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

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INDEX

M.Sc. Part-I & Part-II (Semester I to IV) Examinations in Microbiology
(Prospectus No. 2014128)

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>Special Note</td>
<td></td>
<td>1</td>
</tr>
<tr>
<td>2.</td>
<td>Ordinance No. 4 of 2008</td>
<td></td>
<td>3</td>
</tr>
<tr>
<td>3.</td>
<td>Direction No. 14 of 2009</td>
<td></td>
<td>12</td>
</tr>
<tr>
<td>4.</td>
<td>Direction No. 26 of 2010</td>
<td></td>
<td>14</td>
</tr>
<tr>
<td>5.</td>
<td>Direction No. 27 of 2010</td>
<td></td>
<td>37</td>
</tr>
<tr>
<td>6.</td>
<td>Direction No. 39 of 2011</td>
<td></td>
<td>40</td>
</tr>
<tr>
<td>7.</td>
<td>Direction No. 25 of 2012</td>
<td></td>
<td>43</td>
</tr>
<tr>
<td>8.</td>
<td>Direction No. 07 of 2014</td>
<td></td>
<td>46</td>
</tr>
<tr>
<td>9.</td>
<td>Direction No. 08 of 2014</td>
<td></td>
<td>47</td>
</tr>
</tbody>
</table>

10. M.Sc. Part-I Semester-I:
    I  Microbial Techniques  2
    II Microbial Enzymology  3
    III Microbial Physiology and Photosynthesis  4
    IV Environmental Microbiology  4

11. M.Sc. Part-I Semester-II:
    V  Biostatistics, Bioinformatics and Computer Applications  6
    VI Enzyme Technology  8
    VII Microbial Metabolism  9
    VIII Environmental Microbiology and Extremophiles  10

12. M.Sc. Part-II Semester-III:
    IX Molecular Biology  12
    X Virology  13
    XI Fermentation Technology  14
    XII Immunology  15

13. M.Sc. Part-II Semester-IV:
    XIII Biotechnology  18
    XIV Clinical Virology  19
    XV Microbial Technology  19
    XVI Medical Microbiology  20
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 (relevent 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 (relevent 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 पारंपरिक (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 पारंपरिक (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 पारंपरिक (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 पारंपरिक 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;

   (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 नैरुरी स्नातक (B.Pharm) or the विज्ञान स्नातक कृषि (B.Sc.Agri.) Degree shall be eligible for admission to the विज्ञान पारंपरिक (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)

% 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)
(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 student offering Chemistry along with 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 of 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 subjects 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 पारंपरिक मान-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 विज्ञान 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,

(i) He / She satisfied the conditions in the table and the provisions thereunder.

(ii) He / She has prosecuted a regular course of study in the university / college affiliated to the university.

(iii) He / She has in the opinion of the Head of the Department / Principal shown satisfactory progress in his / her study.

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 in a 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 an 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-

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 Univerisity.

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)

|------------|-----------|-------|-----------|-------|-----------|-------|----------|-------|

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 at least 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 at least 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.

*****
Now, therefore, I, Dr. Kamal Singh, Vice Chancellor of Sant Gadge Baba Amravati University, in exercise of powers conferred upon me under subsection (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 विश्वास पारंपरि (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
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.

WHEREAS,

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 an 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, students having less than 75% may apply to the H.O.D. for condonation of attendance up to 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 (Member)

iii) Three teachers from the affiliated colleges having postgraduate courses other than University Department nominated by the Vice-Chancellor. (Member)

iv) Deputy Registrar (Acad) (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 Grievance Redressal Committee.

iv) To remove the difficulties if any faced during implementation of the CBCS and report it to Hon'ble 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

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**Table-II**

For Mathematics

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<tr>
<td></td>
<td>Sem-I</td>
<td>Sem-II</td>
</tr>
<tr>
<td>Core courses</td>
<td>12</td>
<td>12</td>
</tr>
<tr>
<td>Elective Courses</td>
<td>08</td>
<td>08</td>
</tr>
<tr>
<td>GIC</td>
<td>δ</td>
<td>04</td>
</tr>
<tr>
<td>Internal Assessment</td>
<td>05</td>
<td>05</td>
</tr>
<tr>
<td>Project</td>
<td>δ</td>
<td>δ</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td>25</td>
<td>25 or 29</td>
</tr>
</tbody>
</table>

**Table-III**

For Biotechnology

<table>
<thead>
<tr>
<th>Course</th>
<th>Credits</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Sem-I</td>
<td>Sem-II</td>
</tr>
<tr>
<td>Core courses</td>
<td>16</td>
<td>12</td>
</tr>
<tr>
<td>Elective Courses</td>
<td>δ</td>
<td>9</td>
</tr>
<tr>
<td>Lab courses</td>
<td>24</td>
<td>18</td>
</tr>
<tr>
<td>Seminar</td>
<td>δ</td>
<td>01</td>
</tr>
<tr>
<td>Project</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Assignment</td>
<td></td>
<td>02</td>
</tr>
<tr>
<td>Internal Assessment</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td>40</td>
<td>40</td>
</tr>
</tbody>
</table>

**Table-IV**

For Computer Science

<table>
<thead>
<tr>
<th>Course</th>
<th>Credits</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Sem-I</td>
<td>Sem-II</td>
</tr>
<tr>
<td>Core</td>
<td>25</td>
<td>20</td>
</tr>
<tr>
<td>Elective</td>
<td>-</td>
<td>05</td>
</tr>
<tr>
<td>GIC</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Lab. Course</td>
<td>06</td>
<td>06</td>
</tr>
<tr>
<td>I.A.</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Project</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td>31</td>
<td>31</td>
</tr>
</tbody>
</table>

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**

<table>
<thead>
<tr>
<th>Grade</th>
<th>Range of Marks obtained out of 100 or Equivalent fraction</th>
<th>Grade Points</th>
<th>Remarks</th>
</tr>
</thead>
<tbody>
<tr>
<td>O</td>
<td>90-100</td>
<td>10</td>
<td>Outstanding</td>
</tr>
<tr>
<td>A+</td>
<td>80-89</td>
<td>9</td>
<td>Excellent</td>
</tr>
<tr>
<td>A</td>
<td>70-79</td>
<td>8</td>
<td>Very Good</td>
</tr>
<tr>
<td>B+</td>
<td>60-69</td>
<td>7</td>
<td>Good</td>
</tr>
<tr>
<td>B</td>
<td>55-59</td>
<td>6</td>
<td>Fair</td>
</tr>
<tr>
<td>C+</td>
<td>50-54</td>
<td>5</td>
<td>Average</td>
</tr>
<tr>
<td>C</td>
<td>40-49</td>
<td>4</td>
<td>Below Average</td>
</tr>
<tr>
<td>F</td>
<td>Below 40</td>
<td>0</td>
<td>Fail</td>
</tr>
</tbody>
</table>
TABLE-II: Final Grade Points for SGPA and CGPA

<table>
<thead>
<tr>
<th>Grade Points</th>
<th>Final Grade</th>
<th>Remarks</th>
</tr>
</thead>
<tbody>
<tr>
<td>9.00-10.00</td>
<td>O</td>
<td>Outstanding</td>
</tr>
<tr>
<td>8.00 – 8.99</td>
<td>A+</td>
<td>Excellent</td>
</tr>
<tr>
<td>7.00-7.99</td>
<td>A</td>
<td>Very Good</td>
</tr>
<tr>
<td>6.00-6.99</td>
<td>B+</td>
<td>Good</td>
</tr>
<tr>
<td>5.50 – 5.99</td>
<td>B</td>
<td>Fair</td>
</tr>
<tr>
<td>5.00 – 5.49</td>
<td>C+</td>
<td>Average</td>
</tr>
<tr>
<td>4.00 – 4.99</td>
<td>C</td>
<td>Below Average</td>
</tr>
</tbody>
</table>

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

<table>
<thead>
<tr>
<th>Sr.No.</th>
<th>CGPA</th>
<th>Class/Division</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>8.00 or more</td>
<td>First Class with Distinction</td>
</tr>
<tr>
<td>2</td>
<td>7.50 or more but less than 8.00</td>
<td>First Class</td>
</tr>
<tr>
<td>3</td>
<td>6.00 or more but less than 7.49</td>
<td>First Class</td>
</tr>
<tr>
<td>4</td>
<td>5.50 or more but less than 5.99</td>
<td>Higher Second Class</td>
</tr>
<tr>
<td>5</td>
<td>4.00 or more but less than 5.49</td>
<td>Second Class</td>
</tr>
<tr>
<td>6</td>
<td>Less than 4.00</td>
<td>Fail</td>
</tr>
</tbody>
</table>

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:

\[
SGPA = \frac{U_1 \times M_1 + U_2 \times M_2 + \ldots + U_n \times M_n}{U_1 + U_2 + \ldots + U_n}
\]

Where \(U_1, U_2, \ldots\) are subject credit of the respective course and \(M_1, M_2, \ldots\) 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:

\[
CGPA = \frac{\sum_{n=1}^{4} SGPA(n) \times C_n}{\sum_{n=1}^{4} C_n}
\]

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 :-

(i) 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.

(ii) At the end of each semester the Departmental Committee shall assign grades to the students.

(iii) The Departmental Committee shall prepare the copies of the result sheet in duplicate.
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.

The Department shall display the grade points and grades for the notice of students.

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. Not withstanding 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 (Dr. Kamal Singh)

Date: 2/6/2010

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

<table>
<thead>
<tr>
<th>Sr. No.</th>
<th>Paper / Code</th>
<th>Course</th>
<th>Max. Marks (Credits)</th>
<th>Min Pass Marks (Min. Grade Pt.)</th>
<th>Int. Ass. (Credits)</th>
<th>Min. Pass Marks (Min. Grade Pt.)</th>
<th>Th + Int. Ass. Min. Pass Mar. (Grade Pt.)</th>
<th>Max. Marks (Credit)</th>
<th>Min. Marks Marks (Min. Grade Point)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>1SA-1</td>
<td>C</td>
<td>80 (04)</td>
<td>32 (04)</td>
<td>20 (01)</td>
<td>08 (04)</td>
<td>40 (04)</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>2</td>
<td>1SA-2</td>
<td>C</td>
<td>80 (04)</td>
<td>32 (04)</td>
<td>20 (01)</td>
<td>08 (04)</td>
<td>40 (04)</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>3</td>
<td>1SA-3</td>
<td>C</td>
<td>80 (04)</td>
<td>32 (04)</td>
<td>20 (01)</td>
<td>08 (04)</td>
<td>40 (04)</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>4</td>
<td>1SA-4</td>
<td>E</td>
<td>80 (04)</td>
<td>32 (04)</td>
<td>20 (01)</td>
<td>08 (04)</td>
<td>40 (04)</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>5</td>
<td>1SA-5</td>
<td>Lab-I</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>100 (03)</td>
<td>40 (04)</td>
<td>0</td>
</tr>
<tr>
<td>6</td>
<td>1SA-6</td>
<td>Lab-II</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>100 (03)</td>
<td>40 (04)</td>
<td>0</td>
</tr>
</tbody>
</table>

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

<table>
<thead>
<tr>
<th>Sr.No.</th>
<th>Paper / Code</th>
<th>Course</th>
<th>Theory</th>
<th>Practical</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Code</td>
<td>Max. Marks (Credits)</td>
<td>Min Pass Marks (Min. Grade Pt.)</td>
<td>Int. Ass. (Credits)</td>
</tr>
<tr>
<td>1</td>
<td>2SA-1</td>
<td>C</td>
<td>80 (04)</td>
<td>32 (04)</td>
</tr>
<tr>
<td>2</td>
<td>2SA-2</td>
<td>C</td>
<td>80 (04)</td>
<td>32 (04)</td>
</tr>
<tr>
<td>3</td>
<td>2SA-3</td>
<td>C</td>
<td>80 (04)</td>
<td>32 (04)</td>
</tr>
<tr>
<td>4</td>
<td>2SA-4 E Or 2GIC-X</td>
<td>E and/or GIC</td>
<td>80 (04)</td>
<td>32 (04)</td>
</tr>
<tr>
<td>5</td>
<td>2SA-5 Lab-III</td>
<td>δ</td>
<td>δ</td>
<td>δ</td>
</tr>
<tr>
<td>6</td>
<td>2SA-6 Lab-IV</td>
<td>δ</td>
<td>δ</td>
<td>δ</td>
</tr>
</tbody>
</table>

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.
### 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

<table>
<thead>
<tr>
<th>Sr. No.</th>
<th>Paper Code</th>
<th>Course</th>
<th>Theory</th>
<th>Practical</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td>Max. Marks (Credits)</td>
<td>Min Pass Marks (Min. Grade Pt.)</td>
</tr>
<tr>
<td>1</td>
<td>4SA-1</td>
<td>C</td>
<td>80 (04)</td>
<td>32 (04)</td>
</tr>
<tr>
<td>1</td>
<td>4SA-2</td>
<td>C</td>
<td>80 (04)</td>
<td>32 (04)</td>
</tr>
<tr>
<td>3</td>
<td>4SA-3</td>
<td>C</td>
<td>80 (04)</td>
<td>32 (04)</td>
</tr>
<tr>
<td>4</td>
<td>4SA-4</td>
<td>E</td>
<td>80 (04)</td>
<td>32 (04)</td>
</tr>
<tr>
<td>5</td>
<td>4SA-5</td>
<td>Lab-V</td>
<td>δ</td>
<td>δ</td>
</tr>
<tr>
<td>6</td>
<td>4SA-6</td>
<td>Project</td>
<td>δ</td>
<td>δ</td>
</tr>
</tbody>
</table>

**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 score Minimum Marks or Minimum Grade Points in either theory or internal assessment then he/she will be declared to have clear 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**

<table>
<thead>
<tr>
<th>Sr. No.</th>
<th>Paper Code</th>
<th>Course</th>
<th>Theory</th>
<th>Practical</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td>Max. Marks (Credits)</td>
<td>Min Pass Marks (Min. Grade Pt.)</td>
</tr>
<tr>
<td>1</td>
<td>1MTH-1</td>
<td>C</td>
<td>80 (04)</td>
<td>32 (04)</td>
</tr>
<tr>
<td>2</td>
<td>1MTH-2</td>
<td>C</td>
<td>80 (04)</td>
<td>32 (04)</td>
</tr>
<tr>
<td>3</td>
<td>1MTH-3</td>
<td>C</td>
<td>80 (04)</td>
<td>32 (04)</td>
</tr>
<tr>
<td>4</td>
<td>1MTH-4</td>
<td>E</td>
<td>80 (04)</td>
<td>32 (04)</td>
</tr>
<tr>
<td>5</td>
<td>1MTH-5</td>
<td>E</td>
<td>80 (04)</td>
<td>32 (04)</td>
</tr>
</tbody>
</table>

**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.
## Appendix-F

### Examination Scheme under C.B.C.S. for the subject

**Mathematics in the faculty of Science**

### M.Sc. Part-I

#### Semester-II

<table>
<thead>
<tr>
<th>Sr.No.</th>
<th>Paper / Code</th>
<th>Course</th>
<th>Max. Marks (Credits)</th>
<th>Min. Pass Marks (Min. Grade Pt.)</th>
<th>Int. Ass. (Credits)</th>
<th>Min. Pass Marks (Min. Grade Pt.)</th>
<th>Th + Int. Ass. Min.Pass Mar (Grade Pt.)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>2MTH-1</td>
<td>C</td>
<td>80 (04)</td>
<td>32 (04)</td>
<td>20 (01)</td>
<td>08 (04)</td>
<td>40 (04)</td>
</tr>
<tr>
<td>2</td>
<td>2MTH-2</td>
<td>C</td>
<td>80 (04)</td>
<td>32 (04)</td>
<td>20 (01)</td>
<td>08 (04)</td>
<td>40 (04)</td>
</tr>
<tr>
<td>3</td>
<td>2MTH-3</td>
<td>C</td>
<td>80 (04)</td>
<td>32 (04)</td>
<td>20 (01)</td>
<td>08 (04)</td>
<td>40 (04)</td>
</tr>
<tr>
<td>4</td>
<td>2MTH-4</td>
<td>E</td>
<td>80 (04)</td>
<td>32 (04)</td>
<td>20 (01)</td>
<td>08 (04)</td>
<td>40 (04)</td>
</tr>
<tr>
<td>5</td>
<td>2MTH-5 and/or 2GIC-X</td>
<td>E and/or GIC</td>
<td>80 (04)</td>
<td>32 (04)</td>
<td>20 (01)</td>
<td>08 (04)</td>
<td>40 (04)</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>400 (20)</td>
<td>100 (05)</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**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.

## Appendix-G

### Examination Scheme under C.B.C.S. for the subject

**Mathematics in the faculty of Science**

### M.Sc. Part-II

#### Semester-III

<table>
<thead>
<tr>
<th>Sr.No.</th>
<th>Paper / Code</th>
<th>Course</th>
<th>Max. Marks (Credits)</th>
<th>Min. Pass Marks (Min. Grade Pt.)</th>
<th>Int. Ass. (Credits)</th>
<th>Min. Pass Marks (Min. Grade Pt.)</th>
<th>Th + Int. Ass. Min.Pass Mar (Grade Pt.)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>3MTH-1</td>
<td>C</td>
<td>80 (04)</td>
<td>32 (04)</td>
<td>20 (01)</td>
<td>08 (04)</td>
<td>40 (04)</td>
</tr>
<tr>
<td>2</td>
<td>3MTH-2</td>
<td>C</td>
<td>80 (04)</td>
<td>32 (04)</td>
<td>20 (01)</td>
<td>08 (04)</td>
<td>40 (04)</td>
</tr>
<tr>
<td>3</td>
<td>3MTH-3</td>
<td>C</td>
<td>80 (04)</td>
<td>32 (04)</td>
<td>20 (01)</td>
<td>08 (04)</td>
<td>40 (04)</td>
</tr>
<tr>
<td>4</td>
<td>3GIC-Y</td>
<td>GIC</td>
<td>400 (20)</td>
<td>100 (05)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>5</td>
<td>3MTH-5 and/or 3GIC-Y</td>
<td>E and/or GIC</td>
<td>80 (04)</td>
<td>32 (04)</td>
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**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.
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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.
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Total Credits: 40

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Total Credits: 40

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

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**Appendix-J**

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**Appendix-I**
### Appendix-K

**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)

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**Total Credits: 35**

### Appendix-L

**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)

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**Total Credits: 35**
## Appendix-M

**Scheme of Teaching and Examination under C.J.C.S., for the subject Computer Science**  
M.Sc. (Computer) SEMESTER PATTERN  
M.Sc.Part-I (SEMESTER-I)

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| 2   | 1MCS-2       | II    | C      | 5 -      | 5 -     | 3 Hrs 100         |
| 3   | 1MCS-3       | III   | C      | 5 -      | 5 -     | 3 Hrs 100         |
| 4   | 1MCS-4       | IV    | C      | 5 -      | 5 -     | 3 Hrs 100         |
| 5   | 1MCS-5       | V     | C      | 5 -      | 5 -     | 3 Hrs 100         |
| 6   | 1MCS-6       | Lab-I | -      | 7 -      | 03 -    |                   |
| 7   | 1MCS-7       | Lab-II| -      | 7 -      | 03 -    |                   |

Total Credits: 40

## Appendix-N

**Scheme of Teaching and Examination under C.J.C.S., for the subject Computer Science**  
M.Sc. (Computer) SEMESTER PATTERN  
M.Sc.Part-I (S-F-M-S-T-R-I-I)

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| 1   | 2MCS-1       | VI    | C      | 5 -      | 5 -     | 3 Hrs 100         |
| 2   | 2MCS-2       | VII   | C      | 5 -      | 5 -     | 3 Hrs 100         |
| 3   | 2MCS-3       | VIII  | C      | 5 -      | 5 -     | 3 Hrs 100         |
| 4   | 2MCS-4       | IX    | C      | 5 -      | 5 -     | 3 Hrs 100         |
| 5   | 2MCS-5       | X or  | C or   | 5 -      | 5 -     | 3 Hrs 100         |
|     | 2GJC-X       |       | GJC    |          |         |                    |
| 6   | 2MCS-6       | Lab III| -      | 7 -      | 03 -    |                   |
| 7   | 2MCS-7       | Lab-IV| -      | 7 -      | 03 -    |                   |

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)

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</tr>
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<td></td>
<td></td>
<td></td>
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</tr>
<tr>
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<td>XIV</td>
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<td>-</td>
<td>-</td>
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<td>-</td>
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<td>Total: 40</td>
</tr>
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</table>

**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)

<table>
<thead>
<tr>
<th>S No</th>
<th>Subject Code</th>
<th>Paper</th>
<th>Course</th>
<th>Hrs/ Week</th>
<th>Credits</th>
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<tbody>
<tr>
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<td>XVI</td>
<td>C</td>
<td>5</td>
<td>-</td>
<td>T: 3 Hrs</td>
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<td></td>
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</tr>
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<td>Or 4UGC-Z</td>
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<td>4</td>
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**Total Credits: 35**
Appendix-Q

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

<table>
<thead>
<tr>
<th>Sr.No.</th>
<th>Subject</th>
<th>Subject Code</th>
<th>Elective</th>
<th>Equivalent General Interest Course Code</th>
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<tr>
<td>1</td>
<td>Chemistry</td>
<td>2CHE3</td>
<td>3</td>
<td>2GIC-1</td>
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<tr>
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<td></td>
<td>2CHE4</td>
<td></td>
<td>2GIC-2</td>
</tr>
<tr>
<td>2</td>
<td>Physics</td>
<td>2PHY3</td>
<td></td>
<td>2GIC-3</td>
</tr>
<tr>
<td></td>
<td></td>
<td>2PHY4</td>
<td></td>
<td>2GIC-4</td>
</tr>
<tr>
<td>3</td>
<td>Mathematics</td>
<td>2MTH4</td>
<td></td>
<td>2GIC-5</td>
</tr>
<tr>
<td></td>
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<td>2MTH5</td>
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<td>2ZOO3</td>
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<td>2GIC-7</td>
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<td></td>
<td>2ZOO4</td>
<td></td>
<td>2GIC-8</td>
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<td>2BOT3</td>
<td></td>
<td>2GIC-9</td>
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<td></td>
<td>2BOT4</td>
<td></td>
<td>2GIC-A</td>
</tr>
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<td>6</td>
<td>Statistics</td>
<td>2SCA3</td>
<td></td>
<td>2GIC-B</td>
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<td>2SCA4</td>
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<td>2GIC-C</td>
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<td>7</td>
<td>Biotechnology</td>
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<td>8</td>
<td>Computer Science</td>
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<td></td>
<td>2CMS4</td>
<td></td>
<td>2GIC-G</td>
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<td>Microbiology</td>
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<td>2GIC-H</td>
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<td>2MCB4</td>
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<td></td>
<td>2GIC-J</td>
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<td>2GIC-K</td>
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<td>2GIC-O</td>
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<td>13</td>
<td>Bioinformatics</td>
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<td>2GIC-Q</td>
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<td>16</td>
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<td>2GIC-W</td>
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<td></td>
<td>2CSW4</td>
<td></td>
<td>2GIC-1A</td>
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<td>17</td>
<td>Remote Sensing and GIS</td>
<td>2RSG3</td>
<td></td>
<td>2GIC-1B</td>
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<td>2RSG4</td>
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<td>2GIC-1C</td>
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<td></td>
<td>2GIC-1D</td>
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<tr>
<td></td>
<td></td>
<td>2PCH4</td>
<td></td>
<td>2GIC-1E</td>
</tr>
</tbody>
</table>

Note: Title of the paper shall prescribed in the respective prospectuses.
(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. ñ5. Bioinformatics.

   6. Computer Software,
   17. Computer Science
   18. Biotechnology, and

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.

Sd/-

Amravati
Date: 21/6/2010
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 "2 (52 core and elective)" be substituted by the figures, sign, and words "8 (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 at least 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.

Sd/-
Amravati
(Mohan K. Khedkar)
Date : 22/8/2011
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 बिंतोक (Bachelor of Science)” shall be substituted as “Degree of फाइंकल पारंत (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 (A) 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

<table>
<thead>
<tr>
<th>Subject/s</th>
<th>Minimum total credits (Core Elective and GIC)</th>
</tr>
</thead>
<tbody>
<tr>
<td>All subjects other than Mathematics, Computer Science &amp; Biotechnology</td>
<td>104</td>
</tr>
<tr>
<td>Computer Science</td>
<td>119</td>
</tr>
<tr>
<td>Biotechnology</td>
<td>150</td>
</tr>
<tr>
<td>Mathematics</td>
<td>100</td>
</tr>
</tbody>
</table>

B) i) Under Table-III (Equivalence of Class/Division of CGPA) of Para IX,

(a) the figures shown Ø.49Ø Ø.99Ø and Ø.49Ø against Sr.Nos.3, 4 & 5 in Column No.2 (CGPA) be substituted by the figures Ø.50Ø Ø.00Ø and Ø.50Ø respectively.

(b) Following sub-para be added before the para ØKØ

   Declaration of Merit List :- Merit list of M.Sc. (C.B.C.S.) examination shall be prepared from the examinee who have successfully 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 Ø.

4. In Direction No.39 of 2011, under para IX), in Table-I & II, under column No.2, i.e. ØGrade PointsØ and ØFinal GradeØ shall be substituted respectively as under.

<table>
<thead>
<tr>
<th>Ø</th>
<th>by</th>
</tr>
</thead>
<tbody>
<tr>
<td>ØD</td>
<td>AA</td>
</tr>
<tr>
<td>A+</td>
<td>AB</td>
</tr>
<tr>
<td>A</td>
<td>BB</td>
</tr>
<tr>
<td>B+</td>
<td>BC</td>
</tr>
<tr>
<td>B</td>
<td>CC</td>
</tr>
<tr>
<td>C+</td>
<td>CD</td>
</tr>
<tr>
<td>C</td>
<td>DD</td>
</tr>
</tbody>
</table>

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).

Sd/-
Amravati
(Mohan K. Khedkar)
Date: 28/6/2012
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, "Corrigendum to Direction No. 25 of 2012, Direction, 2014."

2) This Direction shall come into force w.e.f. the date of its issuance.

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

Date: 3/5/2014

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 विभाग (Master of Science) (Four Semester Degree Course).

Whereas, Ordinance No.4/2008 in respect of Examinations leading to the Degree of विज्ञान विभाग (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 विभाग (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, "Corrigendum to Direction No. 14 of 2009 in respect of Examinations leading to the Degree of विज्ञान विभाग (Master of Science) (Four Semester Degree Course) Direction 2014."

2) This Direction shall come into force w.e.f. the date of its issuance.

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

Date: 3/5/2014
3) In Direction No. 14 of 2009 in respect of Examinations leading to the Degree of Master of Science (Four Semester Degree Course), in para 3., after the lines 'A person who has passed the Degree of Bachelor of Science with Post Graduate Diploma in Computer Science of this University OR' following lines be inserted

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

Date: 3/5/2014
Sd/-
(Dr. J.A. Tidke)
Vice-Chancellor
Sant Gadge Baba Amravati University
Syllabus Prescribed for
M.Sc Part I Microbiology (Semester I)

THEORY

Paper I  Microbial Techniques  100 (80 + 20*) Marks
Paper II  Microbial Enzymology  100 (80 + 20*) Marks
Paper III  Microbial Physiology and Photosynthesis  100 (80 + 20*) Marks
Paper IV  Environmental Microbiology  100 (80 + 20*) Marks

PRACTICAL

Practical I  Soil Microbiology  100 Marks
Practical II  Analytical Biochemistry and Instrumentation  100 Marks

M. Sc Part I Microbiology (Semester II)

THEORY

Paper V  Biostatistics, Bioinformatics and Computer Applications  100 (80 + 20*) Marks
Paper VI  Enzyme Technology  100 (80 + 20*) Marks
Paper VII  Microbial Metabolism  100 (80 + 20*) Marks
Paper VIII  Environmental Microbiology and Extremophiles  100 (80 + 20*) Marks

PRACTICAL

Practical III  Environmental Microbiology and Biodiversity  100 Marks
Practical IV  Microbial Enzymology, Biostatistics and Computer Applications  100 Marks

M. Sc Part II Microbiology (Semester III)

THEORY

Paper IX  Molecular Biology  100 (80 + 20*) Marks
Paper X  Virology  100 (80 + 20*) Marks
Paper XI  Fermentation Technology  100 (80 + 20*) Marks
Paper XII  Immunology  100 (80 + 20*) Marks

PRACTICAL

Practical V  Fermentation Technology  100 Marks
Practical VI  Immunology and Medical Microbiology  100 Marks

M. Sc Part II Microbiology (Semester IV)

THEORY

Paper XIII  Biotechnology  100 (80 + 20*) Marks
Paper XIV  Clinical Virology  100 (80 + 20*) Marks

Paper XV  Microbial Technology  100 (80 + 20*) Marks
Paper XVI  Medical Microbiology  100 (80 + 20*) Marks

PRACTICAL

Practical VII  Applied Microbiology and Biotechnology  100 Marks
Project  Project Work  100 Marks

* Internal assessment marks for theory Paper

Notes:
The practical schedule of M.Sc. (Microbiology) should be as follows:
1. Each practical in M.Sc. Part I should be of 8 hours duration per week (4 hrs/day for two consecutive days).
2. Each practical in M.Sc. Part II (Practical II, project work & I) should be of 8 hours duration per week (8 hrs/days) for two days).
3. Atleast 70% practicals should be performing during each semester.
4. Examination of each practical should be at least for 10 Hr. (Split over two days)

M.Sc. Part I (Semester I) (MICROBIOLOGY) EXAMINATION

PAPER I

MICROBIAL TECHNIQUES

Unit-I  : Biological Relevance of pH and Buffers:- The pH dependents ionization of amino acids and proteins. Isoionic and isoelectric points. Effects of the pH change on non-protein protoplasmic components. The pH and metabolic reactions involving proton.

Unit-II  : Absorption and Emission of Radiation: Principles laws of absorption of radiation, visible ultraviolet and infrared Spectrophotometry. Absorption spectra, fluorescence, fluorometry, flame photometry, NMR, ESR.

Unit III  : Isotopic Tracers techniques in Biology:- Stable and radioactive isotopes, preparation, labeling, detection and measurement of isotopes. Dilution technique, Kinetics of radioactive disintegration.

Unit IV  : Chromatography: Paper, Column, thin layer, Gas, Ion exchange and affinity chromatography, Gel filtration.

Unit V  : Electrophoresis: Moving boundary, Zone (paper, gel etc.) electrophoresis. Immuno electrophoresis, Isoelectric focussing.
PAPER-II
MICROBIAL ENZYMEOLOGY

Unit-I: GENERAL INTRODUCTION:
   b) Enzymes as catalyst.
   c) Enzyme activity units.

Unit II: a) Enzyme isolation and purification - Importance of purification, Methods of purification and fractionation.
   b) Criteria of purity of enzymes - Tests of homogeneity.
   c) Classification of enzymes - IUB nomenclature.
   d) Constitutive, Inducible and marker enzymes.

Unit-III: ENZYME KINETICS:
   a) Importance of Kinetic Study
   b) Effect of Enzyme concentration on progress curves.
   c) Effect of pH and Temperature.
   d) Effect of Substrate concentration - Concepts of ES complex, Steady state and Rapid state equilibrium kinetics, Derivation of Henry - Michaelis - Menten equation of rectangular hyperbola, Significance of Vmax and Km, Transformation of H.M.M. equation to a straight line equation, Construction of Lineweaver - Burk Plot, Single and Double reciprocal plots, Limitations of H.M.M. equation, Sigmoidal saturation kinetics, Co-operatively of an enzyme, Hill's equation, steady kinetics (Haldane and Briggs equation).
   e) Bisubstrate enzyme kinetics.

Unit-IV a) Types of inhibitors (reversible and irreversible), Kinetics of enzyme inhibition (competitive, non-competitive, uncompetitive and mixed inhibitors), Graphical presentation of inhibition effects.
   b) Kinetics of reversible reactions (Haldane & Briggs relationship)
   c) Mechanism of action of lysozyme.
   d) Enzyme activators, Co-enzymes and Co-factors in enzymatic catalysis.

Unit-V: MECHANISM OF ENZYME ACTION:
   a) Concept of enzyme and substrate specificity.
   b) Chemistry of active Centre, chemical modification by active site directed reagents.
   c) Factors affecting catalytic efficiency of enzymes-covalent proximate, orientation, distortion or strain, acid-base and nucleophilic effects.
   d) Various theories of mechanism of enzyme action.
   e) Mechanism of action of lysozyme.

PAPER-III
MICROBIAL PHYSIOLOGY AND PHOTOSYNTHESIS


Unit II: Energy metabolism: ATP cycle, Free energy, standard free energy change, conventions in biochemical energetic, Calculation of DG. Standard free energy of hydrolysis of phosphate, compounds, Reservoirs of high-energy phosphate groups, Energy rich bonds, Biological energy transducer.

Unit-III: Bacterial and Mitochondrial respiration: Respiratory chain in mitochondria and bacteria, Oxidation-reduction enzymes. Respiration linked proton translocation.

Unit-IV: Oxidative phosphorylation: Coupling of oxidative phosphorylation to electron transport. Uncouplers, inhibitors, Reactions of oxidative phosphorylation, Mechanisms of oxidative phosphorylation. Chemical coupling, Conformational coupling and chemiosmotic coupling mechanism

Unit-V: Microbial photosynthesis: Structure of photosynthetic pigments, Primary photochemistry PS I & PS II and electron transport. CO₂ fixation in bacterial photosynthesis, Anoxygenic and oxygenic photosynthesis, Halobacterial photosynthesis

PAPER-IV
ENVIRONMENTAL MICROBIOLOGY

Unit-I: An Introduction: Definition of environment, Interaction between environment and biota, Concept of the habitat in biosphere, Food Chain, Ecosystem, Community, homeostasis and ecosystem management.

Concept of sustainable development of ecosystem: Definition and Need of Sustainable developments. Role of bacterial technology in achieving sustainable development. Improvement and restoration of barren/degraded land. Pollution control, Renewable source of energy and fuel using microorganisms, biodiversity and its conservation
Unit-II: Advancement in Biogeochemical cycles:

Nitrogen cycle: Symbiotic and non-symbiotic N-fixation, Mechanism of nitrogenase, cross inoculation group and host specificity, energy input/output ratio of N-fixation process in crop production, Biochemistry of Nitrate reduction.

Unit-III: Phosphours cycle: Significance of P-element, Occurrence and solubilization in nature, role of phosphobacter and mycorrhizae in crop production.

Carbon cycle - General aspects, generation and decay of detritus C-compounds, features of plant cell wall polysaccharides, cellulose & lignin degrading microorganisms, mechanism of enzymes and its products. Carbonic anhydrase and its role in carbon cycle.

Sulphur cycle - Significance of S-compound, microbial sulphur metabolism, sulphur oxidizing bacteria and mechanism, distribution of sulphur bacteria in nature, Biochemistry of sulphate reduction.

Selenium cycle - Significance and occurrence, metabolism, deficiency and toxicity.

UNIT-IV: Biochemistry and Microbiology of acid mine drainage:

Unit V: Biodeterioration: Concept of biodeterioration. Biodeterioration of Wood, Metal, pharmaceutical products and Stone Work.

Bioleaching: Introduction, application of bacterial leaching, leaching techniques, prospective of bioleaching.

PRACTICAL-I

Soil Microbiology

1. Study of antagonism in microorganism from soil.
2. Isolation of soil microorganisms.
   a) Isolation of Azotobacter spp and Azospirillum
   b) Isolation and cultivation of Rhizobium from soil and roots nodules.
   c) Nodulation of legume roots - Leonard jar experiment.
   d) Isolation of cyanobacteria
   e) Isolation of phosphobacteria from soil.

5. Preparation of biofertilizer/Biopesticides, enumeration of titer inoculum
6. Application of bioinoculant through seed, seedling and soil test under pot condition.
7. Isolation and microscopic examination of iron and sulphur bacteria.

PRACTICAL-II

ANALYTICAL BIOCHEMISTRY AND INSTRUMENTATION

1. Estimation of sucrose in presence of glucose.
2. Determination of pka of amino acids.
5. Ultraviolet spectroscopy of proteins.
6. Absorption spectrum of p-nitro phenol
10. Separation of proteins by paper electrophoresis.
12. Separation of pigments by adsorption chromatography.
13. Thin layer chromatography.
14. Estimation of DNA.
15. Estimation of RNA.

Distribution of marks in University Practical Examination:

1. Long Experiments - 15 marks.
2. Short Experiment - 10 marks
3. Viva-voce examination - 05 marks
4. Spotting - 05 marks
5. Practical record book - 05 marks
6. Internal Assessment - 10 marks

Total - 50 marks

M.Sc PART I (MICROBIOLOGY) EXAMINATION (Semester –II)

PAPER-V

BIOSTATISTICS, BIOINFORMATCS AND COMPUTER APPLICATIONS.

UNIT-I: Biostatistics:

a) Introduction: Definition of Statistics, Statistical application in Biology, Types of statistics used in biology, sample statistics, test statistics, parametric Vs non-parametric
b) Sample and Sampling: Introduction, selection of sample or sampling, theory-qualitative sample, random sample, non-random sample.

c) Graphical distribution of data: Collection of data, classification of data, tabulation of data, graphic representation of data, diagrammatic representation of data

d) Measures of Central tendency: Measures of central tendency, Mathematical averages, arithmetic mean, Geometric mean, Harmonic mean, Average mean- Median and Mode.

e) Measures of Dispersion: Definition, Range, Mean deviation, standard deviation, Standard error, Coefficients of variability, degree of freedom, confidence limit.

Unit II: 

a) Test of Significance: Standard error of mean, standard error of standard deviation, student’s t-test, chi-square test.

b) Probability: Definitions, types of probabilities, Rule of probabilities. Random variable, probability distributions, theoretical probability distributions.

c) Correlation: Meaning of correlation, Definition, Kinds, properties of coefficient of correlation, method of studying.

d) Regression: Introduction, Difference between correlation and regression, objects of regression analysis, kinds of regression analysis, linear regression, regression equation, coefficient


UNIT-III: Computer Fundamentals:

UNIT IV: Bioinformatics:

a) Introduction, Definition, Importance, Analytical Approach, Application, Bioinformatics as tool, Role of bio and Chemoinformatics in drug designs, Bioinformatics in life sciences, Studying bimolecular structures.

b) Biological Data base: Sequence database, Nucleic acid database, gene bank, proteins sequence data base, Swiss port, searching sequence data base, non redundant data base, Low annotation data base, specialized sequence data base, structure data base, motif database, proteome data base, Other data base

c) Sequence analysis:

Unit V: Bioinformatics Tools and Application

a) Tools for Bioinformatics: Pair wise alignment, Dotpots, scoring matrices, Blosum Matrices, PAM matrix, Gap penalty, Alignment Algorithms EMBOSS.

b) Proteins structure predictions: Secondary structure predictions, Tertiary structure Prediction, comparative modeling, folds recognition, Ab-initio prediction, Modeler, RASMO.


d) Emerging areas in Bioinformatics: DNA microarrays, Functional Genomics, Comparative Genomics, Pharmacogenomics, chemiinformatics, Medical informatics, Neural networks, phylogeny, whole cell stimulation, Human genome project.

PAPER-VI

ENZYME TECHNOLOGY

Unit-I: MECHANISM OF ENZYME ACTION:

a) Enzyme activators, Co-enzymes and Co-factors in enzymatic catalysis.

b) Concept of enzyme and substrate specificity.

c) Mechanism of action of lysozyme.

Unit-II: CONTROL OF ENZYME ACTION:

a) Regulation of enzyme activity-Feed-back control, enzyme introduction and repression, covalent modification.

b) Multi-enzyme complexes and their significance in metabolic control.

c) Membrane bound enzyme in metabolic regulation.

Unit III:

d) Isoenzymes and their metabolic significance.

e) Allosterism - allosteric enzymes and Co-operativity.

f) Covalently modulated regulatory enzymes.

Unit IV: COMPARTMENTATION AND IMMOBILIZATION OF ENZYMES:

a) Compartmentation of enzyme and substrate and its significance, Shuttle systems.

b) Naturally occurring Activators, Inhibitors and Co-enzymes.

c) Methods of enzyme immobilization, Industrial advantages. Immobilized multi-enzyme system.

d) Kinetics of immobilized enzymes.

e) Enzyme probes.
Unit V: **ENZYME TECHNOLOGY:**

a) **Immobilization of Microbial enzymes:** Methods viz, adsorption, covalent bonding, entrapments and membrane confinement and their analytical, therapeutical and industrial application. Properties of immobilized enzymes.

b) **Enzyme engineering:** Chemical modification and site directed mutagenesis to study the structure, function relationship of industrially important enzymes.

c) **Application of microbial enzymes:** Microbial enzymes in textile, leather, wood industries and detergents, enzyme in clinical diagnostics, Enzyme sensor for clinical processes and environmental analyses, Enzymes as therapeutic agents.

**PAPER-VII**

**MICROBIAL METABOLISM**

UNIT-I: **Carbohydrate metabolism:** EMP, ED, HMP, and phosphoketolase pathways in different microorganism. Fate of pyruvate. Gluconeogenesis.

**Tricarboxylic acid cycle:** Discovery, Intracellular location, Reactions of the cycle. Amphibolic nature. Anaplerotic reactions, Glyoxylate pathway.

UNIT II: **Aerobic metabolism of C1 Compounds:** Oxidation of methane, methanol, formaldehyde and formate. Ribulose pathways, Serine pathway, Xylulose monophosphate pathway.

UNIT III: **Nucleotide metabolism:** Biosynthesis of purine and pyrimidine nucleotides, biosynthesis of deoxyribonucleotides, Regulation of nucleotide synthesis. Catabolism of nucleotides. Formation of coenzyme nucleotides. Inhibitors of nucleotide synthesis.

UNIT IV: **Microbial metabolism of aromatic compounds:** Ortho cleavage pathway, meta cleavage pathway, Gentisate pathway, reductive catabolism.

**Catabolism of aromatic amino acids:** Tyrosine, Tryptophan, phenylalanine

**Lipid metabolism:** Biosynthesis of fatty acids, triacylglyceride, sphingomyeline and sphingolipids. Oxidation of saturated and unsaturated fatty acids.

UNIT-V: **Protein metabolism:** Assimilation of inorganic nitrogen, Biosynthesis of amino acids: Branched chain amino acids, Aromatic amino acids, Sulphur containing amino acids, Basic amino acids. **Catabolism of amino acids:** Glutamine, glutamate, Aspartate, Asparagine, L-alanine, D-alanine, proline, Serine, Glycine, Arginine, polyamines, Valine, Leucine and Isoleucine, Threonine, Lysine, Methionine, Cysteine.

**PAPER-VIII**

**ENVIRONMENTAL MICROBIOLOGY AND EXTREMOPHILES**

UNIT-I: **Recalcitrant organic compounds and concept of biomagnification:** Definition of recalcitrant organic compounds and their presence in natural ecosystem, concept and consequences of biomagnification, biomagnification of chlorinated hydrocarbons and pesticides. Biodegradation of recalcitrant and toxic chemicals.

UNIT II: **Eutrophication, and its management:** Eutrophication, Microbial changes induced by organic and inorganic pollutants, role of phosphorus and nitrogen in eutrophication, process and control of eutrophication.


UNIT IV: **Water Microbiology**

a) **Water treatment Process,** Disinfections, kinetics of disinfections, factors affection disinfecting drinking water, Halogens, (Chlorine, Chloramines, Chlorine di-oxide, Bromine and iodine) oozes, metal ions, Ultraviolet disinfections,

b) **Water distribution systems,**

c) **Concept of indicator organisms,** Total coliform, MTDT. MPN, MFT, P-A test, TTC, Fecal coliform, Fecal streptococci, Clostridium perfringens, Heterotrophic plate count, Bacteriophages, other indicator organisms, Standards and Criteria for indicators

UNIT V: **Waste water Management:** Introduction to primary, secondary and tertiary treatment, activated sludge process, trickling filters, principles of anaerobic digestion, Methane formation with respect to waste treatment, Oxidation pond and stabilization pond, application of sewage, Aerated lagoons. Biochemistry of nitrate and sulphate reduction with a special reference to waste treatment.

**PRACTICAL-III**

**ENVIRONMENTAL MICROBIOLOGY AND BIODIVERSITY**

1. Isolation of *Salmonella* from polluted water.
2. Isolation of phage from sewage water.
3. Assay of bacteriophages.
4. Demonstration of human enteric viruses.
5. Enumeration of coliform and faecal Streptococci by MF/MPN technique.
6. Examination and estimation of water for:
   a) Ammonical nitrogen
   b) nitrate
   c) nitrite
   d) dissolved oxygen
   e) chlorides
   f) sulphates
   g) Chemical oxygen demand
   h) biochemical oxygen demand
   i) phosphates
   j) calcium
   k) magnesium
   l) hardness
   m) Alkalinity
   n) solids-total dissolved & suspended
7. Enrichment of chemolithotrophs, methylotrophs, thermophiles, halophiles and acidophiles.
8. Enrichment and isolation of aliphatic hydrocarbon, phenol and parathion degraders.
9. Study/Educational tour and submission of report.

PRACTICAL-IV
MICROBIAL ENZYMOLGY, BIOSTATISTICS AND COMPUTER APPLICATION
1. Assay of following microbial enzymes.
   a) Amylase  b) Lipase  c) Protease  d) Invertase
2. Isolation and purification of certain microbial enzymes such as: protease, amylase, invertase by salt fractionation, dialysis, ion exchange.
3. Evaluation of kinetic constants of the purified enzymes.
4. Effect of different parameters on enzymes activity such as:
   a) pH  b) temperature  c) time  d) Enzyme concentration.
5. Effect of inhibitors on enzyme activity.
6. Fluidized bed column reactor using immobilized whole cell to study catabolism.
7. Immobilization of enzymes.
8. Students seminar and submission of report.

b) BIOSTATISTICS:
10. Summarization of data - p describing a sample:
    Measures of central tendency - arithmetic mean, mode, median.(for grouped data)
    Measures of dispersion - variance and standard deviation.
11. Estimation of confidence interval for a normally distributed population.
12. Hypothesis testing - t-test, chi-square test, F-test.
13. Histograms.
D) COMPUTER SCIENCE AND BIOINFORMATICS:
14. Computer operations getting acquainted with different parts of computers.
    Handling WINDOWS and Internet, E-mail and Internet. Use of CD ROM for literature search.
15. Accessign databases for nucleic acids and proteins.

Distribution of marks in University Practical Examination:
1. Long Experiments - 15 marks.
2. Short Experiments - 10 marks.
3. Viva-voce examination - 05 marks.
4. Spotting - 05 marks.
5. Practical record book - 05 marks.
6. Internal Assessment - 10 marks.

Total - 50 marks

M.Sc PART II (MICROBIOLOGY) EXAMINATION
(Semester –III)
paper-IX
Molecular biology
Unit-I : Nucleic Acids : Importance of nucleic acid in living systems, general composition of nucleic acids, purine and pyrimidine bases, tautomeric forms of bases, reactions of purines and pyrimidines, structure of nucleosides and nucleotides, deoxynucleotides, cyclic nucleotides and polynucleotides. Watson and Crick model for DNA. Different types of DNA and RNA

Unit- II DNA Replication:
   i) Enzymes of DNA replication in prokaryotes and eukaryotes, replication mechanisms in prokaryotes, eukaryotes, and phages.
   ii) DNA repair mechanism

Unit-III: a) Genetic recombination: Mechanism of genetic recombination, Transformation, Transudation, Conjugation and Transposable elements
b) Genetics and Molecular organization: Genes concept, genome, Multigene families, Pseudogenes, split genes, overlapping genes, genetic code
d) **Gene mutation**: Insertion deletion, frame shift and suppressor mutation, chemical and physical agents

**Unit-IV: Protein Synthesis:**

a) **Transcription**: RNA polymerases in prokaryotes and eukaryotes, process of transcription, concept of promoters and promoters types, enhancers and silencers and other regulatory elements, post transcriptional processing of tRNA, mRNA and tRNA, transcripts. Post transcriptional modification, spliceosome assisted and self-splicing of RNA transcripts. RNA dependent synthesis of RNA and DNA.

b) **Translation**: Protein synthesis, Translational process and control of translation, post-translational modification (covalent modification, phosphorylation, glycosylation, myxelation etc. protein targeting and degradation, non-ribosomal polypeptic synthesis Processing of RNA.

**Unit-V : Regulation of gene expression**: Gene regulation in prokaryotes - operon concepts (Lac operon and trp, arabinose operon), Negative & Positive Control, Sigma factor, Post translational regulation, etc.  

**Gene regulation in eukaryotes**: Regulation at transcriptional and translational level, by gene rearrangement

**PAPER-X**

**VIROLOGY**

**Unit-I :**

a) **Introduction to Virology**: Historical aspects: nature of viruses; origin and evolution of viruses, terminology, differentiation with other microorganisms,

b) **General properties of Viruses**: Morphology, size, host specificity, viral structure, shape, Chemical properties, Susceptibility to physical and chemical agents, Viral Haemagglunation,

c) **Replication**: Mechanism of virus adsorption and entry into host cell including genome replication, and m-RNA production by animal virus, mechanism of RNA synthesis, mechanism of DNA synthesis, transcription mechanism and post transcriptional processing, translation of virus, protein s, assembly, exit and maturation of progeny virions, multiplication of Bacteriophages.

d) Viral assay, viral genetics, Nomenclature of viruses.

**Unit- II :** **Virus-host Interaction**: Epidemiology, pathogenesis, Host response to virus Infections, Laboratory diagnosis of viral infection, Immunoprophylaxis, chemophylaxis and chemotherapy of viral diseases.


**UNIT III : Laboratory Diagnosis of Viral Infections**: Microscopy, Cultivation of Viruses: Animal inoculation, chick embryo and tissue-cultures (MKC, Human Embrogenic Kidney cell culture, Human Amnion cell culture). Serology, detection of viral proteins and genetics material

**UNIT IV : Structure, Pathogenesis, Laboratory Diagnosis & immunology of viruses**: Pox virus, Herpes viruses, Adenoviruses Picorna viruses,

**UNIT V : Structure, Pathogenesis, Laboratory Diagnosis & immunology of viruses**: Orthomyxoviruse, Paramyxoviruses, Arboviruses, Rubella, Arenaviruses, Rabdoviruses, Hepatitis virus. Miscellaneous virus

**PAPER-XI**

**FERMENTATION TECHNOLOGY**

**UNIT-I : Bioreactors**: Design and type of fermentors, unit operation and techniques, batch and continuous fermentations, evolution of bio-kinetics constants. Significance of bio-kinetic constants, Computer control of fermentation process.

**UNIT II :**

a) **Industrial production**: Penicillin, streptomycin, and tetracycline.

b) **Anticancer drug**: interferons, anthracycline, L-asparginas es.  

Biotechnological application for the production of rare biological molecules, antibiotics, vaccines, steroids, hormones and diagnostic kits

**Unit-III : Food and beverage production.**

a) Cottage & cheddar cheese, Yoghurt and Dahi

b) Mycotoxin production

c) Oriental food fermentations: 1) Koji 2) Soya Sauce 3) Miso,

d) Single cell proteins, mycoproteins.

e) Types of different alcoholic beverages and production of whisky.

**UNIT IV: Food Technology:**

a) Starter culture for food industries,
b) Production and preservation of following fermented foods:
   i. Soya sauce fermentation by moulds,
   ii. Fermented vegetables - Sauerkraut
   iii. Fermented Meat - Sausages
   iv. Production and application of Bakers Yeast
   v. Application of microbial enzymes in food industries.

c) Food borne infection and intoxications, bacterial with examples of infective and toxic types: Clostridium, Salmonella, Shigella, Staphylococcus, Campylobacter, Listeria.

d) Quality assurance: Microbiological quality of standard of food, Government regulatory practices and policies. FDA, EPA, HACCP, ISI.

Unit-IV: 
A) **Biomass Production:**
   i) Bacterial biomass- production: a) Bacillus megatherium b) Acinetobacter cerificans.
   ii) Fungal biomass production: Paecilomyces varioti by Pekilo process & Candida utilis from hydrocarbon.

B) **Prebiotics and probiotics**
   a) Importance of probiotics
   b) Sources of Prebiotics
   c) Probiotics organisms
   d) Desirable characteristics
   e) Benefits of probiotics consumption

PAPER-XII

**IMMUNOLOGY**

Unit-I: **Basic Immunology** - Anatomic organization of the immune system cell types and organs. Effect of mechanisms involved in specific and nonspecific immune mechanisms, characters, Immune Response- primary, Secondary, Immunological memory.

Unit-II: **Antigens, and Immunogenicity**, variation in antigenic Antibody and Immunoglobulins- Structure and functions of IgG, IgA, IgM, IgD, & Ig E., Antigen-Antibody reactions.

Unit-III: **Clinical Immunology** - Complement system; classic and alternate pathways and functions,. Cell mediated immunity, Immunological tolerance and Immunosuppression. Tumors Immunological. Autoimmunity and Autoimmune diseases.

Unit-IV: A) Hypersensitivity, Immune deficiency diseases, MHC class Molecules.

B) Conventional vaccines, peptide vaccine, subunit vaccine, genetically engineered vaccines, production and application of lymphokines. Antibody diversity, Immunogenetics.

Unit-V: **Immunobiotechnology & Hybridoma Technology:**
   Immuni zation of animals, isolation of stimulated spleen cells, myeloma cell lines used as fusion partners, fusion method, detection and application of monoclonal antibodies,

PRACTICAL-V

**APPLIED MICROBIOLOGY**

a) Applied microbiology
   1) Isolation of antibiotic producing organism from soil.
   2) Microbiological assay of antibiotics and purification by ion-exchange resin.
   3) Determination of kLa for fermenter.
   4) Preparation of yoghurt, koji, cheese. Idli
   5) Preparation of Flavor and aroma.
   6) Solid state fermentation of some product.
   7) Microbiological assay of amino acids .
   8) Microbiological assay of vitamins.

b) **Plant tissue culture:**
   9) Preparation of media for plant cell culture.
   10) Callus from explants.
   11) Haploid cell culture.
   12) Proto-plast culture.
   13) Educational tour and submission of report.

PRACTICAL-II

**IMMUNOLOGY AND CLINICAL MICROBIOLOGY**

1. Diagnostic methods for isolation and Identification of pathogenic microorganisms from the following specimens:
   (a) Blood (b) Urine (c) Cerebrospinal fluid (d) Throat (Swabs)
   (e) Sputum (f) faces (g) Pus and wound (infection) fluid.

2. **Isolation and identification of following pathogenic bacteria:**
   (a) Staphylococcus aureus (b) Streptococcus pyogenetic
   (c) Streptococcus pneumonia (d) Salmonella typhi and paratyphi A.B.C. (e) Shigella Species (f) Escherichia coli (g) Proteus vulgaris
   (h) Pseudomonas aeruginosa (i) Vibrio cholera (j) Mycobacterium tuberculosis (k) Clostridium titanic

3. **Serology:**
   a) VDRL Test b) RPR test c) Kahn test d) Widal test
e) C-Reactive protein f) Anti streptomycin-o g) R.A. Factor
h) ELISA test
i) Surface visual B-96 test (ELISA)
j) Latex agglutination test (pregnancy test)

4. **Diagnostic Immunology:**
a) Double diffusion methods of ouchterolony
b) Immunoelectrophoresis
c) Quantitative determination of plasma protein by immunoelectrophoresis.
d) Single radial immunodiffusion.
e) Estimation of antigen-antibody response by immunodiffusion technique.
f) Estimation of antigen-antibody response by immunoelectrophoresis.

5. **Preparation of monoclonal antibodies.**

6. **Hematology:**
a) Estimation of HB, b) PCV c) Blood cell counts W.B.C. & R.B.C.
d) ESR e) blood smear examination f) bleeding time g) clotting time
h) prothrombin time i) prothrombine determination j) Lab. diagnosis of leukaemias.

7. **Study of medical Parasitology:**
a) *E. histolytica* b) *Trypanosomes*
c) Leishmania and d) Plasmodium

8. **Stool Examination for:**
a) Ova, cysts of intestinal parasite blood cell and pus cells b) Occult blood, c) Characteristics of the stool in amoebic and bacillary dysentery.

9. **Antibiotic and chemotherapeutic agents:**
a) Antibiotic sensitivity test.
b) Assay of antibiotic level in the body fluids.

11. **Routine examination of urine.**

12. **Student seminar and submission of report.**

**Distribution of marks in University Practical Examination:**

| 1. Long Experiments (At least two) | 15 marks. |
| 2. Short Experiments               | 10 marks  |
| 3. Viva-voce examination           | 05 marks  |
| 4. Spotting                         | 05 marks  |
| 5. Practical record book           | 05 marks  |
| 6. Internal Assessment              | 10 marks  |
| Total                               | 50 marks  |

**Unit-I:** **Genetic Engineering**
a) **Enzymes used in recombinant DNA technology:** Endonucleases, ligases, Enzymes to modify DNA molecules.
b) **Vectors:** Plasmids, plant vector, bacteriophages, cosmids, phagmides, animal viruses, plants viruses, special vectors.

**UNIT II:** **Genes cloning in prokaryotes & Eukaryotes:** Isolation of gene, Methods of gene transfer, Selection and screening of recombinant DNA, nucleic acid hybridization and clot curves, southern, northern and western blotting techniques, dot and slot blots, colony hybridization.

**UNI III:** **Cloning strategies:**
a) Cloning from m-RNA and genomic DNA, synthesis of gene, gene probes, gene banks, gene libraries, mapping of gene, DNA sequencing, RFLP, DNA finger printing, site direct mutagenesis.
b) Polymerase chain reaction & gene amplification.

**Unit-IV:** **Plant Biotechnology:**
a) Culture media and plant cell culture
b) Tissue culture, micropropogation and somaclonal variation
c) Production and use of haploid cell culture
d) Protoplast culture, regeneration and somatic hybridization
e) Gene transfer method in plants, transgenic plants and animals.

**Unit-V:** **Application of Biotechnology:**
a) Application in agriculture, plants and animal improvement.
b) Enzyme biotechnology
c) Protein engineering, immunotoxins and drug designing
d) Metabolic engineering for over production of metabolites.
e) Use of microbes in industry and agriculture
f) Application to medical sciences, gene therapy, genetic counseling, diagnosis of diseases and phenomenon of ageing.
g) Control of environmental pollution, recovery of minerals and restoration of degraded lands
PAPER-XIV
CLINICAL ViroLOGY

Unit-I: Plant Viruses: Classification, life cycle and replication of tobacco mosaic virus (TMV), PVX, PVY, CMV, TSWV, CaMV, Cynophages, Mycoviruses

Unit-II: Bacterial Viruses: Life cycle, Structure and replication of following RNA and DNA phages: Ox 174 phage, T4 phage; Lambda phage. (Lyric and glycogenic Cycle); Ft phage; MS2, f2, QB phages and Mud phage and O6 phage.

Unit-III: a) Oncogenic Viruses (Tumor Viruses): Classification of viruses characteristics of virus transformed cell or tumor cell.
   i) DNA - Containing Tumor Viruses:
   ii) RNA - Containing Tumor Viruses: Retroviruses (oncornaviruses).

Unit-IV: a) AIDS viruses: Retro viruses, HIV

Unit-V: Viroids and Prions.

PAPER-XV
MICROBIAL TECHNOLOGY

Unit-I: Isolation and screening of microorganisms, maintains of isolates/strains, Inoculum developments, sterilization, strain improvement, process development, Downstream processing, In situ recovery of products. General scale up procedure Solid-state fermentations Manufacturing cost estimation Principal and general consideration in down stream processing.

Unit-II: a) Fermentation of acids: Aspartic acid, L glutamic acid and Gluconic acid.
   b) Modern trends in Microbial Productions: Bioplastic (PHB, PHA) Biopolymer (Dextran, alginates, xanthan, Pullulan)

Unit-II: Fermentation Of enzymes and Amino acids: Amylase, Protease. Riboflavin, cyanocobalamin.


Unit-V: Biofertilizers and Biopesticides.
   a) Basic concept: PSM, N2 Fixer, S-solubilizers etc, K-solubilizers
   b) Biomass production
   c) Formulation (Carrier based, dried, liquid, and mixed inoculum)
   d) Application methods
   e) Inoculation quantity concept.
   f) Biopesticides: Bacterial, fungal, viral etc.
   g) Biocontrol mechanism.
   h) Preparation and application of Biopesticides

PAPER-XVI
MEDICAL MICROBIOLOGY

Unit-I: Pathogenic bacteria and laboratory diagnosis: Staphylococci, Streptococci including pneumococci, Mycobacterium tuberculosis and M. leprea


Unit-III Pathogenic fungi and their laboratory diagnosis: Microsporum, Trichophyton, Epidermophyton, Candida albican, Cryptococcus neoformans, Blastomyces dermatitidis and Histoplasma capsulatum.

Unit-IV Parasites and their laboratory diagnosis: Entamoeba histolytica, Leishmania donovani, Trypanosoma spp., Plasmodia species, Taenia saginata, Taenia solium Echinococcus granulosus, Hymenolepsis nana, Ascaris lumbricoides, Enterobius vermicular and Wuchereria bancrofti.

Unit V: Clinical Microbiology: Normal microbial flora of human body, sore throat and pneumonia, UTI, Diarrhaial diseases, Meningitis, Bacterium, septicimia, Infective Endocarditis, PUO, STD, Hospital acquired infections, Prophalytic immunization, antimicrobial therapy, Antimicrobial sensitivity testing, Hospital waste management, Vechicals and vectors.
PRACTICAL-VII
APPLIED MICROBIOLOGY AND BIOTECHNOLOGY
RECOMBINANT DNA TECHNOLOGY

1) Agarose gel Electrophoresis
2) Restriction Digestion of DNA
3) DNA Ligation
4) DNA Molecular size Determination
5) DNA Fingerprinting
6) Southern hybridization
7) Restriction Mapping
8) In vitro Transcription
9) Southern Blotting
10) Northern Blotting
11) Plasmid preparation
12) Genomic DNA isolation.
13) Gene Cloning
14) Bacterial Gene expression.
15) Bacterial Transformation
16) Bacterial Conjugation
17) Bacterial Transduction
18) Whole Blood DNA extraction.
19) Educational tour and submission of report.

Project work (Marks 50)

Distribution of marks in University Practical Examination:

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<th>Description</th>
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<td>1. Long Experiments (At least two)</td>
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<td>2. Viva-voce (Jointely by internal and external examiners)</td>
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<td>3. Internal Assessment</td>
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<td><strong>Total</strong></td>
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Books recommended for M.Sc. Part-I & Part-II (Microbiology)

1. Biophysical Chemistry - Upadhyay & Nath (Himalaya Pub.)
2. Practical Biochemistry - Plummer (TMH Pub.)
3. Principal of Biochemistry - Lehninger (CBS Pub.)
4. Practical Biochemistry - Jayraman (Wiley Estern Pub.)
5. Physical Biochemistry - Morrison (Oxford)
6. Enzyme - Dixon &. Webb
8. Bacterial metabolism - A.H. Rose
9. Biochemistry - West & Toad
11. Soil Microbiology - Alexander (Wiley Eastern Pub.)
15. Essentials of molecular biology - Freifelder D. (Narosa Pub.)
16. A textbook of biotechnology - Duby (S. Chand Pub.)
17. Molecular Biology - Freifelder D. (Narosa Pub.)
18. Microbial Genetics - Freifelder D. (Narosa Pub.)
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<tr>
<th>No.</th>
<th>Title</th>
<th>Author/Editors</th>
<th>Publisher/Year</th>
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<tbody>
<tr>
<td>19</td>
<td>Text Book of Molecular Biology - Shastry &amp; Other (Macmillan)</td>
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<td>20</td>
<td>Hand Book of Tissue Culture (ICAR Pub.)</td>
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<td>21</td>
<td>A textbook of Biotechnology - H.D. Kumar (E.W. pub.)</td>
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<td>Basic Biotechnology Rev. Iganacimuthu (TMH Pub.)</td>
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<td>23</td>
<td>Plant viruses - Mandahar (S. Chand &amp; Co.)</td>
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<td>24</td>
<td>Microbiology Lewis. (Harper)</td>
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<td>Microbiology - Fundamentals &amp; Application - Purohit. (Agro Botanical Pub.)</td>
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<td>26</td>
<td>Industrial Microbiology - Casida (Wiley Eastern pub.)</td>
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<td>Press Scott and Dunn Industrial Microbiology.</td>
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<td>Microbiology - Anantnarayan &amp; Panikar (Orient Longman)</td>
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<td>29</td>
<td>A text book of Microbiology. ō P. Chakraborty (Central Pub.)</td>
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<td>30</td>
<td>Medical Microbiology - Ichhapunani &amp; Bhatia (J.P. Brothers)</td>
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<td>31</td>
<td>Essential of Medical Mycology - Evans &amp; Genitals (Churchill and Livingston)</td>
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<td>Genetics by Strickbeger (Prentice Hall)</td>
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<td>33</td>
<td>A short textbook of recombinant DNA technology Watson. (Black Well)</td>
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<td>Molecular Biotechnology - Prime Rose - (Black Well.)</td>
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<td>Immunology by Shetty - (Wiley Eastern Pub.)</td>
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<td>Molecular biology of genes. Watson - (Begamin Cumming))</td>
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<td>Recombinant DNA technology - Rodriguez (Begamin Cumming)</td>
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<td>Advances in molecular genetics. Puhlar. (Begamin Cumming)</td>
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<td>Molecular cloning - A lab manual. (Cold spring harbor lab pub.)</td>
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<td>Concept of molecular biology - Rastogi (Wiley Eastern Pub.)</td>
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<td>Genetic Engineering - Sandhy Mitra (Macmillan)</td>
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<td>Applied microbiology. Ed. by H.A. Modi. (Akta Prakashan)</td>
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<td>Environmental Microbiology. Ed. by H.A. Modi (Akta Prakashan)</td>
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<td>Fundamentals of Dairy Microbiology by J.B. Prajapati (Akta Prakashan)</td>
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<td>Bio-Fertilizer. By Vyas &amp; Modi (Akta Prakashan)</td>
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<td>47</td>
<td>Biochemistry. By D. Das (Academic Pub.)</td>
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<td>Biophysics &amp; Biophysical Chemistry. By D. Das. (Academic Pub.)</td>
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<td>Modern Immunology. By A. Das Gupta (Jaypee Pub.)</td>
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<td>A textbook of microbiology by P. Chakraborty (New Central Book Agency)</td>
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<td>Principal of gene manipulation by Old &amp; Prim Rose (black well pub.)</td>
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<td>Agricultural microbiology by Rangaswami &amp; Bagyaraj (PHI)</td>
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<td>An introduction to recombinant DNA by A.E.H. Emery (ELBS)</td>
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<td>Concepts in Biotechnology by D. Bakasubramuniam and other</td>
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<td>Introduction to genetics engineering by D.S.T Nicholl (Cambridge)</td>
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<td>Applied plant biotechnology by Iganacimuthu (TMH)</td>
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<td>Immunodiagonostics S.C. Rastogi (Wiley Eastern Pub.)</td>
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<td>A textbook of Microbiology. R.C.Dubey and D.K.Maheshewari. (S.Chand &amp; Company)</td>
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<td>Gene VII - Lewis (Oxford Science Publication)</td>
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<td>Molecular Cell Biology, Berk, Lipursky, Baltimore, Darnell and Matsuduira (W.H. Freeman and Company)</td>
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<td>Biotechnology - Rhem and Read</td>
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<td>Standard methods of Biochemical analysis - S.R. Thimmaiah (Kalyani Publisher)</td>
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<td>Laboratory Manual of Bacterial Genetics - Institute of Microbial Technology - Chandigarh.</td>
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<td>An Introduction to electrophoresis - K. Anbalgan (The Electrophoresis Institute, Salem Dist.S. India.)</td>
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<td>74</td>
<td>Waste water microbiology - Gabrian Bitton (John Wiley &amp; Sons)</td>
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<td>Environmental Microbiology - Ralph Mitchell (John Wiley and Sons).</td>
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<td>Microbial Biotechnology - Fundamentals of applied Microbiology - Alexander N. Glazer, and Hiroshi Nikoidu (W.H. Freeman and Company)</td>
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<td>Gene structure and expression - John D. Hawkins (Cambridge University Press)</td>
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<td>Biotechnology - John G. Smith, (Cambridge University Press)</td>
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82. General Microbiology - Schiegel (Cambridge University Press)
84. Modern Concepts of Biotechnology - H.D. Kumar, (Vikas Publishing Pvt. Ltd.)
85. A textbook of Microbiology - R.C. Dubey and D.K. Maheshwari (S. Chand & Company)
86. Biotechnology - Applications and Research - Edited by Paul Cheremisinoff and Robert Ouellette (Technomic Pub. Co. Inc.)
87. Basic and Clinical Immunology - Daniel Stites, Abba Terr & Tristram Parslow (Prentice Hall International INC)
88. A Text Book of Biochemistry with Clinical correlation - Edited by Thomas Devlin (John Wiley and Sons, INC).
89. Microbiology Laboratory - Fundamentals and Application, George Wistreich (Prentice Hall)
91. Foundations in Microbiology - Kathleen Talaro & Arthur Talaro (Wm. C. Brown Publishers)
93. Fundamentals of Microbiology - Alcamo (Benjamin / Cummings Pub. Co. Inc.)
94. Sale and Molecular Biology - Concepts and experiments - Gerald Karp (John Wiley and Sons, INC).
95. Cellular and Molecular Immunology - Abul Abbas, Andrew Lichman & Jordan Pober (W.B. Saunders Co.)
96. Biochemistry-Zubay (Wm. C. Brown Publishers)
97. Life-An Introduction to Biology - Beck, Liem & Simpson (Harper Collins Publishers)
98. Genetics - A. V. S. S. Sambamurthy (Narosa Publication)
99. Water Pollution - V.P. Kudesia, (Pragati Prakashan Meerut)
100. Physicochemical Examination of Water, Sewage and Industrial waste - N. Maniwasakam (Pragati Prakashan, Meerut)
102. Textbook of Medical Mycology - Jagdish Chander (Interprint, New Delhi)
103. An introduction to Plant tissue and Cell culture - N.C. Kumar (Emkay Publication Delhi)
104. Short Protocols in Molecular Biology - Edited by Ausubel, Brent, Kingston, Moore, Seidman, Smith and Struhl (John Wiley and Sons)
105. Molecular Cell Biology - Dernell, Lodish and Baltimore, (Scientific American Books)
106. Technological Applications of Biocatalysts - Published on behalf of Open University and University of Greenwich (Butterworth-Heinemann).
107. Microbiology-Principle and Explorations - J.G. Black (John Wiley and Sons)
108. Techniques for engineering Genes - Published on behalf of Open University and University of Greenwich (Butterworth-Heinemann).
109. Biotechnological Innovations in Energy and Environmental management - Published on behalf of Open University and University of Greenwich (Butterworth-Heinemann).
110. Medical Microbiology - Mims, Playfair, Roitt, Wakelin and Williams (Mosby)
111. Principles of Enzymology for the Food Sciences (John Whitaker, Marcel Dekker, Inc.)
112. Biostatistics - A Foundation for analysis in Health Sciences - W.D. Daniels, John wiley and Sons.
113. Basic Statistics - C. Dunn
115. How the Internet works - Preston Gralla, Techmedia.
119. Bioinformatics for Beginners - Dr. K. Mani & N. Vijayraj (Kalai Kathir Achchagani Pub. Coimbatore)
120. Instant Notes - Bioinformatics - West head, Parish and Twyman (Viva Publication) New Delhi.
121. Schaum's Outlines - Biochemistry, Kuchel & Ralston (TMH Edition)
122. Schaum's outlines - Microbiology (TMH Edition)
123. Schaum's outlines - Molecular and cell Biology (TMH Edition)
125. Biotechnology DNA - Protein A Laboratory project in molecular Biology. Thiel, Bissen & Lyons (TMH Edition)
127. Modern Approaches to Soil and Agriculture and Environmental Microbiology. Shiva Aithal and Nikhilesh Kulkarni, Himalaya Publishing House.