

M.Sc. Sem. I to IV
Environmental Science

Prospectus No. 20171212

संत गाडगे बाबा अमरावती विद्यापीठ

SANT GADGE BABA AMRAVATI UNIVERSITY

विज्ञान विद्याशाखा
(FACULTY OF SCIENCE)

अभ्यासक्रमिका
विज्ञान पारंगत सत्र-१ ते ४ परिक्षा
(पर्यावरणशास्त्र)

PROSPECTUS
OF
MASTER OF SCIENCE EXAMINATION IN
ENVIRONMENTAL SCIENCE
Semester I & III, Winter - 2016
Semester II & IV, Summer - 2017



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

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

Ordinance No. 1	: Enrolment of Students.
Ordinance No. 2	: Admission of Students
Ordinance No. 4	: National cadet corps
Ordinance No. 6	: Examinations in General (relevant extracts)
Ordinance No. 18/2001	: An Ordinance to provide grace marks for passing in a Head of passing and Improvement of Division (Higher Class) and getting Distinction in the subject and condonation of deficiency of marks in a subject in all the faculties prescribed by the Statute NO.18, Ordinance 2001.
Ordinance No. 9	: Conduct of Examinations (relevant extracts)
Ordinance No. 10	: Providing for Exemptions and Compartments
Ordinance No. 19	: Admission of Candidates to Degrees.
Ordinance No. 109	: Recording of a change of name of a University student in the records of the University.

Ordinance No.19/2001 : An Ordinance for Central Assessment Programme, Scheme of Evaluation and Moderation of answerbooks and preparation of results of the examinations, conducted by the University, Ordinance 2001.

Dr. Ajay P. Deshmukh
 Registrar
 Sant Gadge Baba Amravati University.

PATTERN OF QUESTION PAPER ON THE UNIT SYSTEM.

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

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

%ORDINANCE NO. 4 of 2008

Examinations leading to the Degree of विज्ञान पारंगत (Master of Science)(Four Semesters Degree Course), Ordinance, 2008.

Whereas it is expedient to provide an Ordinance regarding Examinations leading to the Degree of विज्ञान पारंगत (Master of Science) (Four Semesters Degree Course), in the faculty of Science. The Management Council is hereby pleased to make the following Ordinance.

1. This Ordinance may be Called, "Examinations leading to the Degree of विज्ञान पारंगत (Master of Science) (Four Semesters Degree Course), Ordinance, 2008".
2. This Ordinance shall come into force w.e.f. the date of its approval by the Management Council.
3. The duration of the course shall be two academic years,
 - (a) M.Sc. Course is divided into Semester-I, Semester-II, Semester-III & Semester-IV.
 - (b) University shall hold examinations in Winter and in Summer every year for all semesters.
 - (c) The main examination of odd semesters shall be held in Winter and the main examination of even semesters shall be held in Summer every year. The supplementary examination for odd semesters shall be held in Summer and the supplementary examination for even semesters shall be held in Winter every year.
4. The period of Academic Session/Term shall be such as may be notified by the University and the Examination shall be held at such places and on such dates as may be fixed by the Board of Examinations.
5. Subject to their compliance with the provisions of this Ordinance and of other Ordinances in force from time to time, the following persons shall be eligible for admission to the examinations, namely:-
 - (A) For विज्ञान पारंगत भाग-१ प्रथम सत्र M.Sc.Part-I:-
 - (a) A collegiate candidate admitted to the Degree of Bachelor of Science who has prosecuted a regular course of study in a college or a University Department.
 - (b) a teacher admitted to the Degree of Bachelor of Science and eligible under Ordinance No. 18;
 - (c) a woman candidate admitted to the Degree of Bachelor of Science, who has not pursued a course of study in the University or a College;

% As approved by Management Council on dated 30.5.2008, Vide Item No. 196, and latest amended vide Ordinance No. 14 of 2009 (M.C. dated 25.5.09)

Provided that, applicants eligible under clauses (b) and (c) above shall, if laboratory work is prescribed in the subject which they offer for examination, attend the full course of laboratory instruction in the University Department or a College or a recognised Institution imparting instruction upto the standard of the examination;

Provided further, that in the case of applicants under clauses(b) and (c) above, not less than one academic year shall have elapsed since the date of their passing the examination for the Degree of विज्ञान स्नातक (Bachelor of Science);

- (d) Candidate who has passed B.Sc.Examination of Sant Gadge Baba Amravati University with Chemistry as one of the optional subjects and has also passed the Diploma of Associateship of Institution of Chemists (India) Calcutta and is working as Jr/Sr.Laboratory Asstt. in National Environmental Engineering Research Institute, Nagpur (NEERI) or Council of Scientific and Industrial Research (CSIR), Nagpur or Indian Bureau of Mines (IBM) will be eligible to appear at M.Sc.Semester-I in Chemistry only, without prosecuting a regular course of study in a College/ Department in the University.

Provided he produces certificate of completion of practical course prescribed for M.Sc. Part-I (Semester-I & Semester-II) Examination in Chemistry from his employer.

- (e) any other graduate in Science not eligible under clause (a) (b) or (c) above, shall be eligible for admission to the examination in Mathematics only, after a lapse of not less than one academic year since the date of his passing the examination for the Degree of विज्ञान स्नातक (Bachelor of Science);
- (f) an applicant holding the भेषजी स्नातक (B.Pharm) or the विज्ञान स्नातक कृषी (B.Sc.Agri.) Degree shall be eligible for admission to the विज्ञान पारंगत (M.Sc.) Course in Biochemistry only;
(Note: The विज्ञान स्नातक (B.Sc.) Degree referred to in clause (a) above, shall include the विज्ञान स्नातक (B.Sc.) Degree of the University or an equivalent Degree of any other Statutory University)

- (g) an applicant holding the B.Sc. (Ind.Chem.) Degree of the Banaras Hindu University;
- (h) an applicant holding B.A./B.Sc. with Mathematics/ Statistics or Bachelor of Computer Science Degree for admission to M.Sc. Course in Statistics or Mathematics ;
- (i)
 - i) for admission to M.Sc. Microbiology a candidate shall have offered Microbiology or Industrial Microbiology or Biochemistry as a subject of study and examination at the B.Sc. degree.
 - ii) for admission to M.Sc. Biochemistry a candidate shall have offered Microbiology or Industrial Microbiology or Biochemistry as a subject of study and examination at the B.Sc. degree.
For admission to M.Sc.Biochemistry, in case of vacancies, a students offering Chemistry alongwith Biological Science shall be admitted.
- (j)
 - i) for admission to M.Sc. Electronics (Instrumentation) a candidate shall have offered Physics or Electronics (Instrumentation) or Electronics or Electronics Science or Computer Maintenance as subjects of study and examination at the B.Sc. level and B.C.S. degree of this University or any other equivalent Degree of Statutory University.
 - ii) a person passing B.E. (Electronics & Telecommunication or Industrial Electronics) Examination of Sant Gadge Baba Amravati University is eligible to take admission directly at second year of M.Sc. Electronics (Instrumentation). Such a student who is admitted to second year of M.Sc. Electronics (Instrumentation) shall be awarded M.Sc. degree on the basis of his performance at M.Sc. Part-II only.
- (k) for admission to (M.Sc.) Geography a candidate shall have offered Geography as a subject to study and examination at the B.Sc. Degree.

- (l) for admission to (M.Sc.) Petrochemical Science, a candidate shall have offered Petrochemical Science subject to study and examination at the B.Sc. Degree.
 - (m)
 - i) for admission to M.Sc. Part-I (Environmental Science) a candidate shall have offered one of the optional subject as Environmental Science or Botany or Zoology or Life Sciences or Microbiology or Biochemistry or Biotechnology at B.Sc. degree,
 - ii) Sixty percent seats of the total intake shall be reserved for students who have passed B.Sc. with Environmental Science. If students having Environmental Science as an optional subject are not available then students having other optional subjects be considered.
 - (n) for admission to M.Sc. Geoinformatics or Remote Sensing and GIS, a candidate shall have passed B.Sc. in any discipline of Life Sciences. Preference shall be given to graduates having offered Geology at undergraduate level.
 - (o) for admission to M.Sc. Bioinformatics a candidate shall have passed B.Sc. in any discipline of Life Sciences, Bio Sciences or Bachelor Degree in Agriculture, Veterinary and Fishery Sciences, Pharmacy, or Medical Sciences - Bachelor of Medicine and Bachelor of Surgery, Bachelor of Dental Surgery, B.A.M.S., B.H.M.S. or any equivalent examination recognised by Sant Gadge Baba Amravati University.
- (B) For विज्ञान पारंगत भाग-२ (M.Sc. Part-II) Examination:-
- (a) a student who has been admitted to the Degree of विज्ञान स्नातक (Bachelor of Science) and who has since passing the M.Sc.Part-I (Semester-I & II) Examinations, prosecuted a regular course of study for not less than one academic year in the University or in the College in the subject in which he offers himself for the M.Sc.Part-II Examinations;
 - (b) a teacher admitted to the Degree of विज्ञान स्नातक (Bachelor of Science) and eligible under Ordinance

No. 18 and who has not less than one academic year previously, passed the M.Sc.Part-I Examination in the subject in which he offers himself for M.Sc.Part-II Examinations;

- (c) a woman candidate admitted for the Degree of स्नातक (Bachelor of Science) and who has not less than one academic year previously, passed the M.Sc. Part-I Examination in that subject in which she offers herself for the M.Sc. Part-II Examinations;
- (d) a candidate who has been admitted under Para 3 (A) (d) above and who has not less than one academic year previously, passed M.Sc. Part-I Examination in the subject Chemistry in which he offers himself for the M.Sc.Part-II Examination.

Provided he produces a certificate of completing of practical course prescribed for M.Sc. Part-II Examination in Chemistry from his employer;

- (e) any other Graduate in Science not eligible under clause (a) (b) or (c) who has not less than one academic year previously, passed the M.Sc. Part-I (Semester-I & Semester-II) Examinations in the subject which he offers himself for the Part-II Examination;
6. Subject to his / her compliance with the provisions of this Ordinance and other Ordinances (Pertaining to Examination in General) in force from time to time, the applicant for admission, at the end of the course of study of a particular term shall be eligible to appear at it, if,
- He / She satisfied the conditions in the table and the provisions thereunder.
 - He / She has prosecuted a regular course of study in the university / college affiliated to the university.
 - He / She has in the opinion of the Head of the Department / Principal shown satisfactory progress in his / her study.

Name of Exam.	The student should have passed the Examination of satisfactory	The student should have completed the session/semester
M.Sc.Part-I(Semester-I)	The qualifying examination mentioned in para 5	M.Sc.Part-I (Semester-I)
M.Sc.Part-I (Semester-II)		M.Sc.Part-I (Semester-I & II)
M.Sc.Part-II (Semester-III)	Semester-I	M.Sc.Part-II (Semester-III)
M.Sc.Part-II (Semester-IV)	Semester-I	M.Sc.Part-II (Semester-III & IV)

7. Without prejudice to the provisions of Ordinance No.6 relating to the Examinations in General, the provisions of Paragraphs 8,10, and 31 of the said Ordinance shall apply to every collegiate candidate.
8. The fee for each Semester Examination shall be as prescribed by the University time to time.
Provided that a non-collegiate candidate, other than an ex-student shall also pay a registration fee as prescribed by the University time to time.
9. Every candidate for admission to the examination shall offer one of the following subjects for his examination, namely-
- (1) Mathematics,
 - (2) Physics,
 - (3) Chemistry,
 - (4) Botany,
 - (5) Zoology,
 - (6) Geology,
 - (7) Statistics,
 - (8) Biochemistry,
 - (9) Microbiology,
 - (10) Electronics (Instrumentation),
 - (11) Geography,
 - (12) Geoinformatics,
 - (13) Remote Sensing & GIS,
 - (14) Environmental Science, and
 - (15) Bioinformatics.

Provided firstly, that an examinee who has passed Part-II Examination in one of the subjects listed above from 1 to 15 and is desirous of appearing,

- (a) in any other subject, or
- (b) in a new paper or a combination of papers in the subject in which he has passed, may, without prosecuting a regular course of study present himself in any subsequent academic year for Part-I of the Examination in that other subject or that new paper or new combination of papers, and after not less than one academic year after passing the said Part-I Examination, for Part-II Examination in the said new paper or the said new combination of papers.

Provided secondly, that a candidate eligible for appearing at a examination under the first proviso shall, in the subject or a new paper or the new combination of papers which he is offering for the examination, attend the full course of practical Training, wherever such training is prescribed in the University Department or a College or a recognised Institution imparting instruction upon the standard of the Examination.

Provided thirdly, that an examination successful under clause (b) of the first proviso shall not be awarded division nor shall he be eligible for any scholarship, medal or prize of the University.

10. An examinee at the M.Sc. Part-I or the M.Sc. Part-II Examination shall have the option of not being declared successful at the examination in case he does not secure a minimum of Second Division marks /Higher Second Division marks fifty five percent marks (55%) at the Examination. The option will have to be exercised everytime an application is submitted to any of the three examinations and shall be on the proforma printed on the application form itself. Once exercised the option shall be binding upon the examinee, and shall not be revoked under any circumstances.
11. Any person who has obtained a Third Division at the M.Sc. Examination of this University shall be eligible to take the examination again under this Ordinance in the same subject or group of subjects as the case may be for improving his division. In such a case the provisions of Ordinance No.138 relating to Improvement of Division shall apply.
12. (1) The scope of the subject shall be as indicated in the syllabus.
(2) The medium of instruction and examination shall be English.
13. The number of papers and marks allotted to each subject and the minimum marks which an examinee must obtain in order to pass the examination shall be as indicated in Appendix-6Aö

14. Examinees who are successful in the M.Sc. Semester-I, II, III & IV Examination and have obtained not less than 60% marks in the aggregate of the M.Sc. Semester-I, II, III & IV Examinations taken together shall be placed in the First Division, those obtained less than 60% but not less than 55% marks, in the Higher Second Division, those obtained less than 55% but not less than 48% marks, in the Second Division, and all other successful examinees, in the Third Division.
15. Provision of Ordinance No. 18 of 2001 relating to the an Ordinance to provide grace marks for passing in a Head of passing and improvement of division (higher class) and getting distinction in the subject and Condonation of Deficiency of Marks in a subject in all the faculty prescribed by the Statute No.18, Ordinance, 2001, shall apply to the examinations under this ordinance.
16. As soon as possible after the examination, but not later than 30th, June next following, the Management Council shall publish a list of successful examinees arranged in Three Divisions. The names of examinees passing the examination as a whole in the minimum prescribed period and obtaining the prescribed number of places in each subject in the First or Second Division, shall be arranged in Order of Merit as provided in the Examinations in General Ordinance No.6.
17. Save as provided in Paragraph 11 of this ordinance, no person shall be admitted to an examination under this ordinance, if he has already passed the same examination of this University or an equivalent examination in M.Sc. Part-I (Semester-I & II), and M.Sc. Part-II (Semester-III & IV) of any other Statutory University.
18. Examinees successful at the M.Sc. Part-I (Semester-I & II), and M.Sc. Part-II (Semester-III & IV) shall on payment of the prescribed fees, be entitled for the award of the respective Degree in the prescribed form, signed by the Vice-Chancellor.

(Note : - " P.G. Workload in the faculty shall be as per Ordinance No. 131.")

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

i) 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 examiner for a batch of 10 students or 3 to 5 external examiner for a batch more than 10 students.
- (3) There shall be separate exemption in theory and / or practical on getting minimum pass marks.
- (4) Internal Assessment marks for all semesters shall be granted on the basis of - performance of students in any of the following activities:-
(i) Study tour, (ii) Seminar, (iii) field visits, (iv) Industrial visits, (v) visit to research institute / organisation.
(vi) Assignments, (vii) Unit test and any other co-curricular activities.
- (5) The concerned Department or College shall have to maintain the record of award of internal assessment marks.

DIRECTION

No. : 14 / 2009

Date : 29.6.2009

Subject : Examinations leading to the Degree of विज्ञान पारंगत (Master of Science) (Four Semester Degree Course), Direction, 2009.

Whereas, Ordinance No.4 of 2008 in respect of Examinations leading to the Degree of विज्ञान पारंगत (Master of Science) (Four Semester Degree Course) Ordinance, 2008 is in existence in the University.

AND

Whereas, the Board of Studies in Computer Science (including Computer Application and Computer Science (Computer Software)) in the faculty of Science in its meeting held on 5.6.2009 has resolved to accept revised syllabi of M.Sc. Semester-I to IV Computer Software, eligibility criteria and other details.

AND

Whereas, the Board of Studies further recommended that the scheme of examination will be applicable as per Ordinance No.4 of 2008 to M.Sc. Computer Software, as it is, and the revised syllabi shall be implemented from the academic session 2009-10 expeditiously in the light of advancement of knowledge in the subject.

AND

Whereas the Hon'ble Vice-Chancellor has accepted the revised syllabi of M.Sc. Computer Software, Eligibility criteria, Scheme of examinations and other details under section 14(7) of the Maharashtra Universities Act, 1994 on behalf of the faculty of Science and Academic Council.

AND

Whereas, Original Ordinance No.4 of 2008 is required to be amended for inclusion of the above said course.

AND

Whereas, the matter for the admission to student at the examination of above said course is required to be regulated by an Ordinance, and making amendments in Ordinance is time consuming process.

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 पारंगत (Master of Science) (Four Semester Degree Course), Direction, 2009".
2. This direction shall come into force from the date of its issuance.
3. Eligibility criteria for admission to M.Sc. Computer Software shall be as given below.
A person who has passed the Degree of Bachelor of Science with Computer Science/Vocational Computer Application Subjects
OR
A person who has passed the Degree of Bachelor of Science with Post Graduate Diploma in Computer Science of this University
OR
An Examination Recognised as an equivalent of this University or of any other statutory University.
4. The Scheme of Examination for M.Sc. Computer Software shall be as per Ordinance No.4 of 2008 as other Science subjects, as it is.

Amravati
Date : 29/6/2009

Sd/
(Dr.Kamal Singh)
Vice-Chancellor

DIRECTION

No. : 26 / 2010

Date : 24/06/2010

Subject : Scheme for Choice Based Credit System (CBCS) and Awarding Grades to the Post Graduate Students in the Faculty of Science, 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 11th Plan ñ 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 of choice based credit pattern Examination System at post 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 choice based credit system examination pattern at P.G. level.

AND

Whereas, the faculty of Science in its emergent meeting held on 11th May, 2010 vide item No.27, has considered, accepted and recommended to Academic Council, the policy decision regarding introduction of Scheme for Choice Based Credit System (CBCS) and Awarding Grades to the Post Graduate Students in the Faculty of Science under ordinance No.4 of 2008. The recommendations of the faculty was approved by the Academic Council in its emergent meeting held on 28.5.2010, vide item No.36.

AND

Whereas, Ordinance No.4 of 2008 in respect of Examinations leading to the Degree of विज्ञान स्नातक (Bachelor of Science) is in existence in the University as per semester pattern examination system.

Whereas, it is necessary to frame the Regulation regarding the Scheme for Choice Based Credit System (CBCS) and Awarding Grades to the Post Graduate Students in the Faculty of Science which is to be implemented from the Academic Session 2010-11 of M.Sc.Semester-I & onwards to all subjects in the faculty of Science and framing of Regulation for the above examination is likely to take some time.

AND

Whereas, the admission of students in the above pattern at M.Sc. Part-I (Semester-I) of all subjects in the faculty of Science 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 'Scheme for Choice Based Credit System (CBCS) and Awarding Grades to the Post Graduate Students in the Faculty of Science, Direction, 2010.
2. This Direction shall come into force with effect from the examination as shown below for all subjects for the Examinations leading to the Degree of Master of Science in the faculty of Science-
 - (i) Winter 2010 examination for M.Sc. Part-I, Semester-I,
 - (ii) Summer-2011 examination for M.Sc. Part-I, Semester-II,
 - (iii) Winter-2011 examination for M.Sc. Part-II, Semester-III,
 - (iv) Summer-2012 examination for M.Sc. Part-II, Semester-IV.
3. The detailed Scheme for Choice Based Credit System (CBCS) and Awarding Grades to the Post Graduate students in the Faculty of Science is as given below-

I. The CBCS System

All Programmes (named after the Core subject) mentioned in para 9 of Ordinance No.4 of 2008 shall be run on Choice Based Credit System (CBCS) and the grades in 7 point scale will be awarded to the students. It is an instructional package developed to suit the needs of students to keep pace with the developments in higher education and the quality assurance expected of it in the light of liberalization and globalization in higher education.

II. Credits and Degrees

- i) A candidate who has successfully completed all the core courses Compulsory, Elective/ Specialised courses and project prescribed and optional approved by the University for the programme

and accumulated not less than 72 (52 core and elective) Credits and who has put in the minimum residence time shall be eligible to receive the degree.

- ii) One Credit shall mean one teaching period per week for one semester (of 16 weeks) for theory courses and one laboratory session of two periods / week for one semester. One teaching period shall be of 60 minutes duration including 10 minutes for discussion / movement.

III. Courses

- (i) **Core Course :-** A core course is a course that a student admitted to a particular programme must successfully complete to receive the degree. There may be two kinds of core courses: The **hard-core** courses which cannot be substituted by any other course and which must be successfully completed and **soft-core** courses which may be substituted by equivalent courses from the same department. In all P.G. programmes a project with 03 credits shall be included. The project may include a viva-voce examination with a credit of 1, Normally no theory course shall have more than 4 credits.
- (ii) **Elective Course :** Means a optional course from the basic subject or specialization.

The core credits for any P.G. programme (inclusive of hard-core, soft-core and project) shall not exceed 60 credits and shall not be less than 48 credits. Each Board of Studies shall specify the core-credit load for their respective programme apart from approving syllabi, for all the courses offered by the department.

(iii) General Interest Course (GIC)

The General Interest Course shall be the choice of student. The student who choose the GIC shall have to register for it on payment of fees as prescribed by the University.

The Departmental Committee shall follow a selection procedure on a first come first served basis, fixing the maximum number of students, after counselling to the students etc. to avoid overcrowding to particular course(s) at the expense of some other courses.

- (iv) Each **Course** is designed such that it includes lectures / tutorials / laboratory or field work / Seminar / Practical training / Assignments / Term paper / Report writing or review of literature and any other innovative practice etc., to meet effective teaching and learning needs.

- (v) **Attendance :-** Students must have 75% of attendance in each Core and Elective course for appearing the examination. However student having attendance less than 75% may apply to the H.O.D. for condonation of attendance upto 15% under the provision of para 6-A (i) of Ordinance No.6.

IV. Registration for General Interest Course :-

- i) Each student, on admission shall be assigned to a faculty advisor who shall advise the student about the academic programme and counsel him on the choice of courses listed in Appendix-Q depending on his general interest, academic background and objective.
- ii) With the advice and consent of the faculty advisor the student shall register for courses he plans to take for the semester before classes start. No student shall be permitted to register for courses exceeding 30 credits per semester including those of repeat courses nor shall any student be permitted to register for any course without satisfactorily completing the prerequisites for the course except with the permission of the concerned teacher in the prescribed format.
- iii) If the student feels he has registered for more courses than he can handle, he shall have the option of dropping one or more of the courses he has registered for, with the consent of his advisor before the end of 3rd week of the semester. However, a student, to retain his status, should have registered at least for core course and elective course of that semester.
- iv) Students, other than those freshly admitted, shall register for the courses of their choice in the preceding semester by filling in the prescribed forms.
- v) The University shall prescribe the maximum number of students in each General Interest Course taking into account the teachers and Physical facilities available in the Department.
- vi) The University may make available to all students a listing of all the courses offered in every semester specifying the credits, the prerequisites, a brief description or list of topics the course intends to cover, the instructor who is giving the courses, the time and place of the classes for the course. This information shall be made available on the University website.
- vii) Normally no course shall be offered unless a minimum of 10 students are registered.

- viii) The student shall have to pay the prescribed fee per course for the registration.

V. Programme Committee :-

There shall be the programme committee at the University level constituted as under-

- i) Dean of the faculty (Chairman)
- ii) Heads of all the Departments ñ (Member)
- iii) Three teachers from the affiliated colleges having post graduate courses other than University Department ñ nominated by the Vice-Chancellor. (Member)
- iv) Deputy Registrar (Acad) ñ (Secretary)

Duties and responsibilities of the Programme Committee shall be as under-

- i) To identify the General Interest Courses (GIC) as per the need of the student and availability of teachers in the Departments.
- ii) To approve the time table of GIC and make it available to the students before the commencement of respective semester. This time table also be made available on the University website.
- iii) To consider and approve the report of grivence redresal committee.
- iv) To remove the difficulties if any faced during implementation of the CBCS and report it to Honðle Vice-Chancellor for further action.
- v) Any other matter as it think fit for the effective implementation of CBCS.

VI. Departmental Committee

1. Every P.G. programme of the University/College shall be monitored by a committee constituted for this purpose by the Department.
The Committee shall consist of H.O.D. as a Chairman and all the teachers of the Deptt. of its members including one student members per class. There shall be atleast one student member on the committee.

VII. Grievances Redressal Committee

The University or College shall form a Grievance Redressal Committee for each course in each department with the Course Teacher and the HOD. This Committee shall solve all grievances relating to the Internal Assessment marks of the students.

VIII. Total credits per semester :-**Table-I****For all subjects other than Mathematics,
Biotechnology & Computer Science**

Course	Credits				Total
	Sem-I	Sem-II	Sem-III	Sem-IV	
Core	12	12	12	12	48
Elective	04	04	04	04	16
GIC	00	04	04	04	12
Lab. Course	06	06	06	03	21
I.A.	04	04	04	04	16
Project	00	00	00	03	03
Total	26	26 or 30	26 or 30	26 or 30	116

**Table-II
For Mathematics**

Course	Credits				Total
	Sem-I	Sem-II	Sem-III	Sem-IV	
Core courses	12	12	12	12	48
Elective Courses	08	08	08	08	32
GIC	0	04	04	04	12
Internal Assessment	05	05	05	05	20
Project	0	0	0	04	04
Total	25	25 or 29	25 or 29	25 or 33	116

**Table-III
For Biotechnology**

Course	Credits				Total
	Sem-I	Sem-II	Sem-III	Sem-IV	
Core courses	16	12	12	08	48
Elective Courses	0	9	0	9	18
Lab courses	24	18	18	12	72
Seminar	0	01	01	0	02
Project				06	06
Assignment			02		02
Internal Assessment			02		02
Total	40	40	35	35	150

**Table-IV
For Computer Science**

Course	Credits				Total
	Sem-I	Sem-II	Sem-III	Sem-IV	
Core	25	20	15	10	70
Elective	-	05	05	05	15
GIC	-	-	05	-	05
Lab. Course	06	06	06	03	22
I.A.	-	-	-	02	02
Project	-	-	-	04/02	06
Total	31	31	31	26	119

IX. Grade Awards :-

- (i) A seven point rating scale is used for the evaluation of the performance of the student to provide letter grade for each course and overall grade for the Master's Programme. Grade points are based on the total number of marks obtained by him/her in all the heads of examination of the course. These grade points and their equivalent range of marks are shown separately in Table-I. The performance of the student in theory, practical, internal assessment, subjects shall be evaluated in accordance with following Table-I.

TABLE –I

Grade	Range of Marks obtained out of 100 or Equivalent fraction	Grade Points	Remarks (Not to be displayed On transcripts)
O	90-100	10	Outstanding
A+	80-89	9	Excellent
A	70-79	8	Very Good
B+	60-69	7	Good
B	55-59	6	Fair
C+	50-54	5	Average
C	40-49	4	Below Average
F	Below 40	0	Fail

TABLE-II: Final Grade Points for SGPA and CGPA

Grade Points	Final Grade	Remarks (Not to be displayed On transcripts)
9.00-10.00	O	Outstanding
8.00 – 8.99	A+	Excellent
7.00-7.99	A	Very Good
6.00-6.99	B+	Good
5.50 – 5.99	B	Fair
5.00 – 5.49	C+	Average
4.00 – 4.99	C	Below Average

Equivalence of the conventional division/class with the CGPA is in accordance with the following table no. 4.

Table III. Equivalence of Class/Division to CGPA

Sr.No.	CGPA	Class/Division
1	8.00 or more	First Class ñ Exemplary
2	7.50 or more but less than 8.00	First Class with Distinction
3	6.00 or more but less than 7.49	First Class
4	5.50 or more but less than 5.99	Higher Second Class
5	4.00 or more but less than 5.49	Second Class
6	Less than 4.00	Fail

The overall performance of a student is evaluated by assigning appropriate weightage to all the **four** semesters in order to maintain the quality of education. A student is permitted to appear for the semester examination subject to he or she has a minimum attendance of 75% in theory and practical classes, completes all his/her internal/ sessional assignments and clears all his/her dues. Non appearance in any examination is treated as the student having secured zero mark in that subject examination.

The evaluation is based on an average weightage system. Every subject has credit points based on the hours of study required. Every student is assessed in a subject with appropriate weightage to internal/ sessional work and semester examination, thereby making the students study regularly. Every student is awarded Grade points out of maximum 10 points in each subject (based on 7 Points Scale). Based on the Grade points obtained in each subject, Semester Grade Point Average (SGPA) and then Cumulative Grade Point Average (CGPA) are computed.

X. Computation of SGPA & CGPA

Every student will be awarded points out of maximum 10 points in each subject. (based on 7 Points Scale). Based on the Grade points obtained in each subject the Semester Grade Point Average (SGPA) and then Cumulative Grade Point Average (CGPA) are computed. The computation of SGPA & CGPA, is as under:

Semester Grade Point Average (SGPA) is the weighted average of points obtained by a student in a semester and is computed as follows:

$$SGPA = \frac{U1 \times M1 + U2 \times M2 + \dots + Un + Mn}{U1 + U2 + \dots + Un}$$

Where U1, U2, ñ .. are subject credit of the respective course and M1, M2, ñ .. are the Grade Points obtained in the respective subject (out of 10)

The Semester Grade Point Average (SGPA) for all the four semesters is also mentioned at the end of every semester.

The Cumulative Grade Point Average (CGPA) is used to describe the overall performance of a student in the course and is computed as under:

$$CGPA = \frac{\sum_{n=1}^4 SGPA(n)C_n}{\sum_{n=1}^4 C_n}$$

Where SGPA (n) is the nth Semester SGPA of the student and C_n is the nth Semester total credit. The SGPA and CGPA are rounded off to the second place of decimal.

XI. Internal Evaluation Method :-

- At the beginning of each course, every teacher shall inform his/her students unambiguously the method he/she proposes to adopt for the continuous assessment. Normally the teacher concerned may conduct three written sessional examinations spread periodically during the semester and select best two for contributing to the final marks.
- At the end of each semester the Departmental Committee shall assign grades to the students.
- The Departmental Committee shall prepare the copies of the result sheet in duplicate.

- (iv) Every student shall have the right to scrutinize answer scripts of sessional/end-semester examinations and seek clarifications from the teacher regarding evaluation of the scripts immediately thereafter or within 3 days of receiving the evaluated scripts.
- (v) The Department shall display the grade points and grades for the notice of students.
- (vi) The department shall send all records of evaluation, including sessional evaluation, for safekeeping to the Controller of Examinations as soon as all the formalities are over.

XII. Grade Card

The University shall issue at the beginning of each semester a grade card for the student, containing the grades obtained by the student in the previous semester and his Semester Grade Point Average (SGPA).

The grade card shall list:

- (a) the title of the courses along with code taken by the student
- (b) the credits associated with the course,
- (c) the grade and grade points secured by the student,
- (d) the total credits earned by the student in that semester.
- (e) the SGPA of the student,
- (f) the total credits earned by the students till that semester and
- (g) the CGPA of the student (At the end of the IVth Semester)

XIII. At the end of the IVth semester, the University shall issue the statement of marks to the Students showing details of marks obtained by the student in each Head in each semester along with grade total marks.

XIV. Power to modify and remove difficulties :-

1. Notwithstanding anything contained in the foregoing, Hon'ble V.C. in consultation with the Dean of the faculty shall have the power to issue directions or orders to remove any difficulty,
2. Nothing in the foregoing may be construed as limiting the power of the University to amend, modify or repeal any all of the above.

sd/-

Amravati
Date : 2/6/2010

(Dr.Kamal Singh)
Vice-Chancellor

Appendix-A

Examination Scheme under C.B.C.S. for the subject other than Mathematics, Biotechnology and Computer Science in the faculty of Science M.Sc. Part-I Semester-I

SA-Subject abbreviation; C-Core; E-Elective

Sr.No.	Paper / Code	Course	Theory				Practical		
			Max. Marks (Credits)	Min Pass Marks (Min. Grade Pt.)	Int. Ass. (Credits)	Min. Pass Marks (Min. Grade Pt.)	Th + Int. Ass. Min. Pass Mar (Grade Pt.)	Max. Marks (Credit)	Min. Marks marks (Min. Grade Point)
1	2	3	4	5	6	7	8	9	10
1	1SA-1	C	80 (04)	32 (04)	20 (01)	08 (04)	40 (04)	0	0
2	1SA-2	C	80 (04)	32 (04)	20 (01)	08 (04)	40 (04)	0	0
3	1SA-3	C	80 (04)	32 (04)	20 (01)	08 (04)	40 (04)	0	0
4	1SA-4	E	80 (04)	32 (04)	20 (01)	08 (04)	40 (04)	0	0
5	1SA-5	Lab-I	0	0	0	0	0	100 (03)	40 (04)
6	1SA-6	Lab-II	0	0	0	0	0	100 (03)	40 (04)

Total Marks : 600; Minimum Total Credits : 26

- Note :-** (1) If the student has scored minimum marks or minimum grade points mentioned in Column No.8 out of the sum of total marks of theory and internal assessment taken together then he/she will be declared to have cleared with (04+01) 05 credits.
- (2) If the student has scored minimum marks or minimum grade points in either theory or in internal assessment then he/she will be declared to have cleared in that particular head.

**Examination Scheme under C.B.C.S. for the subject other than
Mathematics, Biotechnology and Computer Science in the faculty
of Science**

M.Sc. Part-I

Semester-II

SA-Subject abbreviation; C-Core; E-Elective; GIC-General Interest Course

Sr.No.	Paper / Code	Course	Theory				Practical		
			Max. Marks (Credits)	Min Pass Marks (Min. Grade Pt.)	Int. Ass. (Credits)	Min. Pass Marks (Min. Grade Pt.)	Th + Int. Ass. Min.Pass Mar (Grade Pt.)	Max. Marks (Credit)	Min. Marks marks (Min. Grade Point)
1	2	3	4	5	6	7	8	9	10
1	2SA-1	C	80 (04)	32 (04)	20 (01)	08 (04)	40 (04)	ò	ò
2	2SA-2	C	80 (04)	32 (04)	20 (01)	08 (04)	40 (04)	ò	ò
3	2SA-3	C	80 (04)	32 (04)	20 (01)	08 (04)	40 (04)	ò	ò
4	2SA-4 Or 2GIC-X	E and/or GIC	80 (04)	32 (04)	20 (01)	08 (04)	40 (04)	ò	ò
5	2SA-5	Lab-III	ò	ò	ò	ò	ò	100 (03)	40 (04)
6	2SA-6	Lab-IV	ò	ò	ò	ò	ò	100 (03)	40 (04)

Total Marks : 600; Minimum Total Credits : 26

- Note :-** (1) If the student has scored minimum marks or minimum grade points mentioned in Column No.8 out of the sum of total marks of theory and internal assessment taken together then he/she will be declared to have cleared with (04+01) 05 credits.
- (2) If the student has scored minimum marks or minimum grade points in either theory or in internal assessment then he/she will be declared to have cleared in that particular head.

**Examination Scheme under C.B.C.S. for the subject other than
Mathematics, Biotechnology and Computer Science
in the faculty of Science**

M.Sc. Part-II

Semester-III

SA-Subject abbreviation; C-Core; E-Elective; GIC-General Interest Course

Sr.No.	Paper / Code	Course	Theory				Practical		
			Max. Marks (Credits)	Min Pass Marks (Min. Grade Pt.)	Int. Ass. (Credits)	Min. Pass Marks (Min. Grade Pt.)	Th + Int. Ass. Min.Pass Mar (Grade Pt.)	Max. Marks (Credit)	Min. Marks marks (Min. Grade Point)
1	2	3	4	5	6	7	8	9	10
1	3SA-1	C	80 (04)	32 (04)	20 (01)	08 (04)	40 (04)	ò	ò
2	3SA-2	C	80 (04)	32 (04)	20 (01)	08 (04)	40 (04)	ò	ò
3	3SA-3	C	80 (04)	32 (04)	20 (01)	08 (04)	40 (04)	ò	ò
4	3SA-4 Or 3GIC-Y	E and/or GIC	80 (04)	32 (04)	20 (01)	08 (04)	40 (04)	ò	ò
5	3SA-5	Lab-V	ò	ò	ò	ò	ò	100 (03)	40 (04)
6	3SA-6	Lab-VI	ò	ò	ò	ò	ò	100 (03)	40 (04)

Total Marks : 600; Minimum Total Credits : 26

- Note :-** (1) If the student has scored minimum marks or minimum grade points mentioned in Column No.8 out of the sum of total marks of theory and internal assessment taken together then he/she will be declared to have cleared that (04+01) 05 credits.
- (2) If the student has scored minimum marks or minimum grade points in either theory or in internal assessment then he/she will be declared to have cleared in that particular head.

Appendix-D

**Examination Scheme under C.B.C.S. for the subject other than
Mathematics, Biotechnology and Computer Science
in the faculty of Science**

**M.Sc. Part-II
Semester-IV**

SA-Subject abbreviation; C-Core; E-Elective; GIC-General Interest Course

Sr.No.	Paper / Code	Course	Theory				Practical		
			Max. Marks (Credits)	Min Pass Marks (Min. Grade Pt.)	Int. Ass. (Credits)	Min. Pass Marks (Min. Grade Pt.)	Th + Int. Ass. Min.Pass Mar (Grade Pt.)	Max. Marks (Credit)	Min. Marks marks (Min. Grade Point)
1	2	3	4	5	6	7	8	9	10
1	4SA-1	C	80 (04)	32 (04)	20 (01)	08 (04)	40 (04)	ò	ò
2	4SA-2	C	80 (04)	32 (04)	20 (01)	08 (04)	40 (04)	ò	ò
3	4SA-3	C	80 (04)	32 (04)	20 (01)	08 (04)	40 (04)	ò	ò
4	4SA-4 Or 4GIC-Z	E and/or GIC	80 (04)	32 (04)	20 (01)	08 (04)	40 (04)	ò	ò
5	4SA-5	Lab-V	ò	ò	ò	ò	ò	100 (03)	40 (04)
6	4SA-6	Project	ò	ò	ò	ò	ò	100 (03)	40 (04)

Total Marks : 600; Minimum Total Credits : 26

- Note :-** (1) If the student score Minimum Marks or Minimum Grade Points mentioned in Column No.8 out of the sum total marks of theory and internal assessment taken together then he/she will be declared to have clear (04+01) 05 credits.
- (2) If the student has scored Minimum Marks or Minimum Grade Points in either theory or in internal assessment then he/she will be declared to have cleared in that particular head.

Appendix-E

**Examination Scheme under C.B.C.S. for the subject
Mathematics in the faculty of Science**

**M.Sc. Part-I
Semester-I**

Sr.No.	Paper / Code	Course	Theory				
			Max. Marks (Credits)	Min Pass Marks (Min. Grade Pt.)	Int. Ass. (Credits)	Min. Pass Marks (Min. Grade Pt.)	Th + Int. Ass. Min.Pass Mar (Grade Pt.)
1	2	3	4	5	6	7	8
1	1MTH-1	C	80 (04)	32 (04)	20 (01)	08 (04)	40 (04)
2	1MTH-2	C	80 (04)	32 (04)	20 (01)	08 (04)	40 (04)
3	1MTH-3	C	80 (04)	32 (04)	20 (01)	08 (04)	40 (04)
4	1MTH-4	E	80 (04)	32 (04)	20 (01)	08 (04)	40 (04)
5	1MTH-5	E	80 (04)	32 (04)	20 (01)	08 (04)	40 (04)
			400 (20)		100 (05)		

Total Marks : 500; Total Credits : 25

- Note :-** (1) If the student score Minimum Marks or Minimum Grade Points mentioned in Column No.8 out of the sum total marks of theory and internal assessment taken together then he/she will be declared to have clear (04+01) 05 credits.
- (2) If the student score Minimum Marks or Minimum Grade Points in either theory or internal assessment then he/she will be declared to have clear either of the head.

**Examination Scheme under C.B.C.S. for the subject
Mathematics in the faculty of Science**

**M.Sc. Part-I
Semester-II**

Sr.No.	Paper / Code	Course	Theory				
			Max. Marks (Credits)	Min Pass Marks (Min. Grade Pt.)	Int. Ass. (Credits)	Min. Pass Marks (Min. Grade Pt.)	Th + Int. Ass. Min.Pass Mar (Grade Pt.)
1	2	3	4	5	6	7	8
1	2MTH-1	C	80 (04)	32 (04)	20 (01)	08 (04)	40 (04)
2	2MTH-2	C	80 (04)	32 (04)	20 (01)	08 (04)	40 (04)
3	2MTH-3	C	80 (04)	32 (04)	20 (01)	08 (04)	40 (04)
4	2MTH-4	E	80 (04)	32 (04)	20 (01)	08 (04)	40 (04)
5	2MTH-5 and/or 2GIC-X	E and/or GIC	80 (04)	32 (04)	20 (01)	08 (04)	40 (04)
			400 (20)		100 (05)		

Total Marks : 500; Total Credits : 25

- Note :-** (1) If the student score Minimum Marks or Minimum Grade Points mentioned in Column No.8 out of the sum total marks of theory and internal assessment taken together then he/she will be declared to have clear (04+01) 05 credits.
- (2) If the student score Minimum Marks or Minimum Grade Points in either theory or internal assessment then he/she will be declared to have clear either of the head.

**Examination Scheme under C.B.C.S. for the subject
Mathematics in the faculty of Science**

**M.Sc. Part-II
Semester-III**

Sr.No.	Paper / Code	Course	Theory				
			Max. Marks (Credits)	Min Pass Marks (Min. Grade Pt.)	Int. Ass. (Credits)	Min. Pass Marks (Min. Grade Pt.)	Th + Int. Ass. Min.Pass Mar (Grade Pt.)
1	2	3	4	5	6	7	8
1	3MTH-1	C	80 (04)	32 (04)	20 (01)	08 (04)	40 (04)
2	3MTH-2	C	80 (04)	32 (04)	20 (01)	08 (04)	40 (04)
3	3MTH-3	C	80 (04)	32 (04)	20 (01)	08 (04)	40 (04)
4	3MTH-4	E	80 (04)	32 (04)	20 (01)	08 (04)	40 (04)
5	3MTH-5 and/or 3GIC-Y	E and/or GIC	80 (04)	32 (04)	20 (01)	08 (04)	40 (04)
			400 (20)		100 (05)		

Total Marks : 500; Min.Total Credits : 25

- Note :-** (1) If the student score Minimum Marks or Minimum Grade Points mentioned in Column No.8 out of the sum total marks of theory and internal assessment taken together then he/she will be declared to have clear (04+01) 05 credits.
- (2) If the student score Minimum Marks or Minimum Grade Points in either theory or internal assessment then he/she will be declared to have clear either of the head.

**Examination Scheme under C.B.C.S. for the subject
Mathematics in the faculty of Science**

**M.Sc. Part-I
Semester-IV**

Sr.No.	Paper / Code	Course	Theory				
			Max. Marks (Credits)	Min Pass Marks (Min. Grade Pt.)	Int. Ass. (Credits)	Min. Pass Marks (Min. Grade Pt.)	Th + Int. Ass. Min.Pass Mar (Grade Pt.)
1	2	3	4	5	6	7	8
1	4MTH-1	C	80 (04)	32 (04)	20 (01)	08 (04)	40 (04)
2	4MTH-2	C	80 (04)	32 (04)	20 (01)	08 (04)	40 (04)
3	4MTH-3	C	80 (04)	32 (04)	20 (01)	08 (04)	40 (04)
4	4MTH-4	E	80 (04)	32 (04)	20 (01)	08 (04)	40 (04)
5	4MTH-5 and/or 4GIC-Z and/or Project	E and/or GIC and/or Project	80 (04)	32 (04)	20 (01)	08 (04)	40 (04)
			400 (20)		100 (05)		

Total Marks : 500; Min.Total Credits : 25

- Note :-** (1) If the student score Minimum Marks or Minimum Grade Points mentioned in Column No.8 out of the sum total marks of theory and internal assessment taken together then he/she will be declared to have clear (04+01) 05 credits.
- (2) If the student score Minimum Marks or Minimum Grade Points in either theory or internal assessment then he/she will be declared to have clear either of the head.

Scheme of Teaching and Examination under C.B.C.S. for the Subject Biotechnology

M.Sc. (Biotechnology) SEMESTER PATTERN

M.Sc.Part-I (SEMESTER-I)

T: Lectures, P: Practical, TU: Tutorial/Assignment; G.I.C. – General Interest Course

S N	Subject Code	Paper	Course	Hrs/ Week		Credits		Examination Scheme								
								Theory				Practical				
				T	P/ TU	Theory	Pract.	Paper Hrs	Max External; Marks	Max Internal Marks	Total	Min Passing Grade Points	Max Marks Practical	Max Marks Int. Ass	Total	Min Passing Grade Points
1	1BTB-1	I	C	04	06	04		3	100		100	4	--	--	--	--
2	1BTB-2	II	C	04	06	04		3	100		100	4	--	--	--	--
3	1BTB-3	III	C	04	06	04		3	100		100	4	--	--	--	--
4	1BTB-4	IV	C	04	06	04		3	100		100	4	--	--	--	--
5	1BTB-5	Lab-I		--	P 01		12	--	--	--	--	--	80	20	100	5
6	1BTB-6	Lab-II		--	P 02		12	--	--	--	--	--	80	20	100	5
				16	24	16	24				400				200	

Total Credits: 40

Scheme of Teaching and Examination under C.B.C.S. for the Subject Biotechnology

M.Sc. (Biotechnology) SEMESTER PATTERN

M.Sc.Part-I (SEMESTER-II)

T: Lectures, P: Practical, TU: Tutorial/Assignment; G.I.C. – General Interest Course

S N	Subject Code	Paper	Course	Hrs/ Week		Credits		Examination Scheme								
								Theory				Practical				
				T	P/ TU	Theory	Practical	Paper Hrs	Max Theory	Max Internal	Total	Min Passing Grade Points	Max Marks Practical	Max Marks Int. Ass	Total	Min Passing Grade Points
1	2BTB-1	V	C	04	06	4		3	100		100	4	--	--	--	--
2	2BTB-2	VI	C	04	06	4		3	100		100	4	--	--	--	--
3	2BTB-3	VII	C	04	06	4		3	100		100	4	--	--	--	--
4	2BTB-4 and/or 2GIC-X	VIII	E and/or GIC	04	06	4		3		100	100	4	--	--	--	--
5	2BTB-5	Lab-III			P 02		12	--	--	--	--	--	80	20	100	5
6	2BTB-6	Lab-IV			P 02		12	--	--	--	--	--	80	20	100	5
		Total		16	25	16	24				400				200	

Total Credits: 40

Scheme of Teaching and Examination under C.B.C.S. for the Subject Biotechnology

M.Sc. (Biotechnology) SEMESTER PATTERN

M.Sc.Part-II (SEMESTER-III)

T: Lectures, P: Practical, TU: Tutorial/Assignment; G.I.C. – General Interest Course

S N	Subject Code	Paper	Course	Hrs/ Week		Credits		Examination Scheme								
								Theory					Practical			
				T	P/ TU	Theory	Pract.	Paper Hrs.	Max Theory	Max Internal	Total	Min Passing Grade Points	Max Marks Practical	Max Marks Int. Ass	Total	Min Passing Grade Points
1	3BTB-1	IX	C	04	06	04		3	100	--	100	4	--	--	--	--
2	3BTB-2	X	C	04	06	04		3	100	--	100	4	--	--	--	--
3	3BTB-3	XI and 3GIC-Y	C and GIC	04	06	04		3	100	--	100	4	--	--	--	--
4	3BTB-4	Lab-V			P 02		18	--	--	--	--	--	80	20	100	5
5	3BTB-5	Internal Assessment			01		02		--	--	--	--	--	75	75	5
6	3BTB-6	Assignment					02		--	--	--	--	--	50	50	5
7		Seminar			01	1		-	--	--	--	--		75	75	5
		Total		12	20	13	22	-	--	--	300	--	--	--	300	--

Total Credits: 35

Scheme of Teaching and Examination under C.B.C.S. for the Subject Biotechnology

M.Sc. (Biotechnology) SEMESTER PATTERN

M.Sc.Part-II (SEMESTER-IV)

T: Lectures, P: Practical, TU: Tutorial/Assignment; G.I.C. – General Interest Course

S N	Subject Code	Paper	Course	Hrs/ Week		Credits		Examination Scheme								
								Theory					Practical			
				T	P/ TU	Theory	Pract.	Paper Hrs.	Max Theory	Max Internal	Total	Min Passing Grade Points	Max Marks Practical	Max Marks Int. Ass	Total	Min Passing Grade Points
1	4BTB-1	XII	C	04	06	04		3	100	--	100	4	--	--	--	--
2	4BTB-2	XIII	C	04	06	04		3	100	--	100	4	--	--	--	--
3	4BTB-3 and/or 4GIC-Z	XIV	E and/or GIC	04	06	04		3		100	100	4	--	--	--	--
4	4BTB-4	Lab-VI					18						80	20	100	5
5	4BTB-5	Project			06		06						200	--	200	5
		Total		12	24	12	24	-	--	--	300	--	--	--	300	--

Total Credits: 35

Appendix-M

Scheme of Teaching and Examination under C.B.C.S. for the subject Computer Science

M.Sc. (Computer) SEMESTER PATTERN

M.Sc.Part-I (SEMESTER-I)

T: Lectures, P: Practical, TU: Tutorial/Assignment; G.I.C. – General Interest Course, C-Core

S N	Subject Code	Paper	Course	Hrs/ Week		Credits		Examination Scheme									
								Theory					Practical				
				T	P/ TU	Theory	Practical	Paper Hrs	Max External; Marks	Max Internal Marks	Total	Min Passing Grade Points		Max Marks Practical	Max Marks Int. Ass	Total	Min Passing Grade Points
1	1MCS-1	I	C	5	-	5	-	3 Hrs	100	-	100	40	4.00				
2	1MCS-2	II	C	5	-	5	-	3 Hrs	100	-	100	40	4.00				
3	1MCS-3	III	C	5	-	5	-	3 Hrs	100	-	100	40	4.00				
4	1MCS-4	IV	C	5	-	5	-	3 Hrs	100	-	100	40	4.00				
5	1MCS-5	V	C	5	-	5	-	3 Hrs	100	-	100	40	4.00				
6	1MCS-6	Lab-I	-	-	7	-	03			-							
7	1MCS-7	Lab-II	-	-	7	-	03			-				100	-	100	40 4.0
		Total		25	14	25	06							100	-	100	40 4.0

Total Credits: 40

Appendix-N

Scheme of Teaching and Examination under C.B.C.S. for the subject Computer Science

M.Sc. (Computer) SEMESTER PATTERN

M.Sc.Part-I (SEMESTER-II)

T: Lectures, P: Practical, TU: Tutorial/Assignment; G.I.C. – General Interest Course, C-Core

S N	Subject Code	Paper	Course	Hrs/ Week		Credits		Examination Scheme									
								Theory					Practical				
				T	P/ TU	Theory	Practical	Paper Hrs	Max Theory	Max Internal	Total	Min Passing Grade Points		Max Marks Practical	Max Marks Int. Ass	Total	Min Passing Grade Points
1	2MCS-1	VI	C	5	-	5	-	3 Hrs	100	-	100	40	4.00				
2	2MCS-2	VII	C	5	-	5	-	3 Hrs	100	-	100	40	4.00				
3	2MCS-3	VIII	C	5	-	5	-	3 Hrs	100	-	100	40	4.00				
4	2MCS-4	IX	C	5	-	5	-	3 Hrs	100	-	100	40	4.00				
5	2MCS-5 Or 2GIC-X	X	E or GIC	5	-	5	-	3 Hrs	100	-	100	40	4.00				
6	2MCS-6	Lab-III	-	-	7	-	03	-	-	-	-						
7	2MCS-7	Lab-IV	-	-	7	-	03	-	-	-	-			100	-	100	40 4.0
				25	14	25	06							100	-	100	40 4.0

Total Credits: 40

Scheme of Teaching and Examination under C.B.C.S. for the subject Computer Science

M.Sc. (Computer) SEMESTER PATTERN

M.Sc.Part-II (SEMESTER-III)

Appendix-O

T: Lectures, P: Practical, TU: Tutorial/Assignment; G.I.C. – General Interest Course

S N	Subject Code	Paper	Course	Hrs/ Week		Credits		Examination Scheme									
								Theory					Practical				
				Paper Hrs.	Max Theory	Max Internal	Total	Min Passing Grade Points	Max Marks Practical	Max Marks Int. Ass	Total	Min Passing Grade Points					
T	P/ TU	Theory	Pract.														
1	3MCS-1	XI	C	5	-	5	-	3 Hrs	100	-	100	40	4.00				
2	3MCS-2	XII	C	5	-	5	-	3 Hrs	100	-	100	40	4.00				
3	3MCS-3	XIII	C	5	-	5	-	3 Hrs	100	-	100	40	4.00				
4	3MCS-4	XIV	E	5	-	5	-	3 Hrs	100	-	100	40	4.00				
5	3MCS-5 Or 3GIC-Y	XV	E or GIC	5	-	5	-	3 Hrs	100	-	100	40	4.00				
6	3MCS-6	Lab-V	-	-	7	-	03			-							
7	3MCS-7	Lab-VI	-	-	7	-	03			-				100	-	100	40 4.0
		Total		25	14	25	06							100	-	100	40 4.0

Total Credits: 35

Scheme of Teaching and Examination under C.B.C.S. for the subject Computer Science

M.Sc. (Computer) SEMESTER PATTERN

M.Sc.Part-II (SEMESTER-IV)

Appendix-P

T: Lectures, P: Practical, TU: Tutorial/Assignment; G.I.C. – General Interest Course

S N	Subject Code	Paper	Course	Hrs/ Week		Credits		Examination Scheme									
								Theory				Practical					
				T	P/ TU	Theory	Pract.	Paper Hrs.	Max Theory	Max Internal	Total	Min Passing Grade Points	Max Marks Practical	Max Marks Int. Ass	Total	Min Passing Grade Points	
1	4MCS-1	XVI	C	5	-	5	-	3 Hrs	100	-	100	40	4.00				
2	4MCS-2	XVII	C	5	-	5	-	3 Hrs	100	-	100	40	4.00				
3	4MCS-3 Or 4GIC-Z	XVIII	E or GIC	5	-	5	-	3 Hrs	100	-	100	40	4.00				
4	4MCS-4	Lab-VII	-	-	7	-	03	4 Hrs	-	-	-	-		100		100	40 04
5	4MCS-5	Project	-	-	7	-	03+1			-	-	-		100	50	100	40 04
6	4MCS-6	Seminar	-	02	-	-	01+1			-	-	-		100	50	150	60 04
7	4MCS-7	Internal Assesment	-	06	-	-	02		-	-	-	40	4.00		50	50	20 04
		Total		23	14	15	11										

Total Credits: 35

**List of General Interest Courses (GIC) to be opted
by the student/s in Semester-II**

Sr.No.	Subject	Subject Code Elective	Equivalent General Interest Course Code
1	2	3	4
1	Chemistry	2CHE3	2GIC-1
		2CHE4	2GIC-2
2	Physics	2PHY3	2GIC3
		2PHY4	2GIC4
3	Mathematics	2MTH4	2GIC5
		2MTH5	2GIC6
4	Zoology	2ZOO3	2GIC7
		2ZOO4	2GIC8
5	Botany	2BOT3	2GIC9
		2BOT4	2GIC-A
6	Statistics	2SCA3	2GIC-B
		2SCA4	2GIC-C
7	Biotechnology	2BTB3	2GIC-D
		2BTB4	2GIC-E
8	Computer Science	2CMS3	2GIC-F
		2CMS4	2GIC-G
9	Microbiology	2MCB3	2GIC-H
		2MCB4	2GIC-I
10	Electronics	2ELE3	2GIC-J
		2ELE4	2GIC-K
11	Biochemistry	2BMC3	2GIC-L
		2BMC4	2GIC-M
12	Geology	2GEO3	2GIC-N
		2GEO4	2GIC-O
13	Bioinformatics	2BIT3	2GIC-P
		2BIT4	2GIC-Q
14	Environmental Science	2ENV3	2GIC-R
		2ENV4	2GIC-S
15	Geoinformatics	2GIT3	2GIC-U
		2GIT4	2GIC-V
16	Computer Software	2CSW3	2GIC-W
		2CSW4	2GIC-1A
17	Remote Sensing and GIS	2RSG3	2GIC-1B
		2RSG4	2GIC-1C
18	Pharmaceutical Chemistry	2PCH3	2GIC-1D
		2PCH4	2GIC-1E

Note : Title of the paper shall prescribed in the respective prospectuses.

DIRECTION

No. : 27 / 2010

Date : 24.6.2010

Subject : Examinations leading to the Degree of विज्ञान पारंगत (Master of Science) (Four Semester Degree Course), Direction, 2010.

Whereas, Ordinance No.4 of 2008 in respect of Examinations leading to the Degree of विज्ञान पारंगत (Master of Science) (Four Semester Degree Course) Ordinance, 2008 is in existence in the University.

AND

Whereas, the Academic Council in its meeting held on 28.5.2010 vide item No.36 has approved the policy decision regarding introduction of Scheme for Choice Based Credit System (CBCS) and Awarding Grades to the Post Graduate Students in the Faculty of Science, for all subjects along with Draft Regulation in this behalf.

AND

Whereas, due to implementation of Scheme for Choice Based Credit System (CBCS) and Awarding Grades to the Post Graduate Students in the Faculty of Science, the provision under Ordinance No.4 of 2008 need to be revised accordingly.

AND

Whereas, admission to students for M.Sc. Part-I (Semester-I) for all subjects in the faculty of Science are to be made in the Academic Session 2010-11 in choice based credit system (C.B.C.S.).

AND

Whereas, making amendments in Original Ordinance No.4 of 2008 is likely to take some time.

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 पारंगत (Master of Science) (Four Semester Degree Course), Direction, 2010'.
2. This direction shall come into force from the date of its issuance.
3. The word 'or Biochemistry' in clause i) of sub-para (i) of para 5 shall be deleted.
4. The title of the subject 'Electronics (Instrumentation)' be substituted as 'Electronics' wherever occur in the Ordinance.
5. Following shall be the eligibility criteria for admission to M.Sc. Part-I Semester-I for the subjects - (i) Pharmaceutical Chemistry, (ii) Biotechnology, (iii) Computer Science.

- (a) for admission to M.Sc. Pharmaceutical Chemistry a candidate shall have offered Chemistry or Industrial Chemistry or Biochemistry as a subject of study and examination at the B.Sc. Degree.
- (b) following shall be the eligibility for admission to M.Sc. Semester-I (Biotechnology) -
 - (i) B.Sc. in any discipline of Life Sciences, Bio Sciences or Bachelor's Degree in Agriculture, Veterinary and fishery Sciences, Pharmacy, or Bachelor of Medicine and Bachelor of Surgery (M.B.B.S.) or Bachelor of Dental Surgery or equivalent examination recognized by Sant Gadge Baba Amravati University are eligible to appear in entrance test as given in para (iii) below.
 - (ii) The student should have minimum 50% marks as aggregate in the degree course.
 - (iii) The student will have to pass entrance examination for admission in M.Sc. Semester-I (Biotechnology) as per the Sant Gadge Baba Amravati University rules.
- (c) following shall be the eligibility for admission to M.Sc. Semester-I (Computer Science) -
 - i. A person who has passed the Degree of Bachelor of Science of this university with Computer Science / Computer Application (Vocational) as on the subjects.
OR
 - ii. A person who has passed B.A. / B.Sc. with Mathematics plus Post Graduate Diploma in Computer Science of this University.
OR
 - iii. A person who has passed a Degree of Bachelor of Computer Science.
6. The following subject be inserted in para 9) of the Ordinance after Sr.No. 615. Bioinformatics.
 616. Computer Software,
 17. Computer Science
 18. Biotechnology, and
 19. Pharmaceutical Chemistry.
7. A person who desire to improve the division obtained by him/her at M.Sc. examination shall be eligible for improvement of division under the provision of Ordinance No.6 of 2008. However, for improvement of division he/she shall have to offer the core courses only. In no case he/she shall be allowed for improvement of division/grade/CGPA by offering General Interest Course.

8. The number of papers and marks allotted to each subject and the minimum marks which an examinee must obtained in order to pass the examination shall be as indicated in Appendices, appended with the Regulation.
9. The classification in reference to the class/division/grade to be awarded to the examinee shall be as per the Table-III (Equivalence to Class / Division to CGPA) of para No.IX, appended to the Regulation.
10. As soon as possible after the examination, but not later than 30th, June following, the B.O.E. shall publish a list of successful examinees arranged in Division as mentioned in Table-III (Equivalence to Class / Division to CGPA) of para No.IX, appended to the Regulation. The names of examinees passing the examination as a whole in the minimum prescribed period and obtaining the prescribed number of places in each subject in the division as per Table-III of the Regulation shall be arranged in order of merit as provided in the Examinations in General Ordinance No.6.

Amravati
Date : 21/6/2010

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

DIRECTION

No. :39/ 2011

Date :23.8.2011

Subject : Corrigendum to Direction No. 26/2010

Whereas, the Direction No.26 of 2010 in respect of Scheme of Choice Based Credit System (CBCS) and awarding Grades to the Post Graduate students in the faculty of Science is in existence.

AND

Whereas, the Academic Council in its emergent meeting held on 28.5.2010 vide item No.36 has approved the decision regarding introduction of scheme for C.B.C.S. and Awarding grades to the P.G. students in the faculty of Science under Ordinance No.4 of 2008..

AND

Whereas, in sub-para V of para 3, under Direction No.26 of 2010, there shall be Programme Committee and the duties of the Programme Committee shall be to remove the difficulties if any faced during implementation of C.B.C.S. and report it to Hon'ble Vice-Chancellor for further action and any other matter as it think fit for the effective implementation of C.B.C.S.

AND

Whereas, the Programme Committee in its meetings held on 14.7.2011, 20.7.2011, 30.7.2011 & 9.8.2011 has recommended necessary corrections in the above Direction which will be effective from the academic session 2011-12. The minutes of the Programme Committee was accepted by Hon'ble Vice-Chancellor on dated 22.8.2011.

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.26/2010.
2. This direction shall come into force from the date of its issuance.
3. (A) In Direction No.26/2010 in respect of Scheme of Choice Based Credit System (CBCS) and awarding Grades to the Post Graduate students in the faculty of Science following paras be corrected as follows :

- i) In para II, sub para (i) of para 3 in the fifth line after the words 'less than' the figure, sign, and words '52 core and elective' be substituted by the figures, sign, and words '64(64 core and elective)
- ii) In para VI: the title 'Departmental Committee' be replaced as 'Programme Monitoring' and Para 1 be completely deleted. Instead of this, the new para should be 'Every P.G. programme of the University/College shall be monitored by the Head of the Department of the University/College of the concerned subject.'
- iii) The para VII shall be substituted as given below -
'VII. Grievance Redressal
All the grievances regarding Internal Assessment shall be settled by H.O.D. or the teacher of the department nominated by H.O.D. / Principal.'
- iv) In para IX : Table I: the grades in column No.2 shall be substituted as under -

"O	by	AA
A ⁺	by	AB
A	by	BB
B ⁺	by	BC
B	by	CC
C ⁺	by	CD
C	by	DD"
- v) **In para X :**
 - i) In the first line the word 'Grade' be added after the word 'awarded' and before the word 'points'
 - ii) In third line the words 'obtained in each subject' be substituted by the words 'obtained in Core and Elective courses of the subject'
- vi) **In para XI :**
 - In sub para (i) in the first line the word 'Head of the Department' be inserted after the words & sign 'each course,' and before the words 'every teacher.'
 - The sentence 'Normally the teacher concerned may conduct three written sessional examinations spread periodically during the semester and select best two for contributing to the final marks' shall be deleted.
 - Sub para (ii) & (iii) be deleted completely.

- Sub para (iv) be renumbered as sub para (ii) and the word 'teacher' in the second line of the original sub para (iv) be substituted by the words 'Head of Departments'.
 - Sub para (v) be renumbered as sub para (iii). In original sub para (v) the words 'grade points and grades' be deleted.
 - Sub para (vi) be deleted completely.
- vii) The word 'Minimum' printed below the table in Appendix A, B, C, D, G, and H, shall be deleted.
- viii) Following special explanatory Note be added below the table in Appendix-D, H, L, and P respectively.
- Special Explanatory Note :-** At the end of IVth semester, the students/examinee who accumulated atleast 88 credits (out of these 88 credits, 64 credits must be on core and elective course) and who has put in the minimum residence time shall be eligible to receive the degree in the subject he/she has admitted.
- (B) The students should have accumulated 28 credits of M.Sc. Part-I, Sem-I & II taken together for admission to III Semester and should have completed the term of M.Sc. Part-I (Semester-I & II) satisfactorily.

Amravati
Date : 22/8/2011

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

DIRECTION

No. : 25 / 2012

Date : 29/6/2012

Subject : Corrigendum to Direction No.26/2010 and 39/2011

Whereas, the Direction No.26 of 2010 in respect of Scheme of Choice Based System (CBCS) and awarding Grades to the Post Graduate Students in the faculty of Science is in existence.

AND

Whereas, University has issued corrigendum to Direction No.26 of 2010 vide Direction No.39 of 2011 on dated 23.8.2011.

AND

Whereas, in sub-para V of para 3, under Direction No.26 of 2010, there shall be Programme Committee and the duties of the Programme Committee shall be to remove the difficulties if any faced during implementation of C.B.C.S. and report it to Hon'ble Vice-Chancellor for further action and any other matter as it think fit for the effective implementation of C.B.C.S.

AND

Whereas, the Programme Committee in its meeting held on 1st March, 2012 and 18th April 2012 has recommended necessary corrections in the above said Directions which shall be effective for 2011-12 session and the minutes of the Programme Committee was accepted by the Hon'ble Vice-Chancellor.

AND

Whereas, the Academic Council in its meeting held on 13.1.2012, vide item No.14(5) F) R-3, I) R-2 & R6 has accepted additional eligibility criteria for Admission to M.Sc. (Zoology), Direct admission to M.Sc. Part-II (Computer Science) for the students who have passed the degree of M.Sc. (Computer Software), and revised syllabi of M.Sc. (Computer Science), which is to be implemented from the Academic Session 2012-13.

AND

Whereas, it is necessary for carryout 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.26/2010 and 39/2011'.
2. This direction shall come into force from the date of its issuance.

3. In Direction No.26/2010 in respect of Scheme of Choice Based System (CBCS) and awarding Grades to the Post Graduate Students in the faculty of Science, following corrections shall be carried out-

- A) i) In para 5th, the words and brackets 'Degree of विज्ञान स्नातक (Bachelor of Science)' shall be substituted as 'Degree of विज्ञान पारंगत (Master of Science)'
 ii) The clause (i), of sub-para (II) of para 3 shall be deleted.
 iii) The clause (i), of sub-para (II) of para 3 shall be renumbered as para (i) and new para (ii) shall be added as follows.

Minimum total credits that students shall have to accumulate in all four semesters for receiving the M.Sc. degree core subject shall be as shown in the table given as under :-

Subject/s	Minimum total credits (Core Elective and GIC)
All subjects other than Mathematics, Computer Science & Biotechnology	104
Computer Science	119
Biotechnology	150
Mathematics	100

- B) i) Under Table-III (Equivalence of Class/Division of CGPA) of Para IX,
 (a) the figures shown 7.49, 7.99 and 7.49 against Sr.Nos.3, 4 & 5 in Column No.2 (CGPA) be substituted by the figures 7.50, 8.00 and 7.50 respectively.
 (b) Following sub-para be added before the para X
Declaration of Merit List :- Merit list of M.Sc. (C.B.C.S.) examination shall be prepared from the examinee who have successively cleared minimum total credits including GIC as shown in the table assigned in the first attempt.
 ii) Special Explanatory note shown under Appendix-D, H, I, L and P shall be deleted.
 The note No.(2) printed under Appendix-A, B, C, D, E, F & H shall be substituted as follows-
 If the student has not scored minimum marks or minimum grade points mentioned in column No. 8 and if the student scores minimum marks or minimum grade points in either theory or internal assessment then he/she will be declared to have cleared either of the head.

4. In Direction No.39 of 2011, under para IX), in Table-I & II, under column No.2, i.e. 'Grade Points' and 'Final Grade' shall be substituted respectively as under.

O	by	AA
A+	by	AB
A	by	BB
B+	by	BC
B	by	CC
C+	by	CD
C	by	DD

5. As the revised syllabi has been accepted by the Academic Council, for the subject Computer Science of four theory papers to each semester therefore the Scheme of Examination for M.Sc. Semester-I to IV shall be as per Appendices-A, B, C & D appended to Direction No.26 of 2010, which is to be implemented for Semester-I from Winter-2012, Semester-II from Summer-2013, Semester-III from Winter-2013 & Semester-IV from Summer-2014 respectively.
 6. The students passing B.Sc. Agriculture with specialization Antomology and Fisheries shall be eligible for admission to M.Sc. Zoology with specialization Antomology and Fisheries respectively.
 7. The student having Degree of M.Sc. (Computer Software) shall be eligible for directly admission to M.Sc. Part II (Semester III) (Computer Science) in the faculty of science within the jurisdiction of sant Gadge Baba Amravati University, Amravati. The average percentage of Marks of M.Sc. (Computer software) and percentage of marks of M.Sc. (Computer Science) shall be considered to award class / Grade for awarding the degree of M.Sc. (Computer Science).

Amravati
 Date : 28/6/2012

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

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

No. : 7 of 2014

Date: 07/05/2014

Subject : Corrigendum to Direction No.25 of 2012

Whereas, Direction No.25 of 2012 in respect of Corrigendum to Direction No.26/2010 and 39/2011 in the Faculty of Science is in existence in the University.

AND

Whereas, the Academic Council in its meeting held on 17.2.2014 vide item No.22 2) E) R-2 while considering the recommendations of Faculty of Science has approved the recommendation regarding award of M.Sc. (Computer Science) degree.

AND

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

AND

Whereas, the changes are to be made applicable from the Academic Session 2014-15.

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

- 1) This Direction may be called, óCorrigendum to Direction No.25 of 2012, Direction, 2014ô
- 2) This Direction shall come into force w.e.f. the date of its issuance.
- 3) In Direction No.25 of 2012, in Para 7., the lines óThe average percentage of Marks of M.Sc. (Computer software) and percentage of marks of M.Sc. (Computer Science) shall be considered to award class / Grade for awarding the degree of M.Sc. (Computer Science)ô be substituted by the lines **óThe class / Grade for awarding the degree of M.Sc. (Computer Science) shall be awarded on the basis of performance at M.Sc. Part-II (Computer Science) only.**

Date : 3/5/2014

Sd/-
(Dr.J.A.Tidke)
Vice-Chancellor
Sant Gadge Baba Amravati University

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

No. : 8 of 2014

Date : 07/05/2014

**Subject :Corrigendum to Direction No. 14 of 2009 in respect of
Examinations leading to the Degree of विज्ञान पारंगत (Master
of Science) (Four Semester Degree Course).**

Whereas, Ordinance No.4/2008 in respect of Examinations leading to the Degree of विज्ञान पारंगत (Master of Science) (Four Semester Degree Course), Ordinance, 2008, in the Faculty of Science is in existence in the University.

AND

Whereas, Direction No. 14 of 2009 in respect of Examinations leading to the Degree of विज्ञान पारंगत (Master of Science) (Four Semester Degree Course) in the Faculty of Science is in existence in the University.

AND

Whereas, the Academic Council in its meeting held on 17.2.2014 vide item No.22 2) E) R-1 while considering the recommendations of Faculty of Science has approved the B.C.A. degree holders of this University are eligible for admission to M.Sc. (Computer Software) course.

AND

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

AND

Whereas, the changes are to be made applicable from the Academic Session 2014-15.

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

- 1) This Direction may be called, óCorrigendum to Direction No. 14 of 2009 in respect of Examinations leading to the Degree of विज्ञान पारंगत (Master of Science) (Four Semester Degree Course) Direction 2014.ô
- 2) This Direction shall come into force w.e.f. the date of its issuance.

- 3) In Direction No. 14 of 2009 in respect of Examinations leading to the Degree of विज्ञान पारंगत (Master of Science) (Four Semester Degree Course), in para 3., after the lines ó A person who has passed the Degree of Bachelor of Science with Post Graduate Diploma in Computer Science of this University OR ó following lines be inserted

óThe Candidates having B.C.A. degree of this University shall be eligible to take admission to M.Sc. Part-I (Computer Software) course OR ó

Date : 3/5/2014

Sd/-
(Dr.J.A.Tidke)
Vice-Chancellor
Sant Gadge Baba Amravati University

**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).
4. Advances of Environmental Science and Technology, Nileel1la 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 ñ 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, Aggrege 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 ñ 600041.3.
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 ñ P.S. Verma, V.K. Agarwal, S. Chand and Co. Delhi.
18. Principles of Environmental Science ñ Wart K.E.F. (1973) Mc Graw Hill Book Company.
19. Ecology ñ M.P. Arora
20. Concept of Ecology ñ E.J. Koromondy, 1996, concept of modern biology series, prentice Hall.
21. Principles of Environmental Biology ñ P.K.G. Nair, Himalaya pub. House, Delhi
22. Basic concepts of soil science ñ A.K. Kolay, Willey estern ltd., New Delhi.
23. Environmental Science ñ Enger, Smith, Smith, W.M.C. Brown company publishing
24. Practical Method in Ecology ñ R.K. Trivedi, P.K. Goel and Trisal., Enviro Publication, Karad.

25. Fundamental of Ecology ñ Dash M.C. Tata McGraw Hill Pub. Co. Ltd. New Delhi.
26. Concepts of Ecology (Fourth Edition)- Edward J. Kormondy, Prentice Hall of India Pvt. Ltd. New Delhi.
27. Biodiversity and environment ñ S. K. Agarwal
28. The Biological Diversity Act. 2002 and Biological Diversity rules 2004 ñ National Biodiversity Authority India. 475, 9th South cross street, Kalpalocwar Nagar, Neelangarai, Chennai ñ 600041.
29. Biodiversity measurement and estimation ñ D. L. Hawks
30. Biodiversity conservation ñ 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 óSpecies Area Curveô method.
2. To determine the minimum no. of quadrats to be laid down in the field under study.
3. To determine frequency density and abudance 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 adapatations in flora and fauna. (Hydrophytes, Mesophytes and Xerophytes, Sandy, muddy and rocky fauna, fossorial, curboreal, Aerial and Desert adaptations (five each.).

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

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Total Marks - 100 Marks

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PAPER III: ENVIRONMENTAL CHEMISTRY

- Unit I** : Fundamentals of Environmental Chemistry: -Stoichiometry, Gibbs 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 CO₂, Earth radiation balance. Chemistry of Ozone layer formation and depletion mechanism. Formation of acid-rain & its effects. Chemistry of photochemical smog, O₃, NO_x, HC, CFCs & PAN. Thermochemical and photochemical 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).

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 energeties,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, windenergy, 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.

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 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 volterra 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, MS PowerPoint, 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 : Wiley International.
2. Statistical Methods :- Snedecor and Cockran (Second Ed.) (Prentice-hall) India, S.P. Gupta.
3. Computer Programming in Fortran IV:- Rajaraman V. Prentice 1982
4. An Introduction to Biostatistics :- Sunder Rao, PH1.
5. Biostatistical Analysis :- Zar, Jerrold H. (1998) Prentice Hall, N.J.
6. Statistics 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.

18. Multiveniance Analysis :- Hunt and Shelly.
19. Computerized Environmental Modeling :- J. Hardstay, D.M. Tailor & 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 Aabad.

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, 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 4th 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

**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 (H₂S) 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.
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 ñ 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_x); nitrogen oxides (NO_x), carbon monoxide, total suspended particulate matter, respirable particulates, photo-chemical oxidants, specific pollutants (Hydrogen sulphide, 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: CO₂, CH₄, N₂O, CFCs, water vapor concentration, alternatives for CFCs, 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)
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 Hand-book, 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 .

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 Wiley 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_x from ambient air.
- (6) Determination of SO_x from ambient air.
- (7) Determination of RPM and TSPM from ambient air.

B. Experiments based on Water Pollution :

- (1) Determination of CO₂ & O₂ 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.
- (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 CO₂ 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

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Total Marks - 100 Marks

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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.
- Unit III** : Effects of solid wastes: Effects of mining and transportation activities, odour nuisance and occupational hazards, health hazards, social and aesthetic impacts of terrestrial pollution, interaction of terrestrial pollution with air and water pollution, agricultural land and their effects on environment,

- Unit IV :** Pollution from production methods: Environmental effects of nuclear, thermal and hydel power production methods pollution from oil, coal, wood and agro-residues burning, food and chemical manufacturing industries, agro industries, fertilizers and pesticides, petroleum production, acid plants.
- Unit V :** Management of solid wastes: Physical methods such as open dumping, sanitary landfill, ocean dumping, incineration, chemical methods such as pyrolysis, biological methods such as composting and vermi-composting, management of hazardous wastes, modern trends in solid waste management, recycling of waste materials, waste minimization technology.

Recommended Books:

1. A. D. Bhide and B.B. Sundersen, Solid Waste Management in Developed Countries, INSDOC, New Delhi (1983)
2. Sinha R. K., Sinha A. K., Saxena V. S., A Book on Waste Management, INA, Shri publishers, Jaipur (2000)
3. Robert A. Corbitt, Standard Handbook of Environmental Engineering, Mc-Graw Hill, (1989)
4. E. D. Enger, B.F. Smith, Environmental Science - a study of interrelationships. 5th Edn. W.C.B. Publ., London. (1995)
5. D. Botkin and E. Keller, Environmental Science - Earth as a Living Planet. John Wiley and Sons, Inc., New York, (1997)
6. Pollution control in process industry ñ S. P. Mahajan
6. Global air pollution ñ Brijman
7. Environmental pollution and management ñ L. Mohan
8. Environmental analysis ñ P. R. Trivedy and Gurdeep Ray
9. Soil pollution and soil organism ñ P.C. Mishra

PAPER X : REMOTE SENSING, GIS AND COMPUTER APPLICATIONS

- Unit I :** Introduction to remote sensing: Definition, Historical perspective, Electromagnetic radiations(EMR), EMR spectrum, Radiation laws, Black body and real body radiation, Hemispheric reflectance, Transmittance, Absorbance,. Application of remote sensing in environmental studies: Land use / land cover; Wastelands; Forest, Forest fires; Water resources, Disasters; Wildlife habitat, Vegetation

- Unit II :** Interaction of electro magnetic radiation (EMR) and remote sensing: With earth surface: reflection, transmission, spectral signatures. With the atmosphere: scattering, absorption, refraction, Types of remote sensing, Characteristics of remote sensing, Platforms and orbits: ground based, air borne, space borne Orbits: geostationary satellites and polar-orbiting satellites Sensors: MSS and TM scanners in landsat series, HRV scanners in spot series, LISS,
- Unit III :** Aerial photography: Definition, Photogrammetry, Flight lines of vertical aerial photography, Types of aerial photography, Types of films, , Aerial photo interpretation.
- Applications of Remote Sensing: ,** , Geologic and Soil Mapping, Agricultural applications, Forestry applications, , Water Resource applications, Urban and Regional Planning application, Wetland Mapping, ,.
- Unit IV :** Computer and statistical applications: History, characteristics and classification of computers, Application of computers;, Main parts of PC, , Basic elements and tools of statistical analysis, probability, Chi-square test, Arithmetic, geometric and harmonic means; Linear equations, Tests of hypothesis and significance.
- Unit V :** Geographical information system (GIS): GIS: definition, capabilities and advantages, History of GIS, Objectives of GIS, Elements of GIS, Data model: Raster and vector data model, Data structures: relational, hierarchical and network data structures, Use of GIS in environmental management Components of GIS, GIS Workflow, GIS Categories, Levels/ Scales of Measurements

Recommended Books:

1. Principles of Remote Sensing: A.N. Patel and S. Singh, Scientific Publishers (India), Jodhpur (1999).
2. Remote Sensing of the Environment: J. R. Jensen, Pearson Education Inc, Delhi(2003).
3. Remote Sensing for Environment and Forest Management: A. Mehrotra and R.K. Suri, Indus Publishing Co., New Delhi (1994).
4. Remote Sensing for Large Wildfires: E. Chuvieco, Springer, New York (1999).

6. Introduction to Geographic Information System: Chang, Kangtang, Tata McGraw Hill, New Delhi (2002).
7. Geographic Information System: R. Ram Mohan Rao and A. Sharieff, Rawat Publication, New Delhi, (2002).
8. Textbook of Remote sensing and GIS (Third edition, 2006) by M. Anji Reddy BS Publication, Hyderabad
9. Fundamentals of remote sensing (Second edition, 2005) by George Joseph Universities press (India) Private Ltd., Hyderabad.
10. Remote sensing and image interpretation (Fifth edition, 2007) by Thomas M. Lilesand, Ralph W. Kiefer, Jonathan W. Chapman Wiley India publication, New Delhi .
11. Remote sensing of the environment (2000) John R. Jensen, Dorling Kindersley India Pvt. Ltd,
12. Current sciences special issue remote sensing for national development Volume 61 numbers 3 and 4 August 1991

**PRACTICAL V : LABORATORY EXERCISE BASED
ON PAPER IX AND X :**

A. Experiments based on Computer and Statistical Applications :

- (1) Basic Program for standard deviations.
- (2) Basic Program for BOD/ COD/Hardness
- (3) Use of Excel program for data manipulations, functions and formulae, chart & graphs.
- (4) Use of MS-Word for creating document, tables, and graphs.

B. Experiments based on G.I.S. :

- (1) Interpretation of aerial photographs.
- (2) Use of GIS software for Environmental Studies.
- (3) Determination of height of the object in aerial photographs.
- (4) Interpretation of Satellite Images
- (5) Analysis of aerial photographs by using stereoscope (3 P)
- (6) Indexing of Topo sheet.
- (7) To study the conventional signs and symbols from Toposheet.
- (8) Interpretation of Topo sheet.
- (9) To study of conventional signs and symbols from weather map.
- (10) Interpretation of weather map.

C. Experiments based on Terrestrial-pollution:

- (1) To Estimate the effect of Exhaust gases on chlorophyll content in different plants.
- (2) Analysis of Physical Parameters of Solid Waste.
- (3) Analysis of Chemical characteristics of Solid Waste
- (4) To compare chemical characteristics of soil by rapid tests.
- (5) Study on physical characteristics of soil.
- (6) Determination of organic matter by walkley and Black method from soil.

Distribution of Practical Marks (Duration - 6 Hrs)

Q.1 Any one major Experiment based on terrestrial pollution	20 Marks.
Q.2. Any one minor Experiment based on terrestrial pollution	10 Marks.
Q.3 Any one Experiment based on Computer and Statistical Applications	15 Marks
Q.4 Any one major Experiment based on Geographical Information systems (GIS)	20 marks
Q.5 Any one minor Experiment based on Geographical Information systems (GIS)	15 marks
Q.6. Viva-voce	10 Marks
Q.7. Practical record	10 Marks

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Total Marks - 100 Marks
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**PAPER XI : ENVIRONMENTAL IMPACT
ASSESSMENT AND AUDIT**

- Unit I** : Environmental impact assessment (EIA): Definition of EIA and EIS, , Concepts, scope and objectives of EIA; National Environmental Policy Act (NEPA, 1969); EIA guidelines-1994 (Notification of Government of India).
- Unit II** : Impact assessment methodologies: Definition and concept of impact; Types of impacts (Negative & Positive: Primary & Secondary; Reversible and Irreversible;); Impact identification; Methods for impact identification: Matrices, networks and checklists, Advantage & disadvantages of EIA methodologies.

- Unit III :** Components of EIA: Environmental Setting; Baseline data; Prediction and evaluation of impacts; Environmental management plan and monitoring, Baseline information, Prediction, evaluation and mitigation of impacts on socioeconomic, air water, soil and noise environment. Public participation in EIA: Decision making, Public participation in environmental decision making, Objectives and techniques for public participation, Advantages and disadvantages of public participation.
- Unit IV :** Preparation and writing of EIA: For water resources, Dams and irrigation projects; Mining and Infrastructural projects etc., eco ñ labeling eco-marks, ecotourism, eco-feminism, Eco-regulation, eco-accountability, green management, green products, green claims, eco wars.
- Unit V :** Environmental auditing: Notification and guidelines for Environmental audit; Scope, applicability and objective of environmental audit; procedure of environmental auditing; Designing and implementation of audit tools ñ pre audit activities ñ on site activities ñ post audit activities ñ Environmental statement ñ benefits of environmental audit ñ EA scenario in India ñ submission of Environmental Audit report in MoEF format.

Recommended Books:

1. Environment Impact Assessment: Larry W. Canter, Mc-Graw Hill Inc., New York (1996).
2. Introduction of Environmental Impact Assessment: John Glassion, Rikay Therival and A. Chadwick, UGC Press Ltd., London (1994).
3. Methods of Environmental Impact Assessment: Peter Morris, Ricky Therivel, UGC Press Limited, London (1994).
4. Environmental Impact Assessment & Management: Daya Publishing House, New Delhi (1998).
5. Using Environmental Management system to improve profits: B. Pearson, BFP Little and M. J. Brierley, Graham & Thotrman, Kluwer Academic Publisher Group, London(1992).
6. A monograph on Environmental Audit: The Institute of cost and works Accounts of India, New Delhi (1994)
7. Handbook of Environmental Impact Assessment (Vol. I): Judith Petts, Blackwell Science, USA (1999).
8. Handbook of Environmental Impact Assessment (Vol. II): Judith Petts, Blackwell Science, USA (1999).

9. Environmental Impact Assessment: A. Eillpin.
10. Environmental Impact Assessment and Management: H. Kumar (1998).
11. Environmental Impact Assessment of Tehri Dam: V. Govardhan.
12. Practical guide to Environmental Impact Assessment: Belly Bowers and Marriott (1977).
13. Environmental Impact Assessment: A. K. Shrivastava APH Publication 2003.
14. Law of Intellectual Property: Dr. S. R. Mysani Asia Law House (2nd Edition) Law Book Sellers, Publishers and Distributors Hyderabad.
15. Environmental Impact Assessment, L. W. Canter, McGraw Hill publication, New Delhi.
16. Proceedings Indo-US workshop on environment impact analysis and assessment (1980) NEERI, Nagpur.
17. Environment & Social impact assessment, Vlcany, F., Bronsetin DA (1995), John Wiley & Sons, New York.
18. EIA ñ A Biography. B. D. Clark, B. D. Bissel, P. Watheam.
19. Second world congress on engineering and environment 1985, Institution of engineers.

PAPER XII : POLLUTION CONTROL TECHNOLOGY

- Unit I :** Air Pollution Control Methods :- Need for control methods. Particulate emission control gravitational settling chambers, cyclone separators, fabric filters, Electrostatic precipitators, wet scrubbers. Control of gaseous pollutants ñ So₂, Nox, Co, Co₂ PAN & Hydrocarbons modifications of operating conditions. Modification of design conditions. Automobile pollution control - control at source, fuel tank, carburetor, crankcase Exhaust emissions, Indian scenario.
- Unit II :** Sewage and Industrial Waste Water Treatment :- The need for waste water treatment: Treatment of waste water ñ Primary treatment (Sewage)-screens, grit chambers and oil separation & primary sedimentation. Primary treatment (industrial waste water) ñ segregation, equalization, neutralization, sedimentation, flotation & Oil separation . Secondary treatment principal of biological treatment ñ waste stabilization ponds ñ Aerated lagoon, - Activated sludge process- trickling filters. Sludge treatment and disposal, preliminary operations- sludge thicker-sludge digesters, sludge conditioning- dewatering methods ñ sludge drying beds, vacuum filtration ñ filter process, centrifugation ñ sludge disposal methods.

Unit III : Advanced waste water treatment :- Removal of suspended solid, dissolved solids, nitrogen removal-phosphorous removal - Adsorption-refractory organics and their treatment ñ Reuse and recycle of waste water. Operation, monitoring & design of Effluent treatment plants, including preliminary, primary, secondary and tertiary treatment for the industries Viz-Sugar, Pulp & Paper, Dairy, Textile, Distillery, fertilizer & petrochemical industries. Concept of common effluent treatment plant (CETP) and Public owned treatment plant (POTP).

Unit IV : Radiation and Noise Pollution Control Measures:- Types of radiations, sources of radiations, biological effects of radiations, Nuclear energy scenario,. The nuclear dilemma. Introduction to noise pollution. The decibel scale ñ physiological, psychological effects of noise ñ Noise measurement Noise control criteria, Equipments for noise measurement ñ Noise control in industries.

Unit V : Solid Waste Management: - Need of Solid Waste management, types of solid waste, biodegradable, refractory, and inorganic, industrial solid waste, pulp and paper, sugar, thermal power station, food processing, textile, urban and agricultural. Solid waste treatment compaction, dewatering, briquette, size reduction,. Solid waste disposal methods solid waste reuse : Recycling and incineration pyrolysis, biogas generation, solid waste as a source of raw material i.e. light weight bricks from fly ash, composting etc. Management of urban solid waste.

Recommended Books:

- 1) Air Pollution :- H.C.V. Rao, 1990.
- 2) Air Pollution & Control:- P. Pratapmouli G.N. Vekatasubbayya, Divya Jyothi. Prakashan, Jodhapur 1989.
- 3) Fundamentals of Air Pollution:- 2nd Ed. Arthur C. Stern Acad. Press 1984.
- 4) Pollution Control in Process Industries:- S.P. Mahajan, Tata Mc.Graw Hill Publications. New Delhi.
- 5) Meteorology of Air Pollution:- R.S. Scores 1990. Ellis Harwood publication.
- 6) Air Pollution :- M.N. Rao, Mc Graw Hill 1993.
- 7) Waste Water Engineering, treatment, Disposal and reuses:- Metcalf and Eddy.

- 8) Water Supply & Sanitary Engineering :- R.C. Rangwala.
- 9) Introduction to Waste Water treatment process. :- Ramalho R.S.
- 10) Environmental Engineering :- Arcadvo. P. Sincero & Gregorial A. Sincero Prentice Hall of India Pvt. Ltd.
- 11) Ecotechnology for pollution control and environmental management:- R.K. Trivedy and Arvind Kumar Enviro. Media.
- 12) Water and Waste Water Technology:- Mark J. Hammer Joh Witeyt Sons.
- 13) Waste Water Engineering :- J.R. White.
- 14) Environmental Pollution and Engineering:- C.S. Rao.
- 15) Environmental Engineering:- M. Narayanrao.
- 16) Solid Waste Management in developing Country:- A.D. Bhide.
- 17) Integrated Solid Waste Management :- George Techbanogl Theisen and Vignl
- 18) Industrial Waste Water Treatment :- M.N. Rao & A.K. Dutta. Oxford 4 IBH Publ. House 1987.
- 19) A Treatise on Rural, Municipal and Industrial water Management:- KVS G Murali Krishna.
- 20) Sewage Disposal and Air Pollution Engineering:- S.K. Garg 1990 Khanna. Publication.
- 21) Water Supply and Sanitary Engineering:- G.S. Bridie & J.S. Brides Dhanpat Rai & Sons. 1993 6th Ed.
- 22) Water treatment specification:- Frank rose Mc growl Hill 1985.

PRACTICAL VI : LABORATORY EXERCISE BASED ON PAPER XI AND XII :

A. Experiments based on Environmental Impact Assessment (E.I.A.)

- (1) To evaluate the impact of traffic density on mix environment.
- (2) To study pollution potential of dairy effluent.
- (3) To draw the flow chart for industrial effluent treatment.
- (4) To compare the impact of chemical pesticides vis-a-vis bio-pesticides on micro flora.
- (5) To examine the effect of chemical v/s bio fertilisers on root ramification and plant growth.
- (6) Impact of air pollution on photo density flux of plant leaves.
- (7) Evaluation of impact of refuse on soil quality.

B. Experiments on Pollution Control Techniques and Analysis :

- (1) To study the effluent characteristics of pulp and paper industry.
- (2) Analysis of textile mill effluent
- (3) Estimation of MLSS, MLVSS from the sewage.
- (4) Determination of chlorine demand for drinking water.
- (5) Determination of pollution load through leachate of solid waste dump.

Distribution of Practical Marks (Duration - 6 Hrs)

Q.1. Any one major Experiment on Environmental Impact Assessment (EIA)	25 marks
Q.2. Any one minor Experiment on Environmental Impact Assessment (EIA)	20 marks
Q.3. Any one major Experiment on Pollution Control Techniques	20 Marks
Q.4. Any one minor Experiments on PCT.	15 Marks
Q.5. Q.6-Viva Voce	10 Marks
Q.7. Practical Record	10 Marks

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Total Marks - 100 Marks

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SEMESTER IV**PAPER XIII : ENVIRONMENTAL TOXICOLOGY AND HAZARDOUS WASTE MANAGEMENT**

- Unit-I :** Scope and concepts of ecotoxicology and toxicology, paracelsus's view of poison; clinical, environmental, economic toxicology; xenobiotic concentration and dose, calibration of Dose response curve, lethal, Lc50 and threshold concentration, acute, sub acute and chronic toxicity; bioconcentration and biomagnifications, Toxicity Vs chemotherapy. Neurotoxicity, carcinogenicity, & mutagenicity.
- Unit II :** Bio-assay techniques; study protocols to evaluation of toxicants. Tests for assessing carcinogenicity and mutotoxicity of compounds. TLC techniques for determination of toxicants in water & vegetable samples.

- Unit III :** Classification of toxicants: natural and synthetic toxins; chemicals classification and mode of action of pesticides. Recent trends in the use of pesticides. Plant toxins; Aflatoxins, ergots, pyrethroids. Heavy metal pollution caused by lead, arsenic, mercury, cadmium and chromium, their effect on human health.
- Unit IV :** Hazardous waste management: Nature and scope of hazardous wastes, classification of hazardous substances and wastes, Hazardous wastes and air and water pollution control, physical forms and segregation of wastes, hazardous substances and health.. Separation of waste at sources of generation for recovery plastic, paper, and metal etc. Need of hazardous waste management; type of wastes, biodegradable, refractory and inorganic, industrial wastes. Industrial sludge, radioactive wastes.
- Unit V :** Waste treatment and disposal :- treatment and disposal of hazardous wastes, reduction, recycling and methods of wastes treatment, neutralization, oxidation reduction, precipitation, solidification, stabilization, incineration Pyrolysis, wet-oxidation etc. landfill treatment for hazardous waste disposal & leachate management, land farming, bioremediation.

Recommended Books:

1. Principles of Environmental toxicology:-Ian C.Shaw and John Chadwick, Taylor and Francies
2. Environmental Toxicology and Chemistry:-Donald G. Crofsy 1998
3. Text book of modern Toxicology:- David A. Wright and Pamela Welbourn Cambridge University Press 2002.Ernest Hodgson and Patricia E.levi Appleton and Lange Stamford etc U.S.A.1995.
4. Basic Toxicology:- Frank C. Lu, Hemisphere publishing Corporation, New York, Washington 1993.
5. Essentials of Toxicology:- Loomis TA, Leae Fabiger.
6. Toxicology:-Hayes.
7. Principles of toxicology:-Cassarett and Doulls.
8. Environmental Engineering:- M.Narayanrao.
9. Solid Waste Management in developing countries:-A.D.Bhide
10. Integrated Solid Waste Management:-George Tehbanoglous Theisen and Vigil.
11. Guide lines for setting up operating facility:-Hazardous waste management CPCB Manual, 1998.

12. Environmental Pollution and Toxicology:-S.P.Ray, Chaudhari, D.S. Gupta.
13. Environmental Engineering designing approach:-Arcadia P. Sincero Gregoria A.Sincero Prentice hall of India Pvt. Limited.
14. Encyclopedia of Environmental control technology (9 Vols. Set):- Paul N.Cheremisinoff Technip Book International.
15. Principal of Environmental Toxicology:-Ian C.Shaw & John Chadwick; Taylor and Frances
16. Environmental Toxicology And Chemistry. :- Donald G. Crosty 1998
17. Environmental Toxicology : - David A. Wright & Pamela Welbourn Cambridge University Press 2002.
18. Text book of modern toxi.:- Ernest Hodgson & Patricia E. levi Appleton & Cange stamfend etc U.S.A 1995.
19. Basic Toxicology:- Frack C. Lu, Homisphere publishing Cerporation, New York, Washington 1993.

PAPER XIV : INDUSTRIAL HYGIENE AND SAFETY

- Unit I** : Industrial safety: History and development of safety movement, Need for safety, Safety legislation: Acts and rules, Safety policy: safety organization and responsibilities and authorities of different levels, Accident sequence theory, Causes of accidents, Accident prevention and control techniques, Plant safety inspections, Job safety Analysis and investigation of accidents, Role of safety committee and its formation, Safety awareness programme: motivation, education and training.
- Unit II** : Risk assessment and management: Checklist procedure, Preliminary hazard analysis, What if analysis, Failure mode effect analysis, Hazard and operability (HAZOP) studies, Hazard analysis techniques: Fault tree analysis, Event tree analysis, General outline of DOW index, Risk estimation and management, Major hazard control, On-site and Offsite emergency preparedness.
- Unit III** : Specific hazards: Identification of hazard, machine guarding, safety with hand tools/ portable power tools, Pressure vessel hazards and their control, Safety in material handling: hazards and safe Practices, safety with storage of materials, Electrical hazards: classification, safe work practices, Chemical hazards: laboratory safety, bulk handling of chemicals, Fire and

explosion hazards, Fire detection, Prevention ,control, and extinguishments, Industrial layout, Industrial waste management.

Unit IV : Industrial hygiene: Environmental stresses: physical, chemical, biological and ergonomic stresses, Principles of industrial hygiene, Overview of control measures. Permissible limits. Stress, Exposures to heat, Heat balance, Effects of heat stress, Control Measures. Chemical agents, IS/UN classification, Flammables, Explosives, Water sensitive chemicals, Oxidants, Gases under pressure, Chemicals causing health hazards: irritants, asphyxiates, anesthetics, systemic poisons and carcinogens, Chronic and acute exposure, Routes of entry, , Occupational exposure limits, Engineering control measures, Principles of ventilation.

Unit V : Occupational health: Concept of health and occupational health, , Occupational and work related diseases, Levels of prevention, History of occupational health, Characteristics of occupational diseases, Essentials of occupational health service, personal protective equipments (respiratory and non-respiratory)

Recommended Books:

1. Frank Lees Book on loss prevention in process industry, vol. 1 & 2.
2. Industrial safety / safety management ñ K.G. Mistry
3. Safety Management ñ Grimandi and siemens.
4. Safety supervision ñ Peterson
5. Eleventh edition of NSC, USA
6. IS 14489 On Safety Audit
7. Factories Act 1948
8. Environmental Protection & Law ñ H. V. Jadhav & V. M. Bhosale
9. Law Science & Environment ñ R. P. Ananad
10. Instrumental Methods of chemical analysis ñ Willard Merrit Dcan.
11. Analytical Spectroscopy ñ Chhatwal
12. Analytical Instrumentation ñ NEERI Publication
13. Analytical Chemistry ñ Kennedy
14. Instrumental Method ñ Sharma
15. A text Book of Quantitative Inorganic Analysis ñ A. L. Vogel
16. International Environmental Policy emergence and Dimension by L. K. Caldwell 1990.

17. Industrial Safety and pollution control handbook: National Safety Council and Associate publishers Pvt. Ltd, Hyderabad(1993).
18. Handbook of Environmental Health and Safety: Herman Koren and Michel Bisesi, Jaico Publishing House, Delhi (1999).
19. Environmental Toxicology and Chemistry: Donald G. Crosby Oxford University Press, USA (1998).
20. Handbook of Environmental Risk Assessment and Management: Peter Calow, Blackwell Science Ltd. USA (1998).
21. Principals of Environmental Toxicology: Ian C. Shaw and John Chadwick, Taylor and Francis, USA (1998).
22. The Factories Act-1948, Government Printing Press, Civil lines, Delhi (1994).
23. Risk Assessment and Environmental Management: D. Kofi Asvite-Dualy, John Willey & Sons, West Sussex, England (1998).
24. Introduction to Environmental Engineering & Science: Gilbert M. M., Pearson Education, Singapore (2004).

PAPER XV : NATURE, CONSERVATION AND ENVIRONMENTAL MANAGEMENT

- Unit I :** Biodiversity and resource conservation:, Strategies for biodiversity conservation, Causes and Impacts of depletion in biodiversity; Endangered and threatened plant and animal species, Importance and need of conservation, Mineral resources, Forest resources, Water resources; Environmental impact of resource exploitation, Wasteland reclamation, Wetland conservation; Watershed management, Rain water harvesting.
- Unit II :** Environment Biotechnology: Vermiculture technology- Role of earthworm, process of vermin composting, applications; Bio-fertilizer technology- Definition, classification importance, prospects; Fermentation Technology- Bioreactor, pretreatment and purification, materials of the bioreactor,
- Unit III :** Non-conventional energy sources and their programs in India: Biogas, Wind Mill (wind farm, Advantages and limitation, wind energy), Solar energy (SPV,ST), Geothermal energy, Nuclear energy, Hydro power (small hydal project), Tidal power
- Unit IV :** ISO 14000: Definition, Standards (14001), TC-207, EMAR and EMAS, TAG. ISO 9000, ISO 14001, Relation between

ISO 14001 and ISO 9000, Certification, Accreditation and Registration, Preparation for ISO 14000

Unit V : Sustainable Development: Concepts of sustainable development; definition of sustainable development, Principles of sustainable development; barriers to sustainable development ñ health aspect of sustainable development; practices of sustainable development in India;

Industrial and urban environmental problems in India:

Industrial development ñ impact on resources depletion and pollution (case studies), environmental problems of urbanization.

Recommended Books:

1. Biodiversity: K. C. Agrawal, Agro Botanical Publishers, New Delhi, India (1996),
2. Environmental Biology: S.N.Prasad, Campus Books International, New Delhi (2000),
3. Fundamentals of Biotechnology: S.S.Purohit and S.K.Mathur, Agro Botanical Publishers, New Delhi, India. (1990).
4. Environmental Biology: K. C. Agrawal, Agro Botanical Publisher, New Delhi, India. (1993).
5. Compendium of Environmental Statistics: Central Statistical Organization, Dept. of State. Ministry of Planning and Programme Implementation, Govt. of India. (1997).
6. Environment Pollution and Development: Prof. Chandra Pal, Mittal Publications, New Delhi (1999).
7. Environmental Guidelines and Standards in India: P. K. Goel and K. P. Sharma, Techno science Publications, Jaipur, (1996).
8. Global Environmental Chemistry: D. C. Parashar, C. Sharma and A. Mitra, Narosa Publishing House (1998).
10. Environmental Challenges and the Universities: AIN (1994).
11. Environment and Development: I. S. Grover and A. K. Thukval, Scientific Publishers, Jodhpur (1998).
12. CEE towards a green future ñ CEE Ahamedabad 1999.
13. Waste minimization ñ Prasal Modak
14. Towards an agro-ecosystem policy for India ñ A Damodharan
15. Environmental economics for sustainable development ñ Kumar

15. Ecology and economics: an approach to sustainable development ñ Sengupta
16. Environment, Development and sustainability ñ Bhaskar Nath
17. Water technology management challenges and choices ñ A.K.

PAPER XVI : ENVIRONMENTAL POLICIES AND LEGISLATION

- Unit I : Environmental education programme :-** Definition and background of environmental education, need and objectives of environmental education, Role of environmental education in the formal education, ñ role of various organization Govt. and non-Govt. shairing concerns in Env. Education.
- Unit II : Environmental Education :**
Traditional methods of environmental education . Methods of education for sustainable development , . Current problems in environmental education:Environmental education at various levels.Teachers training programme. Recent methods of environmental education.
- Unit III : Global environmental Controversies:**
Environmental movements and peoples responses; social, political and economic issues in the controversies over natural resources, silent valley, Narmada Project, Almatti dam project, Sardar Sarovar project, Tehri dam, Koyna dam, , , impact of Mahtura refineries on Taj Mahal.
- Unit IV : Environmental Awareness and Conservation strategies:-** Stockholm conference, Earth summit, Agenda-21 (Rio,1992) Johansburg 2002),World commission on environment and development (WCED). World water council (WWC), World health organizations (WHO) ISI, EPHA, United Nations Environmental Programme (UNEP), International Union for conservation of Nature and Natural Resources (IVCN) World wide fund for Nature (WWF)
- Unit V : Environmental Laws:-** Wild life protection Act, 1972, amended 1991. Forest (Conservation) Act, 1980, Indian forest Act (Revised) 1982, Air (Prevention and Control of Pollution) Act,1981 as amended by Act, 1987 and rule 1982. Motor Vehicle Act, 1988. The Water (Prevention and Control of Pollution) Act, 1974 as amended up to 1988 and rules 1975. The Environ (Protection)Act, 1986 and rules 1991. Public

Liability Insurance Act, 1991 Hazardous waste management and handling. Rules 1989 as amended up to 2003.

Recommended Books:

1. Hand Book of Env. Laws, Acts, Rules, Guidelines, Compliance and Standard Vol. 1 & 2: R. K. Trivedy Environmental Edition: 1st 1996.
2. Pollution control Acts, Rules and notifications issued there under: Central Pollution Control Board April. 1995.
3. Environmental Protection and the Laws: C. N. Mehta, 1991.
4. Legal aspects of Environmental Pollution and its Management: Ed. S. M. Ali, 1992.
5. International Environmental Policy Emergence and Dimensions: by L. K. Caldweil 1990.
6. Lalõs Commentevis on water, Air pollution laws along with the environmental (Protection) Act and rules 1986, 3rd Rd. 1992: Law Publisher India.
7. Universal Environment and Pollution law manual: S. K. Mohanty 1998.
8. Pares Distn. Environmental Laws in India: (Deep, Lated Edn).
9. Environmental Problems, protection and control Vol I & Vol II Ed: Arun Kumar.
10. Hand book of Env. Laws, Acts, Rules, Guidelines, Compuliances and Standards VoL. 1 & 2 :- R.K. Trivedy Enviromedia Edition:1st 1996
11. Pollution control Acts, Rules, and notifications issued there under: - Central Pollution Control. Board April. 1995.
12. Environmental Protection and the Lawõs:- C.N. Mehta, 1991.
13. Legal aspects of Environmental Pollution and its Management:- Ed.S.M. Ali, 1992.
14. International Environmental Policy Emergence and Dimensions:- by L.K. Caldweil 1990.
15. Lelõs Commentenes on water, Air Pollution laws along with the environmental (Protection) Act, and rules, 1986, 3rd Ed. 1992:- Law Publisher India.
16. University Environment and pollution law manual:- S.K. Mohanty 1998.
17. Environmental Governance (the Global Challenge):- Lamont C. Hempel Affiliated East-West Press Pvt. Ltd. New Delhi.
18. Declaration of :- The stockhdm conference, Rio, Rio +5 and Rio+10.

19. Constitution of India [Referred articles from Part III, Part IV and Part IV A].
20. Praes Distn. Environmental laws in India :- (Deep. Deep, Lated edn.)
21. Environmental problems, protection and control Vol I and II Ed.:- Arun Kumar 1999.
22. Universal Environment pollution law Manual.:- S.K. Mohanty 1998.

**PRACTICAL VII: LABORATORY EXERCISE
BASED ON PAPER XIII TO XVI :**

A. Experiments on Environmental Toxicology :/ environmental education

- (1) Effects of radiation on Microbial genetic system.
- (2) Designing of protocols to evaluate pollutants toxicity.
- (3) To study absorption and accumulation of heavy metals by aquatic flora.
- (4) Study of Bio-accumulation of pesticides in aquatic fauna.
- (5) To collect the data of natural resources from local area.
- (6) To collect the data of practices for waste management from your local area.
- (7) To collect the data of environmental education awareness among the local people.
- (8) Case study of daily waste collection practices in house hold.

B. Experiments on Industrial Hygiene and Safety :

- (1) To determine the ambient air quality in Industrial belt.
- (2) Study of noise and dust pollution in flour mills.
- (3) Design of settling tank.
- (4) Design of Aeration tank.
- (5) To study Environmental Status of Thermal Power Plant.
- (6) Construction of wind rose and study of wind profiles.

C. Experiments on Natural Resource Management :

- (1) Identification and observation of Hot spot (Water Scarcity Area)
- (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 |

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Total Marks - 100 Marks

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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.
