST2: CLIENT SERVER TECHNOLOGY**

- Unit I** : Client-Server Technology and its uses, historical development, client-server technology and heterogeneous computing, Distributed Computer, Computing plate forms, Microprocessor integration and client server computing, implementations and scalability.
- Unit II** : Fundamentals of client server design, division of labour, Transition to client-server programming; Interaction of client and server communication Techniques and protocols, implementing client server applications, multitasking with process and threads.
- Unit III** : Scheduling implementations, scheduler internals, primitive Vs non-primitive systems; synchronization-understanding.
- Unit IV** : Semaphores, semaphore implementation in Novell Netware, windows NT and UNIX, Memory-management, Allocation, sharing and manipulating.
- Unit V** : Client server computing with ORACLE-Overview of DBMS, client server relationships, ORACLE and client server computing, using SQL with SQL, \*DBS, the ORACLE tools and design aids, SQL windows & Power Builder.

**Books:**

1. Novell's Guide to client-server Applications : Jaffrey D. Schank and Architecture (BPB Public. 1994)
2. Client/server Computing with ORACLE : Salemi (BPB publications 1994)
3. Client/server computing : Smith and Guengerich (PHI) 1998)
4. Client/server Computing : Dewire (Mc Graw-Hill, International)
5. Client/Server Architecture : Bessen (Mc Graw-Hill, International)
6. Building Client Server Networks : Bay Arinze (TMH, 1997)
7. Power Builder: a guide for Developing : Banbara & Allen Client/Server Applications (Mc Graw-Hill International, 1998)
8. Client/Server System Design and : Vaughn Implementation (Mc Graw-Hill International 1997)
9. Mastering ORACLE-7 Client/Server : Bobrowski Computing (TMH 1998)

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**6ST3: MULTIMEDIA AND ITS APPLICATIONS**

**Unit I** : **Introductory Concepts:** Multimedia, Definition, CD-ROM and the multimedia highway, Uses of Multimedia; Introduction and Hardware: Definition of Multimedia, CD-ROMs and Multimedia applications, Multimedia requirements-Hardware, Software.

**Unit II** : **Multimedia Software:** Basic tools, painting and drawing tools, OCR software, Sound editing programs, Animation devices. Linking multimedia objects, office suites, word processor, spreadsheets presentation tools, Types of Authoring tools card and page based, icon based and time based authoring tools, object oriented tools.

**Unit III** : **Production Building Blocks:** Test-using test in Multimedia, Computers and Text, Font editing and Design tools, Hyper media and Hyper text, Sounds-multimedia system sounds MIDI verses Digital Audio, Audio file formats, Working with sound in Windows, Adding sound.

**Unit IV** : **Production Tips:** Image-creation, making still images, images colors, Image, File format, Animation-principles of animation, making workable animations Video, using video, Broadcast video, Standard, Integrating Computer and TVs, shooting and editing Video, using Recording formats, Video tips, Video Compression.

**Unit V** : **Multimedia Project Development and Case Studies:** Project planning, Estimating, RPFs and Bid proposals, Designing, Producing acquiring and using contents, Testing, CD-ROM Technology and Standards.

Designing for the Word Wide, working on the Web, Text for the Web, Images for the Web, Sound for the Web, Animation for the Web.

**Books:**

1. Multimedia Making It Work (TMH) 1997 : Tay Vaughan
2. Multimedia Power Tools, 2 Edition : Peter Jerram and M. (Random House Electronic Publishing) Gosney

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**6ST4: Software Testing**

**Unit I** : **Principles of Testing:** Context of testing in producing software, Phases of Software Project, Quality Assurance and Quality Control , Testing, Verification and validation concepts ,

**Unit II** : **White Box Testing** : Static testing by Humans, Static Analysis Tools, Structural Testing, Code Functional Testing, Code Coverage Testing, Code Complexity Testing, Challenges in White Box Testing ; Black Box Testing-Need & purpose of Black Box Testing, Requirement based testing, Positive and Negative testing

**Unit III** : **Integration Testing:** Introduction, Top-Down Integration, Bi-Directional Integration, System Integration; System and Acceptance Testing, System Testing Overview, Functional System Testing, Beta Testing, Non-Functional System Testing, Stress Testing, Interpretability Testing.

**Unit IV** : Acceptance Testing, Acceptance Criteria, Selecting Test Cases, Executing Acceptance Tests; Performance Testing- Introduction, Factors governing performance testing, Methodology for performance testing

**Unit V** : **Regression Testing:-**Introduction, Types of Regression Testing, Understanding the Criteria for selecting Test Case, Classifying Test Cases, Methodology for selecting Test Case; Test Planning, Management, Execution and Reporting:- Test Planning, Preparing a Test Plan, Setting up Criteria for Testing, Test Case Specification, Developing and Executing Test Cases, Test Summary Report.

**Text Book:**

1. Software Testing Principles and Practices - Srinivasan Desikan and Gopalaswamy Ramesh, Publisher: Pearson Education.

**6ST5: Advance Database Management System**

**Unit I** : **Introduction** : Review of Database Concepts, File Organization concepts, Normalization. Physical Database Design and Tunning. Index Selection, Overview of Database Tunning, Choices in tuning the conceptual schema.

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Choices in tuning queries and views, DBMS Benchmarking. Security.

**Unit-II** : Concurrency control transactions and schedule, Serializability, Lock based concurrency control lock management, specialized locking techniques, control without locking.

Crash Recovery, Introduction to crash recovery, Log, Check pointing, Recovery from a system crash.

**Unit-III** : Parallel and distributed databases. Architectures for parallel databases, Parallel query Evaluation and optimization, Parallelizing individual operations, Introduction to distributed databases, Architecture, Fragmentation and Replication, Catalog management, Distributed Query processing, updating distributed data, Distributed transaction management, Distributed Concurrency control, Distributed recovery.

**Unit-IV** : **Object database Systems** : Objects, Identity, inheritance, Database Design for an ORDBMS, Storage and access methods, Query processing and optimization, Comparing RDBMS with OODBMS and ORDBMS.

**Unit-V** : **Data Warehousing**  
Introduction, DSS and OLTP, Metadata Management in Data Warehouse. Related data structures, OLAP and Data Warehousing environment.  
Data mining.  
Introduction and application areas.

**Books :**

- 1) Database Management System -Raghu Ramkrishna McGraw Hill. International Editions.
- 2) Introduction to Database System by C.G.Date.

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**6SP1: LAB I-6ST1+6ST2:** Minimum 8 practical on each.

The distribution of marks in Practical examination is given as:

(1) Program writing/ execution based on 6ST1	15 marks.
(2) Program writing/ execution based on 6ST2	15 marks.
(3) Practical Record	10 marks.
(4) Viva-Voce	10 marks.

**50 marks.**

**6SP2: LAB II-6ST3+6ST4:** Minimum 8 practical on each.

The distribution of marks in Practical examination is given as:

(1) Program writing/ execution based on 6ST3	15 marks.
(2) Program writing/ execution based on 6ST4	15 marks.
(3) Practical Record	10 marks.
(4) Viva-Voce	10 marks.

**50 marks.**

**6SP3: LAB III-**Project work with Report.

The distribution of marks in Practical examination is given as:

(1) Project Work with Report	30 marks.
(2) Viva-Voce	20 marks.

**50 marks.**

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## **PG Syllabus**



## Appendix-A: Allotment of Project Work

**APPENDIX-A**  
**SCHEME OF EXAMINATION FOR M.Sc. PART-I & II.**  
**(FOR ALL SUBJECTS)**

M.Sc. Part-I Semester-I	Paper-I	-	50 Marks	Practical-I	-	40 Marks
	Paper-II	-	50 Marks	Internal Assessment	-	10 Marks
	Paper-III	-	50 Marks	Practical-II	-	40 Marks
	Paper-IV	-	50 Marks	Internal Assessment	-	10 Marks
M.Sc. Part-I Semester-II	Paper-V	-	50 Marks	Practical-III	-	40 Marks
	Paper-VI	-	50 Marks	Internal Assessment	-	10 Marks
	Paper-VII	-	50 Marks	Practical-IV	-	40 Marks
	Paper-VIII	-	50 Marks	Internal Assessment	-	10 Marks
M.Sc. Part-II Semester-III	Paper-IX	-	50 Marks	Practical-V	-	40 Marks
	Paper-X	-	50 Marks	Internal Assessment	-	10 Marks
	Paper-XI	-	50 Marks	Practical-VI	-	40 Marks
	Paper-XII	-	50 Marks	Internal Assessment	-	10 Marks
M.Sc. Part-II Semester-IV	Paper-XIII	-	50 Marks	Practical-VII	-	40 Marks
	Paper-XIV	-	50 Marks	Internal Assessment	-	10 Marks
	Paper-XV	-	50 Marks	Project Work	-	40 Marks
	Paper-XVI	-	50 Marks	Internal Assessment	-	10 Marks

ii) For the subject Mathematics, there shall be five theory papers of sixty marks for each semester.

**Notes:-**(1) Minimum pass marks for theory and practical examination including internal assessment shall be 36% separately.

(2) (a) Topic of project work shall be given by concerned supervisor with prior approval of Head of Department.

There shall be no duplication of the topic of the project work. Project shall be based on research in the laboratory and / or field work. Project work shall be allotted at the beginning of third semester and the student shall have to submit it atleast 15 days before commencement of practical examination of the fourth semester. Project work will be evaluated by external and internal examiners.

(b) There should be atleast 2 to 3 external examiners.

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**Prospectus No. 2013124**

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**Semester-III****Distribution of Practical Marks for Practical-VI:- (Bio-Programming – I and Parasite Informatics)****(Based on Paper-XI & XII)**

<b>Time: 6Hrs.</b>	<b>Max. Marks:100</b>
1) Setting and working on any one exercise based on Programming/Regular Expressions	20 Marks
2) Setting and working on any one exercise based on CGI/ CPAN Database Modules	20 Marks
3) Setting and working on any one exercise based on Biopearl / HTML	20 Marks
4) Setting and working on any one exercise ' based on parasite informatics	20 Marks
5) Viva-voce	10 Marks
6) Practical Record	10 Marks
<b>Total</b>	<b>100 Marks</b>

***Syllabus Semester-IV (Bioinformatics)*****Paper XIII****(Molecular Modeling and Drug Design)****Unit-I : (Concepts in Molecular Modeling)**

Introduction; Coordinate System; potential energy surfaces molecular graphics; Computer hardware and software; Mathematical concepts – introduction of molecular mechanics & quantum mechanics

**Unit-II : (Molecular Mechanics)**

Features of molecular mechanics, force fields; Bond structure and bending angles – electrostatic, Vander Waals and non-bonded interactions, hydrogen bonding in molecular mechanics; Derivatives of molecular mechanics energy function; Calculating thermodynamic properties using force field; Transferability of force field parameters, treatment of delocalized  $\pi$  system; Force field for metals and inorganic systems – Application of energy minimization

**Unit-III : (Molecular Dynamics Simulation Methods)**

Molecular Dynamics using simple models; Molecular Dynamics with continuous potentials and at constant temperature and pressure; Time-dependent properties; Solvent effects in Molecular Dynamics; Conformational changes from Molecular Dynamics simulation. Introduction, Newton's equation of motion, equilibrium point, radial distribution function, pair correlation functions, MD methodology, periodic box, algorithm for time dependence; leapfrog algorithm, Verlet algorithm, Boltzman velocity, time steps, duration of the MD run. Starting structure, analysis of MD job, uses in drug designing, ligand protein interactions.

**Unit-IV : (Molecular Modeling in Drug Discovery)**

Deriving and using 3D pharmacophore; Molecular Docking; Structure based methods to identify lead compounds; *de novo* ligand design; Applications of 3D Database Searching and Docking, Finding new drug targets to treat diseases – Pharmacophore identification - Structure based drug design -Molecular Simulations

**Unit-V : (Structure Activity Relationship)**

QSARs and QSPRs, QSAR Methodology, Various Descriptors used in QSARs: Electronic; Topology; Quantum Chemical based Descriptors. Use of Genetic Algorithms, Neural Networks and Principle Components Analysis in the QSAR equations

**Suggested Reading:**

1. Andrew R. Leach (2001) "Molecular Modeling – Principles and Applications"; Second Edition, Prentice Hall, USA
2. Fenniri, H. (2000) "Combinatorial Chemistry – A practical approach", Oxford University Press, UK.
3. Gordon, E.M. and Kerwin, J.F. (1998) "Combinatorial chemistry and molecular diversity in drug discovery"; Wiley-Liss Publishers
4. Lednicer, D. (1998) "Strategies for Organic Drug Discovery Synthesis and Design"; Wiley International Publishers
5. Swatz, M.E. (2000) "Analytical techniques in Combinatorial Chemistry"; Marcel Dekker Publishers

**Paper XIV**  
**(Chemo-informatics)**

**Unit-I : (Introduction to Chemo-informatics)**

Chemo-informatics: Introduction, scope and application, Basics of Chemo-informatics, Current Chemo-informatics resources for synthetic polymers, pigments. Primary, secondary and tertiary sources of chemical information, Databases: Chemical Structure Databases (PubChem, Binding database, Drugbank), Database search methods: chemical indexing, proximity searching, 2D and 3D structure and substructure searching. Drawing the Chemical Structure: 2D & 3D drawing tools (ACD Chems sketch) Structure optimization.

**Unit-II : (Introduction to Chemo-informatics)**

Introduction to quantum methods, combinatorial chemistry (library design, synthesis and deconvolution), spectroscopic methods and analytical techniques, Representation of Molecules and Chemical Reactions: Different types of Notations, SMILES Coding, Structure of Mol files and Sd files (Molecular converter, SMILES Translator). Similarity search of the molecule (Zinc Database).

**Unit-III : (Introduction to Chemo-informatics)**

Analysis and use of chemical reaction information, chemical property information, spectroscopic information, analytical chemistry information, chemical safety information, Drug Designing: Prediction of Properties of Compounds, QSAR-Data Analysis, Structure-Activity Relationships, Electronic properties, Lead Identification, Molecular Descriptor Analysis.

**Unit-IV : (Introduction to Chemo-informatics)**

Target Identification: Molecular Modeling and Structure Elucidation: Homology Modelling (Modeller 9v7, PROCHECK), Visualization and validation of the Molecule (Rasmol, Pymol Discovery studio), Applications of Chemo-informatics in Drug Research - Chemical Libraries, Virtual Screening, Prediction of Pharmacological Properties.

**Unit-V : (Introduction to Chemo-informatics)**

Drug Discovery: Structure based drug designing, Docking Studies (Target Selection, Active site analysis, Ligand preparation and conformational analysis, Rigid and flexible docking, Structure based design of lead compounds, Library docking), Pharmacophore - Based Drug Design, Pharmacophore Modeling (Identification of pharmacophore features, Building 2D/3D pharmacophore hypothesis), Toxicity Analysis-Pharmacological Properties (Absorption, Distribution and Toxicity), Global Properties (Oral Bioavailability and Drug-Likeness) (ADME, OSIRIS, and MOLINSPIRATION)

**Suggested Reading:**

1. Bajorath J (2004), "Chemoinformatics: Concepts, Methods and Tools for Drug Discovery" Humana Press
2. Leach A, Gillet V, "An Introduction to Chemoinformatics" Revised edition, Springer
3. Gasteiger J. Engel T. "A textbook of Chemoinformatics" Wiley-VCH GmbH & Co. KGaA
4. Bunin B. Siesel B. Guillermo M. "Chemoinformatics: Theory, practice & products", Springer
5. Lavine B. (2005), "Chemometrics and chemoinformatics" American Chemical Society
6. Gasteiger J. and Engel T (2003) "Chemoinformatics" Wiley-VCH
7. Bunin Barry A. Siesel Brian, Morales Guillermo, Bajorath Jürgen. Chemoinformatics: Theory, Practice, & Products Publisher: New York, Springer. 2006. ISBN: 1402050003.
8. Gasteiger Johann, Engel Thomas. Chemoinformatics: A Textbook. Publisher: WileyVCH; 1st edition. 2003. ISBN: 3527306811.
9. Leach Andrew R., Valerie J. Gillet. An introduction to chemoinformatics. Publisher: Kluwer academic, 2003. ISBN: 1402013477.
10. Gasteiger Johann, Handbook of Chemoinformatics: From Data to Knowledge (4 Volumes), 2003. Publisher: Wiley-VCH. ISBN: 3527306803.

**Paper XV****(Bio-Programming – II)****Unit I : (Introduction to Java)**

Why JAVA is important to the internet, the continuing revolution, an overview of JAVA, Object Oriented Programming, Data types- Variables and Arrays, the simple types, floating point types, Operators, Control statements, Class fundamentals, Declaring objects, Assigning object reference variables, Introducing methods, Constructors, The this keyword; Garbage collection, using objects as parameters, Argument passing, Retaining objects, Recursion, Introducing Access control, Understanding static; Nested and inner classes, exploring the string class, Using command line arguments.

**Unit II : (Introduction to Java)**

Inheritance: Basics, Member access and inheritance. Using super: to call super class constructors, Creating a multilevel hierarchy, Method overriding, Dynamic method dispatch, Using abstract classes, Using final with inheritance, Using final to prevent overriding, Using final to prevent inheritance, The object class

Packages and Interfaces: Packages, Defining a package, Understanding class path, Access protection: Importing packages, Defining an interface, Implementing interfaces, Applying interfaces, Variables in interfaces, Exception Handling: Fundamentals, Exception types, Uncaught exceptions, Using try and catch, Displaying a description of an exception. Multiple catch clauses, Nested statements, throw, throws; Java's built in exceptions, Creating own exception subclasses, Using exceptions

**Unit III : (Introduction to Java)**

Multithreaded programming: The Java thread model. Thread priorities, Synchronization, Messaging, The thread class and the run able interface. The main thread: creating a thread, Implementing run able, extended thread, Choosing an approach, creating multiple threads, Using is alive () and join(), Thread priorities; Synchronization :Using synchronized methods, the synchronized statement, Inter-thread communication, Deadlock, Suspending resuming and stopping threads, Using multithreading.

**Unit IV : (Introduction to Java)**

I/O Applets: I/O basics - Streams, Byte streams and character streams. The predefined streams; Reading console Input: reading characters, reading strings, Writing files, Applets, Fundamentals, The transient and volatile modifiers, using instance of, Native methods, Problems with native methods

**Unit V : (Introduction to Bio-Java)**

Installing Bio-Java, Symbols, Basic Sequence Manipulation (DNA to RNA, Reverse Complement, motif as regular expression), Translation (DNA to Protein, Codon to amino acid, Six frame translation), Proteomics (Calculate the mass and pI of a peptide), Sequence I/O (File Formats conversions), Locations and Features (Point Location, Range Location, Feature modifications), BLAST and FASTA (Blast and FastA Parser, extract information from parsed results), Counts and Distributions, Weight Matrices and Dynamic Programming, User Interfaces.

**Suggested Reading:**

1. Benjamin, Cummings and Booch, G. (1994) “Object Oriented Design and Applications”; Second edition, Addison Wesley Publishers.
2. Horstmann, C.S. (2000) “Computing Concepts with Java 2 Essentials”; Second Edition, John Wiley Publishers
3. Naughton, P. and Schildt, H. (1999) “Java-2: The complete Reference”; Third Edition, McGraw Hill Publishers.
4. Bal H, Hujol J, (2007) “Java for bioinformatics and biomedical application” Springer Japan
5. Lindsey C. S., Tolliver J.S., Lindblad T, (2005) “JavaTech: an introduction to scientific and technical computing with JAVA” Cambridge University Press
6. Srinivas V.R. (2005) “Bioinformatics: A modern Approach” PHI learning Pvt. Ltd

**Paper XVI****(Research Methodology, IPR and Bioethics)****Unit I : (Research Methodology)**

Research and Technical Writing: What is research? The process of research – various types of research – research methodology – Hypothesis – research writing – basic principles; publication process – peer review - Journal impact factors – popular journals in Computational Biology & Bioinformatics (brief overview of their scope),



Professional Societies in the field – their role in research and knowledge dissemination, Open Access Publications, Concept of ethics – its application in Scientific Research and Academics, Solving ethical conflicts, moral reasoning & ethical theories, responsibilities and rights

**Unit II : (Intellectual Property Rights)**

General principles of Intellectual property rights (IPR); Patents and methods; application of patents; Legal implications; International treaties for protection of IP – Bern, Paris, TRIPS, WIPO treaties, Biodiversity convention, etc

**Unit III : (Intellectual Property Rights)**

Nature of Intellectual Property: Patents, Designs, Trademarks and Copyright. Process of Patenting and Development: technological research, innovation, patenting, development; International cooperation on Intellectual Property, Procedure for grants of patents, Patenting under PCT; Scope of Patent Rights; Licensing and transfer of technology. Patent information and databases, Geographical Indications

**Unit IV : (Bioethics)**

The legal and socioeconomic impacts of biotechnology; public education of the process of the processes of biotechnology involved in generating new forms of life for informed decision making; Biosafety regulation and national and international guidelines; rDNA guidelines; Experimental protocol approval; levels of containment

**Unit V : (Bioethics)**

Environmental aspects of biotechnology applications; Use of genetically modified organisms and their release in environment; Special procedures for rDNA-based product production ; Biodiversity and farmers rights; Beneficial applications and development of research focus to the need of the poor; Identification of directions for yield effect in agriculture, aquaculture, etc; Bioremediation

**Suggested Reading:**

1. Sasson, A. (1988) “Biotechnologies and Development”, UNESCO Publications
2. Sasson, A. (1993) “Biotechnologies in developing countries present and future”; UNESCO Publishers

3. Singh, K. “Intellectual Property Rights on Biotechnology”; BCIL, New Delhi
4. Halbert, (2007) “Resisting Intellectual Property” Taylor & Francis Ltd
5. Ramappa T., “Intellectual Property Rights Under WTO”, S. Chand

**Practical Based on Paper XIII, XIV, XV and XVI**

**Molecular Modeling, Drug Design, Chemo-informatics , Bio-Programming–II and Research Methodology, IPR and Bioethics**

1. Binding site identification
2. Pharmacophore identification
3. Rigid body docking using Autodock and ADT
4. Molecular dynamics simulations using Gromacs
5. Visual Molecular Dynamics (VMD)
6. Docking with LigandFit (Discovery Studio)
7. Receptor and Ligand Optimization
8. Conformational Analysis
9. Concepts of Flowcharting, Algorithm Development
10. Chemo-informatics Software
  - a. AMBER
  - b. ArgusLab 3.0
  - c. BABEL
  - d. ACD/Labs
  - e. Chemos
  - f. VEGA
  - g. HaptiChem
  - h. ChemJun
11. PubChem
12. ChemSketch
13. Chemo-informatics databases
14. Chemical structure representation
15. Smiles - Simplified Molecular Input Line Entry System
16. Molecular Dimension Limited (MDL) file format for chemical connectivity
17. Chemical Structure similarity
18. Fingerprints and search for substructure similarity
19. Generation of 3D structures from 2D representations

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20. 3D structure similarity
21. Elements of molecular descriptors
22. Writing Pseudo Codes
23. Working with Objects, Arrays, Conditionals and Loops
24. Creating Classes and Applications in Java
25. Java Applets Basics, Graphics, Fonts and Color
26. Simple Animation and Threads, Advanced Animation, Images and Sound
27. Managing Simple Events and Interactivity
28. Creating User Interfaces with AWT, Modifiers
29. Packages and Interfaces, Exception, Multithreading
30. Streams and I/O, Using Native Methods and Libraries
31. Java Programming Tools, Working with Data Structures
32. Sequence Analysis Packages – EMBOSS, NCBI Tool Kit
33. Dynamic programming
34. Analysis of Biological Sequences
  - a. Basic Blast
  - b. Specialized Blast
35. FASTA

#### Semester-IV

**Distribution of Practical Marks for Practical-VII:- (Molecular Modeling, Drug Design, Chemo-informatics , Bio-Programming –II and Research Methodology, IPR and Bioethics)**

**(Based on Paper-XIII, XIV, XV & XVI)**

**Time: 6Hrs.**

**Max. Marks:100**

1)	Setting and working on any one exercise based on molecular modeling	20 Marks
2)	Setting and working on any one exercise based on molecular dynamics	20 Marks
3)	Setting and working on any one exercise based on programming	20 Marks
4)	Setting and working on any one exercise based on chemo-informatics	20 Marks
5)	Viva-voce	10 Marks
6)	Practical Record	10 Marks
<b>Total</b>		<b>100 Marks</b>

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**Seminars:** Two theory classes/ week. Student have to submit script of the seminar.

**Projects:** Project to the students will be distributed at the beginning of third semester with the consent of HOD and shall be examined during the period of practical examination in IV semester. The student will develop the skill for designing the programs related to Bioinformatics. For this, variety of small research projects designed by the teachers based on the interest of the student and capabilities should be worked out.

The projects should be based on following topics

- Biological database designing
- Biological software designing
- Biological tool designing
- Chemo-informatics
- Comparative genomics and proteomics
- Drug designing
- Molecular modeling
- Parasite bioinformatics
- Pharmaco-informatics
- Plant bioinformatics
- Structural biology
- System biology
- Vaccine designing
- Any recent biological research topics

#### Semester-IV

**Distribution of Practical Marks for Practical-VIII:- (Project Work)**

**Distribution of Marks for Project :-**

**Total Marks - 100 (Time : 3 Hrs per Week)**

(1) Hypothesis	10 Marks
(2) Viva based on the project.	20 Marks
(3) Depth of Work	30 Marks
(4) Conduct of project work	20 Marks
(5) Project Record	20 Marks

**Total**

**100 Marks**

40

**Internal Assessment:** It should be based on-

1. Study tour : Educational / Institutional / Industrial tour is compulsory for M. Sc. Bioinformatics
  - Semester I/II: Visit to local research laboratory
  - Semester III/IV: Educational tour to visit the industry / CSIR research laboratory, ICAR laboratory.
2. Seminars.
3. Unit test, Open Book Test and Semester end terminal examination.

**List of Equipments:**

1. Microscopes
2. Laminar Airflow
3. High speed centrifuge
4. Horizontal gel electrophoresis apparatus
5. Vertical gel electrophoresis apparatus
6. Submarine gel electrophoresis apparatus
7. UV spectrophotometer
8. Sonicator
9. Chromatography Chamber
10. Calculator.
11. Computer systems.
12. LAN
13. Server
14. High speed internet connection
15. Telescope
16. Monochromator
17. Spectrophotometer
18. Babinet's compensator
19. Conductors.
20. Conductivity meter.
21. Printers.
22. CCD Camera.
23. Projector.
24. Online lecture hall.
25. Rosetta Server
26. Discovery Studio Server
27. MySQL Operator
28. Deep Frezer
29. PCR Machine
30. Lyofilizer

**M.Sc. Sem-I to IV**

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**SYLLABUS PRESCRIBED FOR M.Sc. PART-I BOTANY  
SEMESTER – I**

**PAPER-I: CELL BIOLOGY, CYTOLOGY AND GENETICS**

- Unit-I** 1.1 Cell wall and Plasma membrane: Structural organization and function.
- 1.2 Cell organelles: Golgi bodies, Lysosomes, Endoplasmic Reticulum and Ribosomes: Structural organization and their functions
- 1.3 Techniques in Cell Biology: Confocal microscopy, Phase Contrast microscopy, Flow Cytometry: Principle and working.
- Unit-II** 2.1 Cell Cycle and Apoptosis: Mechanism of Cell division; Regulation, Roles of Cyclins and Cyclin dependent kinases, Cell Plate formation, PCD.
- 2.2 Cell to cell Interaction and Signal transduction : Intercellular junctures, Hormones and neurotransmitter signalling, receptors, G-proteins, kinases and messengers.
- 2.3 Protein sorting: Targeting of proteins to nucleus, chloroplasts and secretory pathways of leader polypeptides.
- Unit-III** 3.1 Chromosome Organisation : Eukaryotic chromosome structure and DNA packaging, Nucleoproteins, Organisation of centromeres and telomeres, nucleolus and r-RNA Genes, Euchromatin and heterochromatin..
- 3.2 Specialised Chromosomes: Polytene, Lampbrush, B-Chromosomes, Sex Chromosomes.
- 3.3 Structural aberrations of Chromosomes: Origin, Meiosis and breeding behaviour of duplication, deficiency, inversions and translocation- Heterozygosity.
- 3.4 Karyotype and Banding Patterns: Types, Evolution of Karyotype, Analysis and its significance. Application of banding techniques.
- Unit-IV** 4.1 Genetics of Mitochondria and Chloroplast: Semi autonomous, Genome character, size and regulation, cytoplasmic male sterility.
- 4.2 Mutations: Origin, Physical and Chemical mutagenic agents, Molecular basis and mutational breeding.
- 4.3 Transposable elements in Prokaryotes: IS elements, Composite transposons, transposition mechanisms and their effect on phenotype and genotype
- 4.4 Physiology of Cancer; Genetics of Cancer: C-Oncogenes, V-Oncogenes, Tumor Suppressor genes.

2

- Unit-V 5.1** Genetic Code: Triplet nature of code, Breaking of code, Wobble Hypothesis, Properties, Evolution and Central dogma - transcription, types of RNAs, Initiation and termination signals, differences between eukaryotic and prokaryotic transcription (promoters, caps and tails, Introns, RNA editing).
- 5.2 Regulation of gene expression in Prokaryotes: Gene structure, Lac - operon, Trp-operon, Phage operon, transcriptional-control systems, translational control and post translational control.
- 5.3 Genetics of Nitrogen fixation: Organization, function and regulation of nitrogen fixing genes in klebsiella, hup genes.

**Suggested Readings:**

1. Lewin, B. 2000. Genes VII, Oxford University Press, New York.
2. Rost, T. et al.. 1998. Plant Biology. Wadsworth Publishing Co., California, USA.
3. Krishnamurthy, K.V.2000. Methods in Cell wall Cytochemistry, CRC Press, Boca Raton, Florida.
4. De, D.N. 2000. Plant Cell Vacuoles: An introduction. CSIRO Publication, Collingwood, Australia.
5. Atherly, A.G, Girton, J.R. and McDonald, J.F. 1999. The Science of Genetics. Saunders College Publishing, Fort Worth, USA.
6. Burnham, C.R. 1962. Discussions in Cytogenetics. Burgess Publishing Co., Minnesota.
7. Busch, H. and Rothblum, L. 1982. Volume X. The Cell Nucleus & DNA Part A. Academic Press.
8. Hartl, D.L. and Jones, E.W. 1998. Genetics: Principles and Analysis (4th Edition). Jones and Bartlett Publishers, Massachusetts, USA.
9. Khush, G.S. 1973. Cytogenetics of Aneuploids. Academic Press, New York, London.
10. Lewin B., 2000. Gene VII. Oxford University Press, New York, USA.
11. Lewis R., 1997. Human Genetics: Concepts and Applications (2nd Edition). WCB McGraw Hill, USA.
12. Russel, P.J. 1998. Genetics (5th Edition). The Benjamin/ cummings Publishing Company Inc., USA.
13. Snustad, D.P. and Simmons, M.J. 2000. Principles of Genetics (2nd Edition). John Wiley and Sons Inc., U.S.A.
14. Gunning, B.E.S. and Steer, M.W. 1996. Plant Cell Biology: Structure and Function. Jones and Barlett Publishers, Boston, Massachusetts.
15. Hall, J.L. and Moore, A.L. 1983. Isolation of Membranes and



34. Sahni, K.C. 2000. the Book of Indian Trees, 2nd edition. Oxford University Press, Mumbai.
35. Schery, R.W. 1972. Plant for Man. 2nd Ed. Englewood Cliffs, New Jersey. Prentice Hall.
36. Sharma, O.P. 1996. Hill's Economic Botany (Late Dr.A.F.Hill, adapted by O.P.Sharma) Tata McGraw Hill Co. Ltd., New Delhi.
37. Swaminathan, M.S. and Kocchar, S.L. (Eds) 1989. Plants and Society. Macmillan Publication Ltd., London.
38. Thakur, R.S., Puri, H.S. and Husain, A. 1989. Major and Aromatic Plants, CSIR, Lucknow.
39. Thomas, P. 2000. Trees : Their National History, Cambridge University Press, Cambridge.
40. Wagner, H., Hikino, H. and Farnswarth, N. 1989. Economic and Medicinal Plant Research, Vols. 1-3. Academic Press, London.
41. Walter, K.S. and Gillett, H.J. 1998. 1997 IUCN Red List of Threatened Plants. IUCN, the World Conservation Union, IUCN, Gland, Switzerland, and Cambridge, U.K.

#### **Suggested laboratory Exercises:**

The Practical course is divided into three units: (1) Laboratory work, (2) Field survey and (3) Scientific Visits.

#### **Laboratory Work:**

1. Food Crops: Wheat, Rice, Maize, Chickpea (Bengal gram), Potato, Tapioca, Sweet potato, Sugarcane. Morphology, Anatomy, Microchemical tests for stored food materials.
2. Forage / fodder crops: Study of any five important crops of the locality (for example fodder Sorghum, Bajra, Berseem, clove, guar bean, gram, ficus sp.)
3. Plant fibres :
  - (a) Textile fibres : Cotton, Jute, Linen, Sunn hemp, Cannabis.
  - (b) Cordage fibres : Coir.
  - (d) Fibres for stuffing: Silk cotton or kapok  
Morphology, anatomy, microscopic study of whole fibers using appropriate staining procedures.
4. Medicinal and aromatic plants: Depending on the geographical location of college/ university select five medicinal and aromatic plants each from a garden crop field (or from the wild only if they are abundantly available).

*Papaver somniferum, Atropa belladonna, Catharanthus roseus, Adhatoda zeylanica (Syn A. vasica), Allium sativum, Rauwolfia serpentina, Withania somnifera, Phyllanthus amarus, (P. fraternus), Andrographis paniculata, Aloe barbadense, Mentha arvensis, Rosa sp., Pogostemon cablin, Origanum vulgare,*

21. B.R.Vashishta : Algae

**Laboratory Exercises: -**

1. Morphological study of Algae :(Any 12 of the following)  
*Oscillatoria, Nostoc, Anabaena, Spirulina, Gleotricha, Chlamydomonas, Eudorina, Volvox, Closterium, Hydrodictyon, Pediastrum, Cladophora, Ulva, Pithophora, Draparnaldia, Cosmarium, Chlorella, Acetabularia, Chara, Nitella, Laminaria, Sargassum, Padina, Ectocarpus, Batrachospermum, Gracillaria, Gellidium, Polysiphonia,*
2. Morphological, anatomical and reproductive studies of following members: *Targonia, Cyathodium Marchantia, Plagiochasma, Deumortiera, Anthoceros, Notothylus; Polytrichum, Pogonatum, Sphagnum,*
3. Field study: i) Collection of Algal material from water reservoirs (ii) Collection of Bryophytic material.

Field visits: Visits to the field to study distribution of algal flora and bryophytic forms.

**PAPER – IV: PLANT DEVELOPMENT AND REPRODUCTION**

- UNIT I:**
- 1.1 Unique features of plant development, differences between plant and animal development.
  - 1.2 Structure of seed, germination of seed and seedling growth and control.
  - 1.3 Metabolism of nucleic acids, proteins and mobilization of reserve food.
  - 1.4 Seed dormancy: types, importance and means to break the seed dormancy.
- UNIT II:**
- 2.1 Organisations of shoot apical meristem (SAM). Cytological and molecular analysis of SAM, Root apical meristem.
  - 2.2 Types of meristem, tissue differentiation, structures, development and importance of tissue differentiation: Vascular cambium and cork cambium, evolution of Xylem.
  - 2.3 Wood development in relation to environmental factors, secondary growth: stem and root.
  - 2.4 Leaf development and structure, differentiation of epidermis and mesophyll. Structure and function of secretory ducts and laticifers.
- UNIT III:**
- 3.1 Plant reproduction: Means of reproduction, flower development, homeotic mutants in *Arabidopsis* and *Antirrhinum*, sex determination.

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- 12) Raven, P.H., Evert, R.F. and Eichhorn, S.E. 1992. *Biology of Plants* (5th Edition). Worth, New York.
- 13) Steeves, T.A. and Sussex, I.M. 1989. *Patterns in Plant Development* (2nd edition). Cambridge University Press, Cambridge.
- 14) Sedgely, M. and Griffin, A.R. 1989. *Sexual Reproduction of Tree Crops*, Academic Press, London.
- 15) Waisel, Y., Eshel, A. and Kafkaki, U. (eds) 1996. *Plant Roots: The Hidden Hall* (2nd edition.) Marcel Dekker, New York.
- 16) Shivanna, K.R. and Sawhney, V.K. (eds) 1997. *Pollen Biotechnology for Crop Production and Improvement*, Cambridge University Press, Cambridge.
- 17) Shivana, K.R. and Rangaswamy, N.S. 1992. *Pollen Biology: A Laboratory Manual*. Springer-Verlag, Berlin.
- 18) Shivana, K.R. and Johri, B.M. 1985. *The Angiosperm Pollen: Structure and Function*. Wiley Eastern Ltd., New York.
- 19) *The Plant Cell*. Special issue on Reproductive Biology of Plants, Vol. 5(10) 1993. The American Society of Plant Physiologists, Rockville, Maryland, USA.

**Suggested Laboratory / Field Exercises (Any 10):**

1. Effect of gravity, unilateral light and plant growth regulators on the growth of young seedlings.
2. Role of dark and red light / far-red light on the expansion of cotyledons and epicotylar hook opening in pea.
3. Study of living shoot apices by dissections using aquatic plants such as *Ceratophyllum* and *Hydrilla*.
4. Study of cytohistological zonation in the shoot apical meristem (SAM) in sectioned and double-stained permanent slides of a suitable plant such as *Coleus*, *Kalanchoe*, *Tobacco*. Examination of shoot apices in a monocotyledon in both T.S. and L.S. to show the origin and arrangement of leaf primordia.
5. Study of alternate and distichous, alternate and superposed, opposite and superposed; opposite and decussate leaf arrangement. Examination of rosette plants (*Launaea*, *Mollugo*, *Raphanus*, *Hyoscyamus* etc) and induction of bolting under natural conditions as well as by GA treatment.
6. Microscopic examination of vertical sections of leaves such as *Cannabis*, *Tobacco*, *Nerium*, Maize and Wheat to understand the internal structure of leaf tissues and trichomes, glands etc. Also study the C3 and C4 leaf anatomy of plant.
7. Study of epidermal peels of leaves such as *Coccinia*, *Gallardia*, *Tradescantia*, *Notonea*, etc. to study the development and final structure of stomata and prepare stomatal index. Demonstration of the effect of ABA on stomatal closure.

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8. Study of whole roots in monocots and dicots. Examination of L.S. of root. from permanent preparation to understand the organization of root apical meristem and its derivatives. (use maize, aerial roots of banyan, Pistia, Jussieuia etc.). Origin of lateral roots. Study of leguminous roots with different types of nodules.
9. Study of microsporogenesis and gametogenesis in sections of anthers.
10. Examination of modes of anther dehiscence and collection of pollen grains for microscopic examination (Maize, Grasses, *Cannabis sativa*, *Crotolaria*, *Tradescantia*, *Brassica*, *Petunia*, *Solanum melongena*, etc.)
11. Tests for pollen viability using stains and *in vitro* germination. Pollen germination using hanging drop and sitting drop cultures, suspension culture and surface culture.
12. Estimating percentage and average pollen tube length *in vitro*.
13. Role of transcription and translation inhibitors on pollen germination and pollen tube growth.
14. Pollen storage, pollen-pistil interaction, self-incompatibility, *in vitro* pollination.
15. Study of ovules in cleared preparations; study of monosporic, bisporic and tetrasporic types of embryo sac development through examination of permanent stained serial sections.
16. Field study of several types of flower with different pollination mechanisms (wind pollination, thrips pollination, bee/butterfly pollination, bird pollination).
17. Emasculation, bagging and hand pollination to study pollen germination, seed set and fruit development using self compatible and obligate outcrossing systems. Study of cleistogamous flowers and their adaptations.
18. Study of nuclear and cellular endosperm through dissections and staining.
19. Isolation of zygotic globular, heart-shaped, torpedo stage and mature embryos from suitable seeds and polyembryony in citrus, jamun (*Syzygium cumini*) etc. by dissections.
20. Study of seed dormancy and methods to break dormancy.

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- D. Study of important fossil gymnosperms from material and permanent slides.
- E. Visit to palaeobotanical Institutes, localities and collection of specimens.
- F. Field visits to ecologically different localities to study living gymnosperms.

### Semester- III

#### PAPER- X: TAXONOMY OF ANGIOSPERMS.

- UNIT I** : Systems of Angiosperm classification: -  
Phenetic versus phylogenetic systems. Relative merits and demerits of following systems of classification. Engler and Prantls system; Hutchinsons system; Bessey's system; Cronquist's system.
- UNIT II** : Origin of intrapopulation variation. Population and Environment. Ecads & Ecotypes. Evolution and differentiation of species. Different models.
- UNIT III** : Taxonomic hierarchy, concept of species, genus, families and other categories (above the family and below the species rank). Principles used in assessing relationship. Salient features of international code of Botanical nomenclature.
- UNIT IV** : Evolutionary trends in Angiosperms with special reference to vegetative floral anatomical and chemical characters. Systematic studies of following families with emphasis on origin, evolution and interrelationship. Magnoliaceae, Ranunculaceae; Papaveraceae; Capparidaceae; Meliaceae; Leguminosaceae, Myrtaceae; Cucurbitaceae; Cactaceae.
- UNIT V** : Gentianaceae; Rubiaceae; Asteraceae; Apocynaceae; Asclepiadaceae; Convolvulaceae, Boraginaceae. Scrophulariaceae, Acanthaceae, Lamiaceae, Polygonaceae; Nyctaginaceae; Caryophyllaceae; Loranthaceae Podostemonaceae; Poaceae; Cyperaceae Cannaceae; Orchidaceae, Arecaceae.

#### Suggested Readings:

- 1) Bhatnagar, S.P. and Moitra, A., 1996, Gymnosperm. New Age International Pvt.Ltd.New Delhi.
- 2) Cole,A.J., 1969, Numerical Taxonomy, Academic Press, London.
- 3) Davis P.H. and Heywood, V.H. 1973, Principles of Angiosperms Taxonomy, Robert, E.Kreiger, Publishing Company, New York.
- 4) Grant, V. 1971. Plant Speciation, Columbia University Press, New York.
- 5) Grant, W.F., 1984, Plant Biosystematics, Academic Press, London.

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- 11) Anther culture, pollen culture and production of haploids.
- 12) Artificial seed preparation.
- 13) Cytological examination of regenerated plants.
- 14) Agrobacterium culture and selection of transformants.
- 15) Selection of salt tolerance, amino acids analogous resistance through cell cultures.
- 16) Hardening of tissue culture raised plants.
- 17) Visit to forest area to study important plant species and preparation of field diary.
- 18) Visit to plant tissue culture laboratories in state & preparation of report.

### Semester III

#### Plant Tissue Culture : Practical-VI (Elective)

#### PRACTICAL SCHEDULE

Time : 8 Hrs.	Max. Marks: 40
Q.1. Setting and working of one major experiment	12 Marks.
Q.2. Two Minor experiments.	08 Marks.
Q.3 Preparation of any one specific media for tissue culture.	10 Marks.
Q.4 Comment on spots.	05 Marks.
Q.5 Viva voce	05 Marks.

### Semester- III

#### PAPER-XI: BIOINFORMATICS-I(Elective)

- UNIT I :**
- 1.1 Computer system: Overview functions input devices output devices, storage devices, Softwares and Hardwares.
  - 1.2 Main circuits: Chips, Ports, Expansion slots.
  - 1.3 Real time, offline and online processing.
  - 1.4 Operating systems: Concepts, windows 2003/XP, VISTA, UNIX, LINUX.
  - 1.5 Computer Virus: Overview, Transmission and Precautions.
- UNIT II:**
- 2.1 Types of computers- Latest Models.
  - 2.2 Internet: Resources, World Wide Web, Tools associated, terminologies.
  - 2.3 Data communication, links and Data Mining
  - 2.4 LAN, WAN, MAN, Search Engines.
  - 2.5 Data Models: Network and Hierarchical data model and concepts.
- UNIT III:**
- 3.1 Computer application in Bioinformatics.

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- 7) Frequent field visits to study local flora are expected. One short tour within state and one long tour to other state to study the vegetation and biodiversity of angiosperms. Students should submit atleast 100 herbarium specimens (collectively) prepared according to international norms. Excursion report should be supported by field diary and photographic presentation of the flora.

### Semester -III

#### Elective Practical VI – Angiosperm Taxonomy, Phytochemistry and Pharmacognosy.

##### Practical Schedule

Time : 6 Hrs	Full Marks: 40
Q.1) Systematic description of two angiospermic plants (one from dicotyledons and one from Monocotyledons)	10 Marks.
Q.2) Preparation of artificial key	04 Marks.
Q.3) Karyotype studies	04 Marks.
Q.4) Detection of secondary plant metabolites of given plant material.	03 Marks.
Q.5) Morphological and analytical characterization of given drug plant material	06 Marks.
Q.6) Spotting	08 Marks.
Q.7) Viva voce	05 Marks.

### Semester III

#### ELECTIVE PAPER XI: ADVANCED PLANT PHYSIOLOGY AND BIOCHEMISTRY-I

- UNIT I:** 1.1 Membrane transport – Structure and organization of membrane, Glucoconjugates and protein membrane systems; Channels, pumps and carriers of membrane.  
1.2 Aquaporines – Structure and functions; Model membranes.  
1.3 Mineral nutrition – Deficiency symptoms in plants, Regulation of K<sup>+</sup> Phosphorus nutrition and transport; Micronutrient acquisition; Plant response to mineral toxicity; Nutritional status of plants.
- UNIT II:** 2.1 Plant movements– Overview; phototropism, phototropic signal perception, transduction of signal.  
2.2 Gravitropism – signal perception and its mechanism, growth response, Role of calcium in gravitropism.  
2.3 Nastic movements – Mechanism of Nyctynasty and Seismonasty.

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8. Study of reconstruction of vegetation, floras.
9. Study of peat, lignite and coal samples.
10. Study of marine microfossils, especially of oil and natural gas implications.
  - i) Visit to fossil localities for collection.
  - ii) Visit to National Laboratories.
  - iii) Submission of practical record, micropreparations, collection of fossil specimens
  - iv) Field notebook, geological data.
  - iv) Visit to palaeobotanical museums.

**Semester – III**

**ELECTIVE PRACTICAL-VI: PALAEOBOTANY  
(EVOLUTIONARY BOTANY)-I  
PRACTICAL SCHEDULE**

Time: 6 hrs.	Max.marks 40
1. Study of fossil specimens .....	08 Marks
2. Application of technique for isolation.....	08 Marks
3. Identification of specimens & slides .....	10 Marks
4. Study of Geological time-scale .....	04 Marks
5. Identification of pre-angiosperm fossil forms with evolutionary Implications	05 Marks
6. Viva-voce	05 Marks

**Semester – III**

**PAPER – XI: REPRODUCTIVE BIOLOGY OF  
ANGIOSPERMS-I (Elective)**

- Unit-I**
- 1.1: Means of reproduction in flowering plants, flower structure and development.
  - 1.2 : Anther structure : Biochemical and Ultrastructural aspects, structure and function of tapetum.
  - 1.3: Microsporogenesis : Cytoplasmic reorganization, pollen tetrad development and types, pollen wall morphogenesis, biochemical, physiological and genetic events involved in pollen development.
- Unit-II :**
- 2.1: Pollen morphology : pollen wall sculpturing, Ultra structure.
  - 2.2: Pollen apertural types, Techniques for morphological preparations: Acetolysis, NPC.
  - 2.3: Light and scanning electron microscopic studies of pollen.
- Unit-III**
- 3.1: Pollen: Physiological and biochemical aspects, viability, assessment of pollen viability.



13. Cultivation of Mushroom.
14. Demonstration on biodegradation of organic waste.
15. Visit to Mushroom industry, Pharmaceutical industries & Pathological study center.
16. Isolation of Soil fungi by soil plate (War cup) and serial dilution (Walkman) method.
17. Isolation and identification of Rizosphere mycoflora.
18. Isolation of external and internal seed borne mycoflora by blotter and Agar Plate method. Cereals, pulses, oil seeds, fruit seeds.
19. Monographic study of locally available plant diseases caused by fungi (atleast 10).
20. Study of locally available crop plant diseases caused by Bacteria (Five)
21. Study of locally available plant diseases caused by viruses & Phytoplasma (Five)
22. Demonstration of morphological & physiological changes in disease plants.
23. Demonstration of Koch's Postulate.
24. Preparation and presentation of herbarium of pathological specimens available in the region (Atleast 30)
25. Preparation of Fungal spore atlas.
26. Field visit to different localities
27. Visit to Agriculture University, Plant Pathological research centers

### Semester – III

### ELECTIVE PRACTICAL-VI: APPLIED MYCOLOGY AND PLANT PATHOLOGY

#### PRACTICAL SCHEDULED

Time: 06 hrs.

Maximum Marks: 40

- |  |          |
|--|----------|
| Q.1) Identify and describe any two fungal plant diseases.....  | 08 Marks |
| Q.2) Identify and give salient features of two fungi from the mix culture.   | 08 Marks |
| Q.3) Identify, classify and describe any two fungi. from given seed borne mycoflora/soil mycoflora/Rhizosphere mycoflora.....                    | 05 Marks |
| Q.4) Demonstrate Koch's postulate/pure culture technique.....  | 04 Marks |
| Q.5) Spotting (Specimen/Slide)<br>(01 - bacterial disease; 01-viral diseases, 01- Phytoplasmal disease; 01-Fungal disease, 01- Spore slide)..... | 10 Marks |
| Q.6) Viva-Voce   | 05 Marks |

- 24) Field Survey-** A survey of a part of the town or city should be carried out by the entire class in batches. Individual students will select one avenue / road and locate the tree planted on a graph paper. They will identify the trees, mention their size, canopy shape, blossoming and fruiting period and their status (healthy, diseased, infected, mutilated, misused or dyeing) and report whether or not the conditions in which they are surviving are satisfactory. The individual reports will be combined to prepare a large map of the area, which can be used for subsequent monitoring either by the next batch of students / teachers / local communities / NGO's / or civic authorities.
- 25) The purpose is to make the students aware of the kinds of trees and value in urban ecosystem and ecological services.
  - 26) To prepare ombrothermic diagram for different sites on the basis of given data set and to comment on climate.
  - 27) To find out the relationship between two ecological variables using correlation and regression analysis.
  - 28) To determine minimum size and number of quadrats required for reliable estimate of biomass in grasslands.
  - 29) To find out association between grassland species using Chi-square test.
  - 30) To compare protected and unprotected grassland stands using community coefficient (similarity indices).
  - 31) To analyze plant community using Bra-Curtis ordination method.
  - 32) To determine diversity indices (Shannon, Wiever, concentration of dominance, species richness, equitability and B-diversity) for protected and unprotected grassland stands.
  - 33) To estimate IVI of the species in woodland using a point centered quarter method.
  - 34) To determine grass and net phytoplankton productivity by light and dark bottle method.
  - 35) To determine soil moisture content, porosity and bulk density of soils collected from varying depths at different locations.
  - 36) To determine the water holding capacity of soils collected from different locations.
  - 37) To determine present organic carbon and organic matter in the soil of cropland, grassland and forest.
  - 38) To estimate the dissolved oxygen contained in eutrophic and oligotrophic water samples by azide modification of Winkler's method.
  - 39) To estimate chlorophyll content in SO<sub>2</sub>, fumigated and unfumigated plant leaves.

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13. Total proteins detection on Blotting Membranes.
14. Oligonucleotide purification from Metaphor R Agarose gel.
15. Alkaline Gel electrophoresis.
16. Purification of DNA for PCR amplification.
17. DNA fingerprinting of plant genomic DNA.
18. Transfer of Proteins from SDS PAGE to Nitrocellulose Membrane.
19. Detecting DNA with Acridine Orange or methylene Blue.
20. ELISA
21. Immunoassay
22. Antimicrobial sensitivity testing
23. PCR
24. Preparation of insert DNA

#### SEMESTER-IV

### PRACTICAL-VII: PLANT ECOLOGY, ENVIRONMENTAL ECOLOGY, BIOTECHNOLOGY AND GENETIC ENGINEERING

#### PRACTICAL SCHEDULE

Time : 8 hrs.	Marks 40
Q.1. Setting and working of any of major plant Ecology Expt.	— 08 Marks
Q.2. Setting and working of major Experiment on Biotechnology	— 08 Marks
Q.3. Working of major experiment on Environmental Ecology	— 07 Marks
Q.4. Major Experiment on Genetic Engineering	— 07 Marks
Q.5. Comment on one minor Experiment on genetic Engineering/ Biotechnology.	— 05 Marks
Q.6. Viva-Voce	— 05 Marks

**Important note: -**

One long and two short Botanical Excursions and visits to Scientific Laboratories /Institutions /Universities/Botanical Gardens/ Forests within and out of state are compulsory for students of M.Sc. Botany.

**PARCTICAL-VIII :**

Project to the students will be distributed at the beginning of third Semester with the consent of HOD and shall be examined during the period of practical examination in IV Semester

Project	40 marks
Int. Assessment	10 Marks

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Dept. of Chemistry

**SANT GADGE BABA AMRAVATI UNIVERSITY GAZETTE - 2018 - PART TWO - 54**

**NOTIFICATION**

No. 39 / 2018

Date: 7/6/2018

**Subject : Introduction of new syllabi for M.Sc. (Chemistry) Part-II (Sem. III & IV), which to be implemented from the academic session 2018-19.**

- 1) It is notified for general information of all concerned that the authorities of the University has introduced new syllabi for M.Sc.(Chemistry) Part-II (Sem. III & IV), which to be implemented from the academic session 2018-19. Hence the page Nos. 26 to 91, appearing in prospectus No. 2015125 be substituted respectively by the "APPENDIX", which is appended with this notification.
- 2) The authorities further provided two additional chances for the failure students of M.Sc.(Chemistry) Part-II (Sem.III & IV) after implementation of the aforesaid new syllabi.

Sd/-  
(Dr.A.P.Deshmukh)  
Registrar,  
Sant Gadge Baba Amravati University

**SEMESER IV**  
**Practical – VII**  
**Project Work**

**Marks: 100**

**Total Hours: 90 hrs. (9 Hours per week)**

The students will develop utilities such as analytical spectra, simulation programs that will supplement laboratory exercises in their subject of specialisation. Literature survey, Studies of reactions, synthesis, mechanism, isolation of natural products, standardization of reaction conditions, new methods etc. External and internal examiners will examine this jointly at the time of practical examination. (Students should present his/her work in power point presentation. Open Viva is compulsory. Soft Copy of presentation in CD should be submitted with dissertation.)

**Study Tour:**

**Educational/Industrial tour is compulsory for M.Sc. Chemistry.**

- (i) Semester I/II: Visit to local industry/institute.
- (ii) Semester III/IV: Education tour to visit the industry/Research laboratory (Long Tour).  
Students should submit their tour report at the end of Semester II and Semester IV respectively with proof of visiting (Photo etc.)

**List of equipments/appratus required for the M.Sc. Chemistry Semester-I to IV Practicals.**

1. Rotaevaporater	01 no./batch
2. Crycooler	01 no./batch
3. Sonicator bath	01 no./batch
4. Stirrer With Hot Plate	04 nos./batch
5. Eye Washer	01 no./batch
6. Chemdraw Software (version12)	01 no./batch
2. Conductivity meter	03 nos./batch
2. pH meter	03 nos./batch
3. Potentiometer	03 nos./batch
4. Polariometer	02 nos./batch
5. Centrifuge machine	02 nos./batch
6. Vaecum Pump	01 no./batch
7. Hot air oven	01 no./batch
8. Blower hot & cold	03 nos./batch
9. Stop watch	10 nos./batch
10. Weight box con 100 gm.	10 nos./batch
11. Analytical double pan balance	10 nos./batch
12. One pan electronic balance	02 nos./batch
13. Tripple beam balance	02 nos./batch
14. Melting point apparatus	02 nos./batch
15. Spectrophotometer	02 nos./batch
16. Water still	01 no./lab

Dept. of Computer Science

**M.Sc. Computer Science**

**Prospectus No. 20161216**

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Semester-II & IV, Summer-2016**



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**Sant Gadge Baba Amravati University, Amravati**  
**Syllabus prescribed for**

**M.Sc. Part-I and Part-II [Semester I to IV] (Computer Science)**

**SEM-I (CBCS)**

- 1MCS1 Digital System and Microprocessor
- 1MCS2 .Net Technologies and C#
- 1MCS3 Operating System
- 1MCS4 Computer Networks
- 1MCS5 Lab I - Based on 1MCS1 and 1MCS3
- 1MCS6 Lab II – Based on 1MCS2

**SEM-II (CBCS)**

- 2MCS1 Java Programming
- 2MCS2 Data Structures
- 2MCS3 Software Engineering
- 2MCS4 (1) Discrete Mathematical Structures  
(2) Compiler Construction (GIC)
- 2MCS5: Lab III - Based on 2MCS1
- 2MCS6: Lab IV - Based on 2MCS2 and 2MCS3

**SEM-III (CBCS)**

- 3MCS1 Data Mining and Data Warehousing
- 3MCS2 Computer Graphics
- 3MCS3 Client-Server Computing
- 3MCS4 (1) Distributed Database System (GIC)  
(2) Theory of Computation
- 3MCS5 Lab V - Based on 3MCS1 and 3MCS2
- 3MCS6 Lab VI - Based on 3MCS3

**SEM-IV (CBCS)**

- 4MCS1 Artificial Intelligence and Expert Systems
- 4MCS2 Design and Analysis of Algorithms
- 4MCS3 Network Security
- 4MCS4 (1) Mobile Communications  
(2) Digital Image Processing  
(3) Software Testing (GIC)
- 4MCS5 Lab VII - Based on 4MCS1 and 4MCS2
- 4MCS6 Project

Structure, Disk Scheduling Algorithms: FCFS, SSTF, SCAN, C-SCAN, LOOK. [Disk Management, Swap Space Management], RAID: Concept. I/O Systems: I/O Hardware, Interrupts, DMA, Application I/O Interface, Kernel I/O Subsystem.

**UNIT-VI:** Distributed File System: Concept, Naming and Transparency, Remote File Access, Stateful Vs Stateless Service, File Replication, Remote Login, Remote File Transfer, Data Migration, Computation Migration, Process Migration. Embedded Operating Systems: Embedded Systems: Definition, Requirements and Constraints, Organization of Embedded System; Characteristics of Embedded Operating Systems.

#### **Case Studies: Linux and Mobile Operating Systems**

##### **Books:**

1. Operating System Concepts – **Seventh** Edition : Abraham Silberschatz, Peter Galvin, Greg Gagne (John Wiley & Sons)
2. Operating Systems : William Stallings (Pearson)
3. Modern Operating System : Andrew S. Tanenbaum

#### **1MCS4: Computer Networks**

**UNIT-I:** **Digital Communication:** Advantages; **Data Transmission:** Modes: Parallel, **Serial:** Asynchronous, Synchronous, Isochronous; **Transmission Media:** Guided and unguided; **Modulation:** Amplitude, Phase Shift, Frequency, QAM; **Multiplexing:** FDM, WDM, TDM, STDM, CDM; **Switching:** Circuit, Message, Packet; **Delays in Packet Switched Network,** Packet Loss; **Network Reference Models:** OSI: Layered Architecture and Services, TCP/IP: Layered Architecture and Services

**UNIT-II :** **Application Layer:** Principles of Application Layer Protocols; **Processes:** Client-Server Model, Socket Interface; Services required by Application Layer; **HTTP:** Introduction, RTT, HTTP Handshake, types of HTTP Connections, HTTP Messages, Authentication and Cookies; **FTP:** Service Model, FTP Commands; Electronic Mail; SMTP; **DNS:** Services and working

**UNIT-III:** **Transport Layer:** Transport-Layer Services and Principles; Multiplexing and Demultiplexing Applications; Connectionless Transport – UDP; Principles of Reliable of Data Transfer (RDT); Stop-and-wait and Pipelined protocols;



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**Unit-IV : Testing Web Applications:** Introduction, sample application, functional and usability issues, configuration and compatibility testing, reliability and availability, security testing, database testing, post implementation testing.

**Unit-V : Reducing the No. of test cases:** Introduction, prioritization guidelines, priority category scheme, Risk analysis, interviewing to identify problem areas, combination schemes, tracking selected test cases.

**Unit-VI: Creating Quality Software:** Introduction, development environmental infrastructure, software testing environment, software testing tools, applying software standards to test documentation.

**Books:**

1. Introducing Software Testing: Louise Tamres (PE)
2. Software Testing in the Real World by Kit – Pearson
3. Effective methods for software testing – William E. Perry
4. Foundations of Software Testing – Aditya P. Mathur

**4MCS5: Lab VII - - Based on 4MCS1 and 4MCS2**

**“Distribution of marks for Computer Lab-VII”**

- A) Each student shall perform two practicals.
- B) Question slip for each examinee shall be attached to the answer book.
- C) Marks should be given on the basis of following criteria:
- |  |            |
|--|------------|
| D) Practical-I                         | : 30 marks |
| E) Practical-II                        | : 30 marks |
| F) Viva-Voce (Each practical 15 marks) | : 30 marks |
| G) Record                              | : 10 marks |

**Total**

**: 100 marks**

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**4MCS6 : Project**

The subject of the project will be given to the student independently on any current topic belonging to the subject. The topic should be assigned at the beginning of the semester. The examinee shall be required to produce two typed hard-bound and one soft copy (C.D.) copies of project report signed by teacher in-charge and certified by head of the department as bonafide work of him/her.

**Distribution of Marks:**

- |    |                      |   |          |
|----|----------------------|---|----------|
| 1. | Project Submission   | : | 40 marks |
| 2. | Project Presentation | : | 40 marks |
| 3. | Viva                 | : | 20 marks |

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**Total : 100 marks**

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Dept. of Environmental Science

**M.Sc. Environmental Science****Prospectus No. 20131212****संत गाडगे बाबा अमरावती विद्यापीठ****SANT GADGE BABA AMRAVATI UNIVERSITY****विज्ञान विद्याशाखा  
(FACULTY OF SCIENCE)****अभ्यासक्रमिका  
विज्ञान पारंगत सत्र-१ ते २ परिक्षा २०१२-१३  
विज्ञान पारंगत सत्र ३ व ४ परिक्षा २०१३-१४  
(पर्यावरणशास्त्र)****PROSPECTUS  
OF  
MASTER OF SCIENCE IN  
ENVIRONMENTAL SCIENCE  
Semester -I & III , Winter 2012  
Semester-II & IV, Summer-2013****2012****(Visit us at [www.sgbau.ac.in](http://www.sgbau.ac.in))**

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**SYLLABUS PRESCRIBED FOR M.Sc. PART-I  
ENVIRONMENTAL SCIENCE**

**SEMESTER-I**

**PAPER I: ENVIRONMENTAL SCIENCE-AN INTERDISCIPLINARY  
APPROACH**

- Unit I** : Basic issues in environmental sciences: Definition, principles and scope of environmental science, human population growth, urbanization, sustainability and carrying capacity, environmental attitudes of individuals, society,
- Unit II** : Earth as a system: Environmental unity, earth and life, earth as a eco-system, mass and energy transfer across various interfaces, material balance, first and second law of thermodynamics, heat transfer process.
- Unit III** : Environmental geo-science and geo-chemistry: Basic environmental problems, geo-science factors in environmental planning, Concept of plate tectonics, major plates and boundaries. Major trace elements and classification of trace elements, mobility of trace elements, biogeochemical factors in environmental health.
- Unit IV** : Urban environment, waste management and sustaining living resources: City as a system, influence of city life on city planning and environment, concept of waste disposal, . Effects of fertilizers on, pest control and agro-chemicals, integrated pest management, undesirable effects of irrigation.
- Unit V** : Minerals, environment and environmental economics: Importance of minerals in environment, agriculture, industry and life, resources and reserves, Importance of environmental economics, cost benefit analysis (CBA), policy instruments.

**Recommended Books:**

1. Environmental Sciences, Daniel Botkin and Edward Keller, John Wiley and Sons, New York (1997)
2. Environmental Science, Eldon D. Enger and Bradley F. Smith, WCB Publishers, Boston (1995).
3. Forests in India, Dr. A. K. Jain Vorha Publication, Allahabad (1989).

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4. Advances of Environmental Science and Technology, Nileel11a Rajvaidya APH Publishing House, Delhi (1989)
5. T.D. Bishwas & S. K. Mukharji, AJ.B. of Soil Sciences, Tata Mcgraw hill pub. Co. Ltd. New Delhi. (II Edition 1997)

**PAPER II: CONCEPTS OF ECOLOGY AND BIODIVERSITY**

- Unit I** : **Introduction:** Definition, principles and scope of ecology, history of ecology, subdivisions of ecology, relation to other sciences, relevance to civilization, levels of organization types of ecology – syn ecology, aut ecology
- Unit II** : Population ecology :- Basic concepts of population ecology, population dynamics characteristic features: Natality Mortality, fecundity, density, age distribution, biotic potential, prey-predator relationship, Environmental resistance in relation to absolute maximum and realized minimum carrying capacity size and distribution of population. (Random, Aggregate and uniform populations)
- Unit III** : Ecological Succession and community Ecology :- Mechanism of succession; course of succession, trends of succession, climax concept in succession, models of succession. Characteristics of community, composition and structure, origin and development, ecotone, edge effect, ecological niche, interspecific and intra specific competition.
- Unit IV** : Biodiversity and its conservation :- Species, genetic and ecosystem diversity, levels of biodiversity, Importance and biodiversity indices, values of biodiversity, hotspots of biodiversity, loss of biodiversity, convention on biological diversity, strategies for conservation of biodiversity.
- Unit V** : Biodiversity Action Plan :- Exsitu and Insitu conservation, Biodiversity legislation, Sustainable utilization. National Policy and measurement estimation of the biological biodiversity, diversity act 2002, Biological diversity rules, 2004.

**Recommended Books:**

1. Fundamentals of Ecology: - E.P. Odum, Revised Edition 1995-96 Edition 2003.
2. The Biological diversity Act 2002 and Biological diversity rules 2004:- National Biodiversity Authority INDIA. 475, 9th South cross street, Kalpalocwar Nagar, Neelangarai Chennai – 600041.

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3. Biodiversity and Environment: - S.K. Agarwal, S. Tiwari and P.s. Dubey, 1996.
4. Concept of Ecology: - E.J. Koromondy, 1996, Concept of modern Biology Series, Prentice Hall
5. Biodiversity Measurement and Estimation: - D.L. Hawks worth Director international Mycological Institute Surrey, UK, Published:- Chapman & Hall, Condou New York, Tokyo, Madras.
6. Ecology and Environment: - P.D. Sharma, 1994.
7. Biodiversity Conservation: - Global agreements and nationat concerns. RAMSAR sites CBD, Ouarantine, Regulation, National terety pdicy Biodiversity Act wild life Act.
8. Environmental Science: - Daniel Botkin and Edward Kelter, John Wiley and Sons, New York.
9. Environmental Science: - Eldon d. Enger and Bradley F. Smith, WCB Publishers; Boston.
10. Ecology 2000: - Sir Edmand Hillary.
11. Manual for field Ecology: - R. Mishra.
12. Modern Concepts of Ecology: - H.D. Kumar.
13. Fundamentals of Ecology: - Dash M.C. Tata McGraw Hill. Pub. Co- Ltd. New Delhi.
14. Ecology and Environment: - P.W. Sharma Rastogi Publications, Meerut.
15. Principals of Environmental Biology: - P.K.G. Nair, Himalaya Pub. House, Delhi.
16. Environmental Science: - Enger, Smith, Smith W.M.C. Brown. Company Publication
17. Principles of Ecology – P.S. Verma, V.K. Agarwal, S. Chand and Co. Delhi.
18. Principles of Environmental Science – Wart K.E.F. (1973) Mc Graw Hill Book Company.
19. Ecology – M.P. Arora
20. Concept of Ecology – E.J. Koromondy, 1996, concept of modern biology series, prentice Hall.
21. Principles of Environmental Biology – P.K.G. Nair, Himalaya pub. House, Delhi
22. Basic concepts of soil science – A.K. Kolay, Willey estern Ltd., New Delhi.
23. Environmental Science – Enger, Smith, Smith, W.M.C. Brown company publishing

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24. Practical Method in Ecology – R.K. Trivedi, P.K. Goel and Trisal., Enviro Publication, Karad.
25. Fundamental of Ecology – Dash M.C. Tata McGraw Hill Pub. Co. Ltd. New Delhi.
26. Concepts of Ecology (Fourth Edition)- Edward J. Kommondy, Prentice Hall of India Pvt. Ltd. New Delhi.
27. Biodiversity and environment – S. K. Agarwal
28. The Biological Diversity Act. 2002 and Biological Diversity rules 2004 – National Biodiversity Authority India. 475, 9th South cross street, Kalpalocwar Nagar, Neelangarai, Chennai – 600041.
29. Biodiversity measurement and estimation – D. L. Hawks
30. Biodiversity conservation – Global agreements and national concerns. RAMSAR sites CBD, Quarantine, Regulation, National Forestry policy, Biodiversity Act, Wild life protection Act,

#### PRACTICAL I : LABORATORY EXERCISE BASED

#### ON PAPER I AND II :

#### A. Experiments based on field Ecology :

1. To determine the minimum size of quadrat by "Species Area Curve" method.
2. To determine the minimum no. of quadrats to be laid down in the field under study.
3. To determine frequency density and abundance of a species of a given stand.
4. To determine importance value index (IVI) of vegetation.
5. To study the biotic components of a Pond ecosystem.
6. To compare the biomass and net primary productivity of ungrazed and grazed grass land.
7. To study Ecological modeling.

#### B. Experiments based on Ecological Adaptations:

1. Visit to an aquatic ecosystem and methods for water collection (sampling, handling and preservation)
2. Plankton identification and quantification of water and soil.
3. Ecological adaptations in flora and fauna. (Hydrophytes, Mesophytes and Xerophytes, Sandy, muddy and rocky fauna, fossorial, curbeoreal, Aerial and Desert adaptations (five each).

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4. To study the ecological adaptation in plants to aquatic habitat (Hydrophytes)
5. To study the ecological adaptation in plants to mesophytes.
6. To study the ecological adaptation in plants to desert conditions (Xerophytes)
7. Determination of rate of transpiration in mesophytic plants.
8. To study the ecological adaptation in animals to aquatic habitat

**C. Experiments on Ecological energetics and Disaster :**

1. To study the impact of flood on ecology.
2. Visit to landslide area and survey.
3. Visit to local forest or a sanctuary.
4. Study of energy plants.
5. Visit to aquatic and terrestrial ecosystem.

**D. To study the property of rocks and minerals.**

**E. Experiments on Biodiversity.**

1. Determination of Shannon Weiner Species diversity index to terrestrial animal communities.
2. Determination of Margalef diversity index to terrestrial animal communities.
3. Determination of Kothe's Species Deficit index to aquatic organisms.

**Distribution of Practical Marks (Time - 6 Hrs.) :-**

Q.1 Two major experiments based on field ecology and adaptations	20 Marks
Q.2. Two minor experiments based on field ecology and adaptations	20 Marks
Q.3 Summary Report based on Ecological Energetic or Disasters .	10 Marks
Q.4 Experiment based on rocks and minerals.	10 Marks
Q.5. Experiment based on biodiversity.	20 Marks
Q.6. Practical record	10 Marks
Q.7 Tour/ visit report	05 Marks
Q.8 Viva Voce -	05 Marks
<b>Total Marks -</b>	<b>100 Marks</b>

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**PAPER III: ENVIRONMENTAL CHEMISTRY**

**Unit I** : Fundamentals of Environmental Chemistry: -Stoichiometry, Gibb's energy, chemical potential, chemical equilibria, acid base reactions, solubility Product, solubility of gases in water, the carbonate system unsaturated and saturated hydrocarbons.

**Unit II** : Chemistry of atmospheric pollutant - Chemistry of green house gases, emission of Co<sub>2</sub>, Earth radiation balance. Chemistry of Ozone layer formation and depletion mechanism. Formation of acid-rain & its effects. Chemistry of photochemical smog, O<sub>3</sub>, Nox, HC, CFCS & PAN. Thermo chemical and photo chemical reaction in the atmosphere.

**Unit III** : Chemistry of Industrial Pollutants: - Classification of Industrial Pollutants, Chemical characteristics of wastewater, heavy metals, soaps & detergents, polymers & plastics, asbestos & food additives, fertilizers, insecticides, fungicides, herbicides chemistry of pollutants from pulp & paper mill, sugar & starch industries, textile, cement & pharmaceutical industries.

**Unit IV** : Analytical Environmental Data: Basic concept and definition, true result, error, types of error, accuracy, precision and standard deviation.

**Unit V** : Instrumental techniques in environmental analysis (principle, Instrumentation merits and demerits of techniques colorimetry, spectrophotometry, atomic absorption spectrophotometry, flame photometry, gas chromatography, high performance liquid chromatography, ion exchange chromatography, high volume air sampler and polarography).

**Recommended Books:**

1. A. K. De Environmental Chemistry, Wiley Eastern Ltd, New Delhi (2001).
2. G.S. Sodhi, Fundamental concepts of Environmental Chemistry, Narosa Publishing House, New Delhi (2002).
3. F.W. Field and P.J. Haines, Environmental Analytical Chemistry, Blackwell Science Ltd. USA (2000).
4. Physicochemical examination of water, sewage and industrial effluent, Pragati prakashan, Meerut, (1996).
5. Standard Methods for the examination of Water and Wastewater, 19th Edn, American Public Health Association (1995).

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6. Environmental Chemistry: -A.K. De, Wiley eastern Ltd, 1987.
7. Environmental Chemistry:-R.C. Rasswell, Edward Arnold press 1980.
8. Fundamentals of Environmental Chemistry:- Stanley E. Manahan.
9. Demalogy:- Wetzel
10. Photo chemistry & spectroscopy:- J.P. Simmons Wiley 1971.
11. Fundamentals of Photo chemistry:- K.K. Rohatgi-Mukherjee.
12. Environmental Chemistry:- B.K. Sharma.
13. Elements of Environmental Chemistry:- H.V. Jadhav, Himalya Publication House
14. Environmental Chemistry:- B.K. Sharma and H.kaur, Krishan Prakashan Meia (p) Ltd.
15. Environmental Pollution analysis:- S.M. Khopkar, New Age, International.
16. Environmental Chemical Analysis:- Lain L. Marr, Mallelm S. Cresser, international text book company, USA.

#### PAPER IV: GEODYNAMICS AND ENERGY RESOURCES

- Unit I** : Ecosystem dynamics and biomass productivity: - Definition, kinds of ecosystems, fundamental concepts, structure and functions of ecosystem, energy flow through ecosystems: Ecological energetics, food chains and food web, ecological pyramids. Concepts of biomass, Productivity, Methods of measurement of biomass and primary productivity, Ecological efficiencies.
- Unit II** : Geo-environment :- Introduction, fundamental concept of environmental geology. The concept of earth system, cycles in earth system Earth's thermal environment and seasons. Indian monsoon, El-nino; The rock cycles, droughts,
- Unit III** : Geological hazards :- Assessing geologic hazards & risks, types of hazards - earth quakes, volcanic eruptions, floods, subsidence, landslides, soil erosion and desertification. Hazardous of ocean and weather- sea water intrusion, tsunami, tropical cyclones. Environmental impacts of mining, mining for ground water,
- Unit IV** : Conventional energy resources and mechanism of utilization:- Sources of energy, Energy requirement, - wood, Coal. Oil and natural gas, nuclear energy.
- Unit V** : Non-conventional energy resources :- Biogas energy, Ocean & tidal energy, Nuclear energy, solar energy,

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wind energy, geothermal energy, energy from wastes Ecotechnology sustainable development. Photovoltaics, solar ponds. Energy from biomass, biogas, anaerobic digestion; energy use pattern in different parts of the world.

#### Recommended Books:

1. Environmental Geology :- K.S. Valdiya Indian. Context Tata McGraw Hill Pub. Co, New Delhi, 1987.
2. Environmental Geology :- Barbara, Wim, Brain, J.S. Stephen, C.P. John Wiley & Sens. Inc.
3. Environmental Geology :- Cundgran, Lawrence Prentice Hall.
4. Geology in Env. Planning :- Howard, A.D., and Remson, McGraw Hill, New York 1978.
5. Env. Geology :- Kellev. Natural hazards :- Alexander.

#### PRACTICAL II: LABORATORY EXERCISE BASED ON PAPER III AND IV:

##### A. Experiments based on Environmental Chemistry :

1. Calibration of pH meter and determination of pH of the sample
2. Study on Molarity, normality and buffers.
3. Estimation of conductivity from the samples.
4. Determination of temporary and permanent hardness of water.
5. Estimation of Phosphate from fertilizers by colorimetric analysis.
6. Estimation of sucrose from sugar industry effluent.
7. Estimation of Protein from industry effluent.
8. Analysis of total dissolved and suspended solids from water.
9. Estimation of dissolved oxygen by Winkler's method.
10. Determination of energy contents of biomass.

##### B. Experiments based on Instrumental Techniques :

1. To study Principles, components and working operation of flame photometer.
2. To study principle, components and working operation of colorimeter / spectrophotometer.
3. Demonstration of HPLC for Pesticides analysis.
4. Demonstration of Atomic absorption spectrophotometer.



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**Distribution of Practical Marks (6 Hrs)**

Q.1 Major experiment based on Environmental Chemistry -	20 Marks
Q.2 Minor Experiment based on Environmental Chemistry (any two)-	20 Marks
Q.3 Experiments on Instrumental Techniques -	20 Marks
Q.4 Experiments on Biostatistics -	20 Marks
Q.4 Viva-voce	10 marks
Q.5 Practical Record	10 marks

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**Total Marks** **100 Marks**

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**SEMESTER II**

**PAPER V : BIOINFORMATICS IN ENVIRONMENTAL ANALYSIS**

**Unit I** : **Biostatistics** :- Introduction to statistics population, sample primary and secondary data- collection of primary data graphical and diagrammatic representation of data. Measures of central tendency mean, median and mode.

Measures of dispersion range, standard deviation, raw and central moments, skewness and kurtosis (definitions only). Concept of probability classical and relative frequency definitions of probability.

**Unit II** : Concept of random variable, probability mass function, probability density function, and probability distribution function (definitions only). Binomial, Poisson and normal distribution ( definitions and statements of properties)examples

Principle of test squares-, persons coefficient of correlation and statement of its properties and examples. Concept of simple linear regression-examples.

**Unit III** : Test of Significance :- concept of simple random sampling; random sampling and stratified random sampling; concept of testing of hypothesis; critical region-two types of errors; level of significance; large sample; tests for single mean and difference of means; single proportion and difference of proportion. Chi-square test for goodness of fit and for independence of attributes, students t-test for single mean

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and difference of means and F-test for equality of variances. Concept of ANOVA-examples on one way and two way classification

**Unit IV** : Environmental System analysis and modeling :- Approaches to development of models, linear, simple and multiple regression models, validation and forecasting models, population growth and interaction model Lotka voltra model, Leslie's matrix model, point sources stream pollution model, box model, Gauss ion plume model.

**Unit V** : Computer Programming: - Computer organization, computer generation and classifications, structure, function, capabilities and limitations of computers, computer packages, DOS, MS-Office (MS Word, MSPowerPoint, MS-Excel) for data input & output Development of different environmental models by simple computer programming. Internet access to generate the environmental data.

**Recommended Books:**

1. Biostatistics; A Foundation for Analyses in Health Sciences :- Wayne W. Daniels : Wiely International.
2. Statistical Methods :- Snedecor and Cockran ( Seound Ed.) (Prentice-hall) India, S.P. Gupta.
3. Computer Programming in Fortan IV:- Rajaraman V. Prentic 1982
4. An Introudction to Biostatistics :- Sunder Rao, PHI.
5. Biostatistical Analysis :- Zar, Jerrold H. (1998) Prentice Hall, N.J.
6. Staistics for Engineering and Scientists :- Walpole, R and Myers (1995) 5th Edn. Mac Millan, N.Y.
7. Environmental Statistics and Data Analysis :- Wayne, R. ott (1995) CRC Press.
8. The statistical sleuth :- Ramsay & Schafer (1997) Dunbury Press.
9. Fundamentals of Computers :- V. Rajaraman.
10. Computer techniques in Env. Sci:- Ouellette.
11. DOS 6.0 Secret :- Ainsbary.
12. DOS 6.0 :- Kamin.
13. Elements of Practical Statistics ; - S.K. Kolhapur.
14. Applied Regression. Analysis :- Droper A. and Smith G. (1981).
15. Statistical Methods for engineers and Scientist:- Bethea, R.M. Duran, B.N. and Bonlion. T.L. (1975).
16. Fundamentals of Applied Statistical :- S.C. Gupta and V.K. Kappor.
17. Elements of Statistics :- Donald R. Byrkit.

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18. Multivariance Analysis :- Hunt and Shelly.
19. Computerized Environmental Modeling :- J. Hardstay, D.M. Taylor & S.E. Metcalf( John Villa & Sensl 1993) Publication.
20. Computerized Aided Environmental Management:- S.A. Abbasic & F.I. Khan ( Discovery Publication house Delhi. 2000)
21. An Introduction to Biometry:- Anil. MungiKar Printing Press A'bad.

#### PAPER VI: ENVIRONMENTAL MICROBIOLOGY

- Unit I** : Microorganisms and the Environment :- Microorganisms and the structure of ecosystems. The physiological state of microorganisms in Ecosystems.. Surfaces & Biofilms , Microbial mats. Pure culture concept. Techniques used for environment of culture concept. Method of pure culture, preparation, maintenance and preservation of microbial culture, types of culture, sterilization and disinfections. The influence of environmental factors on growth.
- Unit II** : Microbiology of Air , Water & Soil :- Distribution of microbes in air, Allergic disorders by air microflora fungal and pollen allergens. Collection and enumeration of aeroallergens. The microbial community in Marine and Fresh water environments. Aquatic nutrient cycles - Carbon, Nitrogen, Phosphorus & Sulphur, Bacteriological analysis of water. Sewage and waste water microbiology Biodegradation of Industrial wastes Microbiology of soil – soil, habitats, microbial biogeochemical cycling. Nutritional types of organisms. Nitrogen fixation.
- Unit III** : Microbiology of food :- Microorganisms and food spoilage. Microbial examinations of food. Food processing and methods of preservation . Preservation alternatives. Microbial examination of milk & dairy products. Important fermented food. Disease and foods. Microorganisms as sources of food.
- Unit IV** : Industrial Applications of microorganisms.:- Role of microorganisms in the production process of products medicines (Pharmaceuticals) organic acids, amino acids, Enzymes, fuels, Alcoholic beverages, Enhanced recovery of metals, petroleum products.
- Unit V** : Infection and Disease :-Disease definition , water borne , soil borne , air borne diseases. Transmission of disease,

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types of diseases, Establishment of disease, resistance to disease. Immune disorders bacterial diseases of man, viral disease of man. Control of microorganisms by physical and chemical agents.

#### Recommended Books:

- 1) Microbiology By:- Pelezar.
- 2) Introduction Microbiology:- Stainer.
- 3) Introduction to Microbiology :- Modi
- 4) Microbiology of the atmosphere:- Gregory, P.H. Wiley & Company.
- 5) Microbiology:- LM Prescott John P. Harley, Bonald. A. Klein 4<sup>th</sup> Ed. WCB/Mc Graw –Hill.
- 6) Microbiology Fundamental and Application :- Ronald M. Atlas and Richard Bartha 4th Ed. Aim Print of Addison Wesley Long Man Inc.
- 7) The Microbial World :- Stainer et.al, P.H. I, 1990.
- 8) Medical Microbiology :- Anant Narayan.
- 9) General Microbiology :- Robert F. Boyd. /Times, Mirror/Mosby College publishing st. lawis, Toronto/ Santa Clara. 1984.
- 10) General Microbiology :- Stainer, R.Y, Adelberg, E.A. and Ingrahm, J.I. 1977, Macmillan Press .
- 11) Microbiology :- P.D. Sharma (1993). Rastogi and Company, Meerut, India.
- 12) Fundamental Principles of Bacteriology:- Salle, A.J. (1986).
- 13) Microbiology of Extreme Environment:- Clave Edwards.
- 14) Microbiology for Environmental Scientists & Engineers:- Gindyh, A.F. and Gandy. E. (1982) McGraw Hill, N.Y.
- 15) Microbiology An Environmental Perspective:- Paul Edmonds (1978) Max Milan Publishing.
- 16) Basic Microbiology:- Brock, T.D., K.M. Book and D.M. Ward (1996) (III edition).
- 14) General microbiology – Power and Dagniwala
- 15) Microbiology – P.D. Sharma
- 16) Fundamental principle of bacteriology – P.C. Salle
- 17) Microbiology – Pelczar, M.S. Chand.
- 18) Introduction to Microbiology – Kappor and Touro
- 19) Microbiology – Maheswari and Dubey
- 20) Encyclopedia of environmental microbiology – P. Hotter
- 21) Industrial microbiology – K.C. Daa
- 22) Medical microbiology – Anant Narayana

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**PRACTICAL III: LABORATORY EXERCISE BASED  
ON PAPER V AND VI**

**A. Experiments on Environmental Microbiology :**

1. Microscopy - a) Use of compound microscope b) Calibration of microscope
2. Staining Techniques - a) Monochrome staining b) Negative Staining c) Gram Staining d) Special Staining Methods
3. Slide culture techniques for examination of fungi / actinomycetes.
4. Estimation of total viable counts in water and soil samples.
5. Preparation and sterilization of microbial media.
6. Determination of total bacterial and fungal count from garbage piles in housing colonies.
7. Determination of most probable number (MPN) in water samples.
8. Staining of bacterial suspension by simple staining method (monochrome)
9. Staining of bacterial suspension by Hooker's modification or by Gram's staining.
10. Study of microorganisms by Standard Plate Count (SPC) method.
11. Isolation of bacteria from water, soil, decaying matter.
12. Isolation of fungi from soil/ water/ decaying matter.
13. Identification and classification of bacteria.
14. Study of allergenic and non allergenic pollen grains.
15. Study of laboratory instruments used for microbiological study.
16. Study of preparation of sterilization of culture media.
17. Determination of MPN from drinking water resource for potability.
18. Determination of hydrogen sulfide (H<sub>2</sub>S) from sewage sample.

**B. Experiments based on Biostatistics :**

1. To find out mean, mode and median of given data.
2. To find out probability of occurrence and relative frequency of dominant species.
3. To study the random variables in community.

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4. Applications of chi-square and t-test for the given data.
5. To study the concept of ANNOVA.
6. Calculation of standard deviation from data.
7. Calculation of variance from data.
8. Calculation of standard error (SE) from data.
9. Problems on correlation coefficient.
10. Problems on probability.
11. Problems on t- test.
12. Problems on ANOVA.
13. Problems on chi-square test.
14. Problems on Regression equation.

**C- Experiments on Computer**

1. MS-Word
2. MS-Power Point.
3. MS-Excel
4. Use of internet.

**Distribution of Practical Marks (6 Hrs)**

Q.1 Major Experiment on Environmental Microbiology	20 Marks
Q.2 Two minor Experiment on Environmental Microbiology	30 Marks
Q.3 Two Experiments on Biostatistics -	20 Marks
Q.4 Two Experiments on Computer.	20 Marks
Q.5. Viva-voce -	05 Marks
Q.6. Practical record.	05 Marks

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**Total Marks - 100 Marks**

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**PAPER VII: AIR AND NOISE POLLUTION**

**Unit I** : Air pollution: Definition, natural and man made sources of air pollution, stationary and mobile sources, primary and secondary pollutants, transport and diffusion of pollutants, emission and ambient standards, vehicular pollution and urban air quality. Air pollutants: Sulfur oxides (SO<sub>x</sub>); nitrogen oxides (NO<sub>x</sub>), carbon monoxide, total suspended particulate matter, respirable particulates, photo-chemical oxidants, specific pollutants (Hydrogen sulphide,

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particulate fluoride, formaldehyde and volatile organic compounds), chemical composition of SPM photochemical smog, peroxy acyl nitrates (PAN), benzo-a-pyrene (BAP) formations, atmospheric sinks.

**Unit II** : Global air pollution problems: Green house effect (green house gases: CO<sub>2</sub>, CH<sub>4</sub>, N<sub>2</sub>O, CFC's, water vapor concentration, alternatives for CFC's, fire extinguishers), global warming and climate change, ozone layer depletion (ozone depleting processes, ozone hole, environmental effects and strategies for ozone layer protection), acid rain.

**Unit III** : Effects of air pollution and air monitoring instruments: Human health, plants, animals and microbes, archeological monuments and aesthetics, Orsat apparatus, high volume air sampler and source monitors Status of Air pollution in India..

**Unit IV** : Air pollution meteorology: Wind speed, direction and their vertical profiles, turbulence (mechanical and thermal), atmospheric stability characteristics and classes, Plume behavior, , wind-valley effects, land/sea breeze-effects, heat island effect, mixing height-boundary layer definition, temperature inversions, factors affecting on dispersion of air pollutants,

**Unit V** : Noise pollution: Properties of sound waves, sound level meters, definition of noise, industrial community noise factors, effects of noise on human beings, hearing mechanism, audiometric tests, , effects on human performance, , noise standards and guidelines, permissible noise levels for occupational exposures, noise pollution control and abatement measures.

**Recommended Books:**

1. Magill, Holden and Ackdey, Air Pollution Hand Book, Mc-Graw Hill, New Delhi (1998)
2. R. K. Trivedi & P. K. Goel, An Introduction to Air Pollution, TechnoScience Publications, Jaipur (1995)
3. C.S.Rao, Environmental Pollution Control Engineering, New Age International Publication New Delhi (2001)
4. A. Sharma & A. Roychaudhari, The Deadly Story of Vehicular Pollution in India, CSE New Delhi (1996)
5. Wahi S.K., Agnihotri A. K., and Sharma J.S., Environmental Management, Willey Eastern Ltd., New Delhi. (1992)

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6. G N. Pandey, and G.C. Carney, Master Gillbert M., Introduction to Environmental Engineering and Science, Prentice Hall, New Delhi (2000).

7. E. Robart Alley and Associates, Air Pollution Control Handbook, Mc-Graw Hill, New Delhi (1998)

**PAPER VIII: WATER POLLUTION**

**Unit I** : Characteristics of water and wastewater: Physical, chemical, and biological characteristics of water and wastewater, physiochemical and bacteriological sampling and analysis of water quality, quality standards, (BIS, WHO, CPCB and US Environmental Protection Agency), water quality indices: definition, types, applications and significance, water quality for industrial and bathing purpose, prevention and control of water pollution, sewage treatment plant.

**Unit II** : Sources of water pollution: Sources of water pollution from urban, industrial, agricultural and natural waters, interaction in aquatic system, , sources of marine pollution, criteria for disposal of pollutants in marine ecosystem, coastal management.

**Unit III** : Pollution potential of industrial effluents (Process, sources and characteristics): Effluent characteristics- (temperature, concentration and volume). Nuclear/thermal power stations, agriculture, sugar, food processing, chemical, tanneries, pulp and paper, oil and petroleum, textile and electroplating industries.

**Unit IV** : Water resources and environment: Phytoplankton, zooplankton and macrophytes in aquatic ecosystem, global water balance, origin and composition of sea water, types of water: surface, ground water, brackish and marine water, human use of surface and ground water, exploration of ground water, ground water table, aquifers, design, construction and maintenance of wells and infiltration galleries.

**Unit V** : Consequences of water pollution: Biological uptake of pollutants and their effects on land, vegetation, animals and human health, bio-deterioration, bioaccumulation, biomagnifications and eutrophication, infectious microbial agents in water system and their consequences on human health. Bio-indicators: Specific pollutants in aquatic system and their speciation, behavior, toxicity .

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**Recommended Books:**

1. Gerard Kiely, Environmental Engineering Vol. I, II, & III Liptak, Tata McGraw Hill, New Delhi (1998)
2. A.K. De, Environmental Chemistry. 2nd edn., 1990, Wiley Eastern Ltd., New Delhi.
3. Nancy J. Sell, Industrial Pollution Control, John Willey and Sons, Inc., New York (1992)
4. S.S. Dara A Text Book of Environmental Chemistry and Pollution Control, S. Chand, and Co. Ltd., New Delhi. (1995)
5. P. K. Goal and K. P. Sharma, Environmental Guidelines and Standards in India, Techno science Pub. Jaipur, India (1996)
6. G. R. Pathade, and G. K. Goal, Environmental Pollution and Management of Waste Water by Microbial Techniques, A. B.D. Pub. Jaipur India (2001)
7. S. N. Jogdand, Environmental Biotechnology (Industrial Pollution Management) Himalaya Pub. House Delhi. (1995)

**PRACTICAL IV : LABORATORY EXERCISE BASED  
ON PAPER VII AND VIII**

**A. Experiments based on Air and Noise Pollution :**

- (1) Study of Micrometeorological equipments.
- (2) To study principle, components and working operation of Respirable dust sampler.
- (3) To study principle, components and working operation of stack monitoring kit.
- (4) Measurement of Noise levels.
- (5) Determination of NO<sub>x</sub> from ambient air.
- (6) Determination of SO<sub>x</sub> from ambient air.
- (7) Determination of RPM and TSPM from ambient air.

**B. Experiments based on Water Pollution :**

- (1) Determination of CO<sub>2</sub> & O<sub>2</sub> by Orsat apparatus.
- (2) Determination of oil / grease in water.
- (3) Determination of Inorganic Phosphorus in water.
- (4) Estimation of chlorides in water sample by Mohr's method.
- (5) Estimation of Residual chlorine in water sample by iodometric method.
- (6) Estimation of sulphate in water sample by turbidimetric method.
- (7) Estimation of ferric and ferrous ions present in water.

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- (8) Estimation of Nitrate in water.
- (9) Determination of chemical oxygen demand (COD) in waste water.
- (10) Determination of Biological Oxygen demand (BOD) of waste water.
- (11) Determination of total acidity CO<sub>2</sub> in Water.

**Distribution of Practical Marks (6 Hrs)**

Q.1	Any one Major Experiment on Water Pollution	20 Marks
Q.2	Any one Major Experiment on Air Pollution	20 Marks
Q.3	Any one minor Experiments on Water pollution	15 Marks
Q.4	Any one minor Experiments on air pollution	15 Marks
Q.5	Any one minor Experiments on noise pollution	15 Marks
Q.6	Practical Record.	05 Marks
Q.7	Viva Voce	10 Marks

**Total Marks -**

**100 Marks**

**SEMESTER III**

**PAPER IX : TERRESTRIAL POLLUTION**

**Unit I :** Composition and Sources of solid waste: Ashes, residues, slag, grit, debris, dirt, masonry, garbage, rubbish, trash, dead animals, abandoned vehicles, industrial waste, agro-waste, sewage treatment residues. Urban and rural, agricultural and industrial, demolition, , textile, paper and allied products, chemical and agro-chemical, petroleum refining, rubber and plastic products, leather, primary metals, steel plant, ordnance factories, hospitals.

**Unit II :** Collection, transportation and characterization of solid wastes: Waste storage devices, , collection equipments, alley, curb, backyard, block and curbside collections, transportation equipments, transfer station, long distance transports, processing of solid wastes for disposal, general properties, physical, chemical and biological properties of solid wastes, Bulkiness, combustibility, solubility.

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- (2) Study of a forestation programme of social forestry.
- (3) To study the water shade management practices from local area.
- (4) To study the water harvesting practices from local area and prepare flow chart.

**Distribution of Practical Marks :**

Q.1)	One major experiment on Environmental Toxicology/ Environmental education	20 Marks
Q.2)	One minor Experiment on Environmental Toxicology/ Environmental education	15 Marks
Q.3)	Experiments on Industrial Hygiene and Safety	20 Marks
Q.4)	Experiment of Natural Resource Management	25 Marks
Q.5)	Viva-voce	10 Marks
Q.6)	Practical record	10 marks

**Total Marks-****100 Marks****PRACTICAL VIII: PROJECT Total marks – 100.****Project topic on Environmental protection and nature conservation :**

The students are expected to study the local environmental problems related to the following aspects during their Project work.

- a. Urban Environmental Problems.
- b. Quality of water resources.
- c. Watershed management
- d. Biodiversity study and its conservation
- e. Quality of soil parameters.
- f. Ecotourism
- g. Wildlife management.
- f. Bioremediation.
- g. Health effects of pollution.
- h. Environmental and socio-economic impacts of various human activities.
- i. Environmental health, hygiene and sanitation.
- j. Environmental microbiology.

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Dept. of Physics

**M.Sc. Physics****Prospectus No. 2015124****संत गाडगे बाबा अमरावती विद्यापीठ****SANT GADGE BABA AMRAVATI UNIVERSITY****विज्ञान विद्याशाखा  
(FACULTY OF SCIENCE)****अभ्यासक्रमिका  
विज्ञान पारंगत (पदार्थविज्ञान)  
सत्र-१ ते सत्र -४****PROSPECTUS  
OF  
MASTER OF SCIENCE IN  
PHYSICS  
Semester-I & III, Winter, 2014 and  
Semester-II & IV, Summer-2014****2014****(Visit us at [www.sgbau.ac.in](http://www.sgbau.ac.in))**

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## I

**SANT GADGE BABA AMRAVATI UNIVERSITY, AMRAVATI****SYLLABUS PRESCRIBED FOR M.Sc. SEM-I TO IV PHYSICS****M.Sc. (Physics) 4-Semester course contents****(Restructured syllabi finalised by Sub-Committee of BOS (Physics))**

CODE	TYPE	TITLE OF THE PAPER/LABORATORY	Remarks
1PHY-1	C	Mathematical Physics	Compulsory
1PHY-2	C	Classical Mechanics	Compulsory
1PHY-3	C	Quantum Mechanics-I	Compulsory
1PHY-4	C	Computational Methods and Programming	Compulsory
1PHY-5	C	General Lab	Compulsory
1PHY-6	C	Computer Lab	Compulsory
2PHY-1	C	Electrodynamics-I	Compulsory
2PHY-2	C	Quantum Mechanics-II	Compulsory
2PHY-3	C	Solid State Physics	Compulsory
2PHY-4	E/GIC	i. Network Theorems and Solid State Devices ii. Lasers & Laser Applications Elective Interdisciplinary	
2PHY-5	C	Lab on Solid State Physics	Compulsory
2PHY-6	C	Lab on Electronics	Compulsory
CODE	TYPE	TITLE OF THE PAPER/LABORATORY	Remarks
3PHY-1	C	Electrodynamics -II (Radiation & Plasma Physics)	Compulsory
3PHY-2	C	Statistical Mechanics	Compulsory
3PHY-3	C	Atomic & Molecular Physics	Compulsory
3PHY-4	ES/GIC	i. Digital Techniques ii. Condensed matter Physics-I iii. Analogue Communication iv. Photonics-I one to be selected	Specialization only
3PHY-5	E	Lab on elective (Specialization)	Specialization
3PHY-6	SR	Review +Seminar Report Evaluation(Survey)	Specialization
4PHY-1	C	Nuclear & Particle Physics	Compulsory
4PHY-2	C	OPAMP theory and applications	Compulsory
4PHY-3	E	i. Micro-processor Programming and Interfacing ii. Condense Matter Physics-II iii. Digital Communication iv. Photonics-II one to be selected	Specialization only
4PHY-4	ES/GIC	i. Advance Microprocessors and Microcontrollers ii. Nano-science and Nanotechnology	Elective Interdisciplinary
4PHY-5	E	Lab on elective (Specialization)	Specialization
4PHY-6	PR	Experimental Project +Seminar Report Evaluation	Specialization

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- Notes:**
- 1.C → Core subjects; compulsory
  - 2.E/GIC → Elective as General Interest Course could be offered to non-departmental students
  - 3.ES → Elective Specialization to be selected by the Institution. If a student selects 3PHY-4(i) at the 3<sup>rd</sup> Semester then 4PHY-5 & 4PHY-6 will be on the elective specializations.

1. 3PHY-6 at the third semester is related with Review +Seminar Report Evaluation (Survey).
2. 4PHY-6 is related with Experimental Project +Seminar Report Evaluation
3. The topic for 3PHY-6 must be related with 4PHY-6.
4. The experimental Projects in 4PHY-6 may be based on research area.
5. The student is required to submit three copies in each case i.e. 3PHY-6 and 4PHY-6 at the time of examination.
6. The performances in 3PHY-6 and 4PHY-6 will be evaluated by an external and an internal examiners appointed by the S.G.B.Amravati University, Amravati.

The topic of the Project which is to be completed by every student during fourth semester under 4PHY-6 is to be decided at the beginning of third semester. Accordingly the students are expected to do literature survey, define the problem of the project work and prepare a report including scope, limitation and objectives and deliver the seminar.

**The distributions of Lab activity marks :**

Lab Activity codes	60% weightage	20% weightage	20% weightage
1PHY-5, 1PHY-6, 2PHY-5, 2PHY-6, 3PHY5 and 4PHY-5	Performance of the student at the time of examination including report.	Viva-Voce	Record and performance in the Lab assignments
3PHY-6	Performance in the seminar at the time of examination	Viva-Voce	Seminar report
4PHY-6	Outcome of the Project and Presentation & performance	Viva-Voce	Project report

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Dept. of Zoology

**M.Sc. Zoology****Prospectus No. 2015127****संत गाडगे बाबा अमरावती विद्यापीठ****SANT GADGE BABA AMRAVATI UNIVERSITY****विज्ञान विद्याशाखा  
(FACULTY OF SCIENCE)****अभ्यासक्रमिका  
विज्ञान पारंगत सत्र-१ ते ४  
(प्राणिशास्त्र)****PROSPECTUS  
OF  
MASTER OF SCIENCE IN  
ZOOLOGY  
Semester -I & III, Winter 2014  
Semester-II & IV, Summer-2015****2014****(Visit us at [www.sgbau.ac.in](http://www.sgbau.ac.in))**

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Paper-II	Animal Structure and Function (Chordata)	4
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**11. M.Sc. I Semester II**

Paper-V	Molecular Cell Biology	16
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**M.SC.IIZOOLOGY****SEMESTER-IV****Project Work:**

The subject of the project will be given to a student independently on any topic belonging to Life sciences. The examinee shall be required to produce three typed copies of project signed by teacher in-charge and certified by the department as bonafide work of him/her. Oral presentation is necessary to explain details there of the project. Therefore, he/she is required to prepare transparencies for O.H. P. or slides for slide projector, or power point program for L. C. D. projector if available. The *viva voce* on the project shall be the part of interaction among the examiner and the student presenting his/her project. Valuation and marks will be submitted to the university.

**Distribution of marks –**

1.	Project submission	80
2	Viva)	20

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**Total : 100 marks**

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COP-Ecotourism and wildlife Photography Certificate Course

Prospects No. ....

संत गाडगे बाबा अमरावती विद्यापीठ

SANT GADGEBABA AMRAVATI UNIVERSITY

PROSPECTUS

OF

ECO-TOURISM & WILD LIFE PHOTOGRAPHY

CERTIFICATE / DIPLOMA & ADVANCE DIPLOMA COURSE

EXAMINATIONS - 2009-2010



2009

**GUIDELINES TO PREPARE THE SYLLABUS  
FOR CERTIFICATE COURSE IN  
ECO-TOURISM & WILD LIFE PHOTOGRAPHY  
UNDER THE CAREER ORIENTED PROGRAMME**

**UNIT I ENVIRONMENT & ECOLOGY.**

- 1.1 Environment : Defination, Classification
- 1.2 Natural Resources : Defination, Classification, Types (Renewable & Non renewable)
- 1.3 Ecology : Defination, principles, scope of ecology, Ecological factors.
- 1.4 Community ecology : Defination, species diversity, ecological niche, ecotons.
- 1.5 Population ecology : Defination, Characteristics, Inter specific relationship, Naturalism, commensalisms, parasitism, predation, competition.

**UNIT II ECOSYSTEM**

- 2.1 Ecosystem, definition, components, structures.
- 2.2 Food Chains
- 2.3 Ecological pyramids
- 2.4 Energy flow models
- 2.5 Ecological indicators

**UNIT III ECOTOURISM**

- 3.1 Ecotourism : Defination & Scope of ecotourism.
- 3.2 Potential of ecotourism in Vidarbha region.
- 3.3 Tiger Reserve : Melghat, Pench, Tadoba.
- 3.4 Sanctuaries & National parks – Navegaon, Nagzira, Katepurna, Bor, Tipeswar.
- 3.5 Forts, Caves & Temples : Narnala, Gawilgarh, Salbardi, Muktagiri, Markanda.