M.Sc. Sem- I to IV
(Mathematics)

Prospectus No. 2017129

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

2016

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Price Rs........./-
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SANT GADGE BABA AMRAVATI UNIVERSITY
SPECIAL NOTE FOR INFORMATION OF THE STUDENTS

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

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

Ordinance No. 1 : Enrolment of Students.
Ordinance No. 2 : Admission of Students
Ordinance No. 4 : National cadet corps
Ordinance No. 6 : Examinations in General (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 ग्रामम 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;

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

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

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

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

(e) any other graduate in Science not eligible under clause (a) (b) or (c) above, shall be eligible for admission to the examination in Mathematics only, after a lapse of not less than one academic year since the date of his passing the examination for the Degree of विज्ञान स्नातक (Bachelor of Science);

(f) an applicant holding the शेखरी स्नातक (B.Pharm) or the शेखरी 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 to study and examination at the B.Sc. Degree.

(l) for admission to M.Sc. Petrochemical Science, a candidate shall have offered Petrochemical Science subject to study and examination at the B.Sc. Degree.

(m) i) for admission to M.Sc. Part-I (Environmental Science) a candidate shall have offered one of the optional 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-2 (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.

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.

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<th>The student should have passed the Examination of satisfactory</th>
<th>The student should have completed the session/semester</th>
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<td>M.Sc. Part-I (Semester-I)</td>
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<td>M.Sc. Part-I (Semester-I &amp; II)</td>
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<td>M.Sc. Part-II (Semester-IV)</td>
<td>Semester-I</td>
<td>M.Sc. Part-II (Semester-III &amp; IV)</td>
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Provided firstly, that an examinee who has passed Part-II Examination in one of the subjects listed above from 1 to 15 and is desirous of appearing.

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

Provided secondly, that a candidate eligible for appearing at 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-6A.

14. Examinees who are successful in the M.Sc. Semester-I, II, III & IV Examination and have obtained not less than 60% marks in the aggregate of the M.Sc. Semester-I, II, III & IV Examinations taken together shall be placed in the First Division, those obtained less than 60% but not less than 55% marks, in the Higher Second Division, those obtained less than 55% but not less than 48% marks, in the Second Division, and all other successful examinees, in the Third Division.

15. Provision of Ordinance No. 18 of 2001 relating to the an Ordinance to provide grace marks for passing in a Head of passing and improvement of division (higher class) and getting distinction in the subject and Condonation of Deficiency of Marks in a subject in all the faculty prescribed by the Statute No.18, Ordinance, 2001, shall apply to the examinations under this ordinance.

16. As soon as possible after the examination, but not later than 30th, June next following, the Management Council shall publish a list of successful examinees arranged in Three Divisions. The names of examinees passing the examination as a whole in the minimum prescribed period and obtaining the prescribed number of places in each subject in the First or Second Division, shall be arranged in Order of Merit as provided in the Examinations in General Ordinance No.6.

17. Save as provided in Paragraph 11 of this ordinance, no person shall be admitted to an examination under this ordinance, if he has already passed the same examination of this University or an equivalent examination in M.Sc. Part-I (Semester-I & II), and M.Sc. Part-II (Semester-III & IV) of any other Statutory University.

18. Examinees successful at the M.Sc. Part-I (Semester-I & II), and M.Sc. Part-II (Semester-III & IV) shall on payment of the prescribed fees, be entitled for the award of the respective Degree in the prescribed form, signed by the Vice-Chancellor.

*****

(Note : - " P.G. Workload in the faculty shall be as per Ordinance No.131.")
APPENDIX-A
SCHEME OF EXAMINATION FOR M.Sc. PART-I & II.
( FOR ALL SUBJECTS)

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<td>Paper-IV</td>
<td>50 Marks</td>
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</tr>
<tr>
<td>Paper-XVI</td>
<td>50 Marks</td>
<td>Internal Assessment</td>
<td>10 Marks</td>
<td></td>
</tr>
</tbody>
</table>

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

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

*****
AND

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

AND

Whereas, the admission of students in the above pattern at M.Sc. Part-I (Semester-I) of all subjects in the faculty of Science are to be made in the Academic Session 2010-11.

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

1. This Direction may be called “Scheme for Choice Based Credit System (CBCS) and Awarding Grades to the Post Graduate Students in the Faculty of Science, Direction, 2010.

2. This Direction shall come into force with effect from the examination as shown below for all subjects for the Examinations leading to the Degree of Master of Science in the faculty of Science-
   (i) Winter 2010 examination for M.Sc. Part-I, Semester-I,
   (ii) Summer-2011 examination for M.Sc. Part-I, Semester-II,
   (iii) Winter-2011 examination for M.Sc. Part-II, Semester-III,
   (iv) Summer-2012 examination for M.Sc. Part-II, Semester-IV.

3. The detailed Scheme for Choice Based Credit System (CBCS) and Awarding Grades to the Post Graduate students in the Faculty of Science is as given below-

I. The CBCS System

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

II. Credits and Degrees

   i) A candidate who has successfully completed all the core courses Compulsory, Elective/ Specialised courses and project prescribed and optional approved by the University for the programme and accumulated not less than 72 (52 core and elective) Credits and who has put in the minimum residence time shall be eligible to receive the degree.

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

III. Courses

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

   (ii) Elective Course : Means a optional course from the basic subject or specialization.

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

(iii) General Interest Course (GIC)

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

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

(iv) Each Course is designed such that it includes lectures / tutorials / laboratory or field work / Seminar / Practical training / Assignments / Term paper / Report writing or review of literature and any other innovative practice etc., to meet effective teaching and learning needs.
v) **Attendance**: Students must have 75% of attendance in each Core and Elective course for appearing the examination. However, a student having attendance 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) 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 post graduate 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>
<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>12</td>
<td>12</td>
</tr>
<tr>
<td>Elective</td>
<td>04</td>
<td>04</td>
</tr>
<tr>
<td>GIC</td>
<td>00</td>
<td>04</td>
</tr>
<tr>
<td>Lab. Course</td>
<td>06</td>
<td>06</td>
</tr>
<tr>
<td>L.A.</td>
<td>04</td>
<td>04</td>
</tr>
<tr>
<td>Project</td>
<td>00</td>
<td>00</td>
</tr>
<tr>
<td>Total</td>
<td>26</td>
<td>26</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>
<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>
X. Computation of SGPA & CGPA

Every student will be awarded points out of maximum 10 points in each subject. 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:

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

Where \(SGPA(n)\) is the \(n\)th Semester SGPA of the student and \(C_n\) is the \(n\)th 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.
(iv) Every student shall have the right to scrutinize answer scripts of sessional/end-semester examinations and seek clarifications from the teacher regarding evaluation of the scripts immediately thereafter or within 3 days of receiving the evaluated scripts.

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

(vi) The department shall send all records of evaluation, including sessional evaluation, for safekeeping to the Controller of Examinations as soon as all the formalities are over.

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

The grade card shall list:
(a) the title of the courses along with code taken by the student
(b) the credits associated with the course,
(c) the grade and grade points secured by the student,
(d) the total credits earned by the student in that semester.
(e) the SGPA of the student,
(f) the total credits earned by the students till that semester
(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 of the above.

sd/-
Amravati (Dr. Kamal Singh)
Date: 2/6/2010
Vice-Chancellor

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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>Thv Int. Pass Marks (Min. Grade Pt.)</th>
<th>Max. Marks (Credit)</th>
<th>Min. 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>5</td>
<td>5</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>5</td>
<td>5</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>5</td>
<td>5</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>5</td>
<td>5</td>
</tr>
<tr>
<td>5</td>
<td>1SA-5</td>
<td>Lab-I</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>6</td>
<td>1SA-6</td>
<td>Lab-II</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></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-C

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

**M.Sc. Part-II**

**Semester-III**

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

<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>Max. Marks (Credits)</td>
<td>Min. Pass Marks (Min. Grade Points)</td>
<td>Int. (Credits)</td>
<td>Min. Pass Marks (Min. Grade Points)</td>
</tr>
<tr>
<td>1</td>
<td>80 (04)</td>
<td>32 (04)</td>
<td>20 (01)</td>
<td>08 (04)</td>
</tr>
<tr>
<td>2</td>
<td>80 (04)</td>
<td>32 (04)</td>
<td>20 (01)</td>
<td>08 (04)</td>
</tr>
<tr>
<td>3</td>
<td>80 (04)</td>
<td>32 (04)</td>
<td>20 (01)</td>
<td>08 (04)</td>
</tr>
<tr>
<td>4</td>
<td>80 (04)</td>
<td>32 (04)</td>
<td>20 (01)</td>
<td>08 (04)</td>
</tr>
<tr>
<td>5</td>
<td>00 (03)</td>
<td>40 (04)</td>
<td>00 (03)</td>
<td>40 (04)</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-B

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>Max. Marks (Credits)</td>
<td>Min. Pass Marks (Min. Grade Points)</td>
<td>Int. (Credits)</td>
<td>Min. Pass Marks (Min. Grade Points)</td>
</tr>
<tr>
<td>1</td>
<td>80 (04)</td>
<td>32 (04)</td>
<td>20 (01)</td>
<td>08 (04)</td>
</tr>
<tr>
<td>2</td>
<td>80 (04)</td>
<td>32 (04)</td>
<td>20 (01)</td>
<td>08 (04)</td>
</tr>
<tr>
<td>3</td>
<td>80 (04)</td>
<td>32 (04)</td>
<td>20 (01)</td>
<td>08 (04)</td>
</tr>
<tr>
<td>4</td>
<td>80 (04)</td>
<td>32 (04)</td>
<td>20 (01)</td>
<td>08 (04)</td>
</tr>
<tr>
<td>5</td>
<td>00 (03)</td>
<td>40 (04)</td>
<td>00 (03)</td>
<td>40 (04)</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>Code</td>
<td>Marks (Credits)</td>
<td>Min. Pass Marks (Min. Grade Pt.)</td>
<td>Int. Ass. (Credits)</td>
</tr>
<tr>
<td>1</td>
<td>4SA-1</td>
<td>C</td>
<td>80 (04)</td>
<td>32 (04)</td>
</tr>
<tr>
<td>2</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 Or GIC-Z</td>
<td>E</td>
<td>80 (04)</td>
<td>32 (04)</td>
</tr>
<tr>
<td>5</td>
<td>4SA-5 Lab-V</td>
<td>E</td>
<td>80 (04)</td>
<td>32 (04)</td>
</tr>
<tr>
<td>6</td>
<td>4SA-6 Project</td>
<td>E</td>
<td>80 (04)</td>
<td>32 (04)</td>
</tr>
</tbody>
</table>

Total Marks : 600; Minimum Total Credits : 26

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

(2) If the student has 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>Code</td>
<td>Marks (Credits)</td>
<td>Min. Pass Marks (Min. Grade Pt.)</td>
<td>Int. Ass. (Credits)</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>
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<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 / Course</th>
<th>Theory</th>
<th>Max. Marks (Credits)</th>
<th>Min Pass Marks (Min. Grade Pt.)</th>
<th>Int. (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></td>
<td></td>
<td></td>
<td>1 2 3 4 5 6 7 8</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1</td>
<td>2MTH-1 C</td>
<td></td>
<td>80 32 20 8 40</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>2MTH-2 C</td>
<td></td>
<td>80 32 20 8 40</td>
<td></td>
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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**

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

## M.Sc. Part-I

### Semester-IV

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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
### 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

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

**M.Sc. (Biotechnology) SEMESTER PATTERN**

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Total Credits: 35
### Scheme of Teaching and Examination under C.B.C.S. for the subject Computer Science

**M.Sc. (Computer) SEMESTER PATTERN**

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Total Credits: 40

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

**M.Sc. (Computer) SEMESTER PATTERN**

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Total Credits: 40
## Scheme of Teaching and Examination under C.B.C.S. for the subject Computer Science

### Appendix-O

**M.Sc. (Computer) SEMESTER PATTERN**

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

<table>
<thead>
<tr>
<th>S N</th>
<th>Subject Code</th>
<th>Paper</th>
<th>Course</th>
<th>Hrs/Week</th>
<th>Credits</th>
<th>Theory</th>
<th>Pract.</th>
<th>Examination Scheme</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
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<td></td>
<td></td>
<td>Theory</td>
</tr>
<tr>
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<td></td>
<td></td>
<td>Paper</td>
<td>Max</td>
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<td></td>
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<td></td>
<td></td>
<td>Hrs</td>
<td>Theory</td>
<td>Internal</td>
</tr>
<tr>
<td>1</td>
<td>3MCS-1</td>
<td>XI</td>
<td>C</td>
<td>5</td>
<td>-</td>
<td>5</td>
<td>-</td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>3MCS-2</td>
<td>XII</td>
<td>C</td>
<td>5</td>
<td>-</td>
<td>5</td>
<td>-</td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>3MCS-3</td>
<td>XIII</td>
<td>C</td>
<td>5</td>
<td>-</td>
<td>5</td>
<td>-</td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>3MCS-4</td>
<td>XIV</td>
<td>E</td>
<td>5</td>
<td>-</td>
<td>5</td>
<td>-</td>
<td></td>
</tr>
<tr>
<td>5</td>
<td>3MCS-5</td>
<td>XV</td>
<td>E or GIC</td>
<td>5</td>
<td>-</td>
<td>5</td>
<td>-</td>
<td></td>
</tr>
<tr>
<td>6</td>
<td>3MCS-6</td>
<td>Lab-V</td>
<td>-</td>
<td>-</td>
<td>7</td>
<td>-</td>
<td>03</td>
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</tr>
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<td>7</td>
<td>3MCS-7</td>
<td>Lab-VI</td>
<td>-</td>
<td>-</td>
<td>7</td>
<td>-</td>
<td>03</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Total</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>25</td>
<td>14</td>
<td>25</td>
</tr>
</tbody>
</table>

**Total Credits:** 35

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

### Appendix-P

**M.Sc. (Computer) SEMESTER PATTERN**

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

<table>
<thead>
<tr>
<th>S N</th>
<th>Subject Code</th>
<th>Paper</th>
<th>Course</th>
<th>Hrs/Week</th>
<th>Credits</th>
<th>Theory</th>
<th>Pract.</th>
<th>Examination Scheme</th>
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<tbody>
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<td></td>
<td></td>
<td></td>
<td>Hrs</td>
<td>Theory</td>
<td>Internal</td>
</tr>
<tr>
<td>1</td>
<td>4MCS-1</td>
<td>XVI</td>
<td>C</td>
<td>5</td>
<td>-</td>
<td>5</td>
<td>-</td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>4MCS-2</td>
<td>XVII</td>
<td>C</td>
<td>5</td>
<td>-</td>
<td>5</td>
<td>-</td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>4MCS-3 Or 4GIC-7</td>
<td>XVIII</td>
<td>E or GIC</td>
<td>5</td>
<td>-</td>
<td>5</td>
<td>-</td>
<td>3 Hrs 100</td>
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<td>4</td>
<td>4MCS-4</td>
<td>Lab-VII</td>
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<td>-</td>
<td>7</td>
<td>-</td>
<td>03</td>
<td></td>
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<td>5</td>
<td>4MCS-5</td>
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<td>-</td>
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<td>6</td>
<td>1MCS 6</td>
<td>02</td>
<td>01 1</td>
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<td>01 1</td>
<td>15</td>
<td>11</td>
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<td>7</td>
<td>4MCS 7</td>
<td>Internal Assessment</td>
<td>Total</td>
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<td>06</td>
<td>-</td>
<td>02</td>
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</table>

**Total Credits:** 35
### 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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<tbody>
<tr>
<td>1</td>
<td>Chemistry</td>
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<td>3</td>
<td>2GIC-1</td>
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<td>4</td>
<td>2GIC3</td>
</tr>
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<td></td>
<td></td>
<td>2PHY4</td>
<td></td>
<td>2GIC4</td>
</tr>
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<td>Mathematics</td>
<td>2MTH4</td>
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</tr>
<tr>
<td></td>
<td></td>
<td>2MTH5</td>
<td></td>
<td>2GIC6</td>
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<td>4</td>
<td>Zoology</td>
<td>2ZOO3</td>
<td>2</td>
<td>2GIC7</td>
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<td>5</td>
<td>Botany</td>
<td>2BOT3</td>
<td>2</td>
<td>2GIC9</td>
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<tr>
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<td></td>
<td>2BOT4</td>
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<td>2GIC-A</td>
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<td>6</td>
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<td>2</td>
<td>2GIC-B</td>
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<td></td>
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<td>2GIC-C</td>
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<td>7</td>
<td>Biotechnology</td>
<td>2BTB3</td>
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<td>2GIC-D</td>
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<td></td>
<td></td>
<td>2BTB4</td>
<td></td>
<td>2GIC-E</td>
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<tr>
<td>8</td>
<td>Computer Science</td>
<td>2CMS3</td>
<td>2GIC-F</td>
<td></td>
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<td></td>
<td></td>
<td>2CMS4</td>
<td></td>
<td>2GIC-G</td>
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<td>Microbiology</td>
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<td>2</td>
<td>2GIC-H</td>
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<td>2GIC-J</td>
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<td>2GIC-K</td>
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<td>11</td>
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<td>2GIC-L</td>
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<td></td>
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<td>2GIC-M</td>
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<td>2GIC-N</td>
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<td>2BIT4</td>
<td></td>
<td>2GIC-Q</td>
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<td>14</td>
<td>Environmental Science</td>
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<td>2GIC-R</td>
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<td></td>
<td></td>
<td>2ENV4</td>
<td></td>
<td>2GIC-S</td>
</tr>
<tr>
<td>15</td>
<td>Geoinformatics</td>
<td>2GIT3</td>
<td>2GIC-U</td>
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<tr>
<td></td>
<td></td>
<td>2GIT4</td>
<td></td>
<td>2GIC-V</td>
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<td>16</td>
<td>Computer Software</td>
<td>2CSW3</td>
<td>2GIC-W</td>
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<td></td>
<td></td>
<td>2CSW4</td>
<td></td>
<td>2GIC-1A</td>
</tr>
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<td>17</td>
<td>Remote Sensing and GIS</td>
<td>2RSG3</td>
<td>2GIC-1B</td>
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<td></td>
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<td>2RSG4</td>
<td></td>
<td>2GIC-1C</td>
</tr>
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<td>18</td>
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<td>2PCH3</td>
<td>2GIC-1D</td>
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<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.

---

### DIRECTION

No. : 27 / 2010  
Date : 24.6.2010

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

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

AND

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

AND

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

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

1. This Direction may be called न एxaminations leading to the Degree of वि́षय पारंगत (Master of Science) (Four Semester Degree Course), Direction, 2010.
2. This direction shall come into force from the date of its issuance.
3. The word न एlectrochemistry in clause i) of sub-para (i) of para 5 shall be deleted.
4. The title of the subject न Electronics (Instrumentation) be substituted as न electronics wherever occur in the Ordinance.
(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.


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


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 Ø2 (52 core and elective) Øbe substituted by the figures, sign, and words Ø8 (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.

vi) The word "Minimum" printed below the table in Appendix A, B, C, D, G, and H, shall be deleted.

viii) Following special explanatory Note be added below the table in Appendix D, H, L, and P respectively.

Special Explanatory Note: At the end of IVth semester, the students/examinee who accumulated atleast 88 credits (out of these 88 credits, 64 credits must be on core and elective course) and who has put in the minimum residence time shall be eligible to receive the degree in the subject he/she has admitted.

(B) The students should have accumulated 28 credits of M.Sc. Part-I, Sem-I & II taken together for admission to III Semester and should have completed the term of M.Sc. Part-I (Semester-I & II) satisfactorily.

Sd/-

Amravati

(Mohan K. Khedkar)

Vice-Chancellor

Date : 22/8/2011

*****
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 बैंकर स्नातक (Bachelor of Science)" shall be substituted as "Degree of बैंकर पार्श्व (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 (B) and new para (ii) shall be added as follows.

 manten 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 4.49, 6.99, and 4.49 against Sr. Nos. 3, 4 & 5 in Column No. 2 (CGPA) be substituted by the figures 5.50, 6.00, and 5.50 respectively.

(b) Following sub-para be added before the para Declaration of Merit List:

"Declaration of Merit List :- Merit list of M.Sc. (C.B.C.S.) examination shall be prepared from the examinee who have successively cleared minimum total credits including GIC as shown in the table assigned in the first attempt.

ii) Special Explanatory note shown under Appendix-D, H, I, L and P shall be deleted.

The note No.(2) printed under Appendix-A, B, C, D, E, F & H shall be substituted as follows-

"If the student has not scored minimum marks or minimum grade points mentioned in column No. 8 and if the student scores minimum marks or minimum grade points in either theory or internal assessment then he/she will be declared to have cleared either of the head"

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

Whereas, Ordinance No.4/2008 in respect of Examinations leading to the Degree of विज्ञान पारंपर (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 पारंपर (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 पारंपर (Master of Science) (Four Semester Degree Course) Direction 2014.”

2) This Direction shall come into force w.e.f. the date of its issuance.
3) In Direction No. 14 of 2009 in respect of Examinations leading to the Degree of B.S. (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. (Mathematics) Semester-I to IV
(Implemented from the Academic Session 2015-16 for Sem-I & II and 2016-17 for Sem-III & IV)

M. Sc. Part-I Semester-I:
Compulsory Papers

Paper-I (101) Real Analysis
Paper-II (102) Advanced Abstract Algebra
Paper-III (103) Complex Analysis
Paper-IV (104) Topology-I

Optional Papers: Choose Any One.

Paper-V (105) Differential Geometry
Paper-V (106) Advanced Discrete Mathematics-I

M. Sc. Part-I Semester-II:

Compulsory Papers

Paper-VI (201) Measure and Integration Theory
Paper-VII (202) Advanced Linear Algebra and Field Theory
Paper-VIII (203) Integral Equation
Paper-IX (204) Topology-II

Optional Papers: Choose Any One.

Paper-X (205) Riemannian Geometry
Paper-X (206) Advanced Discrete Mathematics-II

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

Paper-I (101): REAL ANALYSIS

Unit-I : Definition and existence of Riemann Stieltjes integral, properties of the integral, Integration and differentation. The fundamental theorem of calculus, integral of vector valued function, rectifiable curves.

Unit-II : Sequences and uniform convergence, Cauchy criterion for uniform convergence, Weierstrass M-test, Abel's and Dirichlet's tests for uniform convergence, uniform convergence and continuity, uniform convergence and integration, uniform and differentiation, Weierstrass approximation theorem.

References:

(5) Jain P.K. and Gupta V.P., Lebesque Measure and Integration, New Age international (P.) Ltd., Published, New Delhi, 1986, (Reprint 2000)
Paper-II (102) : ADVANCED ABSTRACT ALGEBRA

Unit I : Normal Subgroups and quotient groups, Isomorphism theorems, Automorphisms, Conjugacy and G-sets, Normal series, Solvable groups, Nilpotent groups.

Unit II : Permutation groups, cyclic decomposition, Alternating group $A_n$, Simplicity of $A_n$, structure theorems of groups, Direct products, Finitely generated abelian groups, invariants of a finite abelian group, Sylow theorems, Groups of order $p^2$, $pq$.

Unit III : Ideals, Homomorphism, Sum and direct sum of ideals, Maximal and prime ideals, Nilpotent and Nil ideals, Zorn's lemma.

Unit IV : Unique factorization domain, Principle ideal domain, Euclidean domain, Polynomial rings over UFD.

Unit V : Modules- Definition and examples, Sub modules and direct sums, R-homomorphism and quotient modules, completely reducible modules, free modules.

Reference:
17) A.R. Vashishta, Modern Algebra, Krishna Prakashan Media (P) Ltd.
21) Basic Abstract Algebra, P.B.Bhattacharya, S.K.Jani, S.R Nagpaul

Paper-III (103) : COMPLEX ANALYSIS

Unit-I : Complex Integration : Power Series representation of analytic functions, Cauchy's integral formula, higher order derivatives, Cauchy's inequality, Zeros of Analytic function, Liouville's theorem, Fundamental theorem of algebra.

Unit-II : Taylor's theorem, Maximum Modulus theorem, Morera's theorem, Counting of zeros, open Mapping theorem, Cauchy-Goursat theorem, Schwarz's lemma.

Unit-III : Singularities, Isolated singularities, classification of isolated singularities, Laurent's series development, Cauchy-Wienerstrass theorem, Argument principle, Rouches theorem.
Unit-IV : Residue, Cauchy's residue theorem, Evaluation of integration by using residue theorem, Branches of many valued function (Specially arg z, log z, z), Hadamard's three circle theorem, Spaces of continuous functions, spaces of analytic functions, Hurwitz theorem

Unit-V : Analytic continuation, uniqueness of direct analytic continuation, uniqueness of analytic continuation along a curve, power series method of analytic continuation, Schwartz reflection theorem, Weierstrass factorization principle.

Reference:
4) J. N. Sharma, Complex Variables, Pragati Publication.
5) A. R. Vashistha, Complex Variables, Krishna Publication.

Paper-IV (104) : TOPOLOGY – I

Unit-I : Cardinal and Ordinal Numbers : Equipolent sets, cardinalnumbers, order types, ordinal numbers, Axiom of choice.

Unit-II : Topological Spaces : Definition and examples of topologicals spaces. Open sets and Limit points. Closed sets and closure, operators and neighbourhoods. Bases and Relative Topologies.


Unit-V : Separation and Countability Axioms (Contd.) : Regular and normal spaces, Completely regular spaces.

References :
Paper-V (105) : DIFFERENTIAL GEOMETRY (OPTIONAL)

Unit-I : Local Intrinsic properties of a surface, Definition of surface, curves on a surface, surfaces of Revolution, Helicoids, Metric, Direction Coefficients.

Unit-II : Families of curves, Isometric correspondence, Intrinsic properties, Geodesics, Canonical Geodesic Equation, Normal Properties, Geodesic Existence theorems, Geodesic parallels.

Unit-III : Geodesic curvature, Gauss-Bonnet Theorem, Gaussian Curvature, Surface of constant curvature, conformal mapping, Geodesic mapping.


Unit-V : Differential manifolds, Tangent vectors, Affine Tensors and Tensorial forms, Connexions, covariant differentiation, Absolute derivation of Tensorial forms, Tensor connexions.

References :
(1) W.Klingenberg (Springer), A course in Differential Geometry
(2) For a comprehensive introduction to tensor calculus, refer to tensor calculus textbooks.
(3) T.M. Karade, G.S. Khadekar, Maya S. Bendre, Lectures on General relativity, Sonu-Nilu publication.
(4) "An Introduction to Differential Geometry" by T.J.Wilmore, Oxford University Press (1959)

Paper-V (106) : ADVANCED DISCRETE MATHEMATICS-I (OPTIONAL)


Unit-II : Semigroups and Monoids : Definitions and examples of semigroups and monoids (including those pertaining to concatenation operation). Homomorphism of semigroups and monoids. Congruence relation and Quotient semigroups. Subsemigroups and submonoids. Direct products. Basic Homomorphism theorem.

Unit-III : Lattice Theory : Lattices are partial ordered sets. Their properties. Lattices as algebraic systems. Sublattices. Direct products and Homomorphisms. Some special lattices, e.g. complete, complemented and distributive lattices.


References :
M.Sc. – I SEMESTER-II

Paper-VI (201) : MEASURE AND INTEGRATION THEORY

Unit-I : Lebesgue outer measure, measurable sets, Regularity, Measurable functions, Borel and Lesbesgue measurability.

Unit-II : Integration of Non-negative function, the general integral, integration of series, Riemann and Lesbesgue integrals.

Unit-III : The Four derivatives, continuous non-differentiable functions, functions of bounded variation, Lebesgue differentiation theorem, differentiation and integration.

Unit-IV : Measures and outer measures, Extension of a measure


References:
(2) G.de Barra, Measure Theory and Integration, Wiley Eastern Limited, 1981.
(3) Halmos P.R., Measure Theory, Van Nostrand Princeton, 1950.

Paper-VII (202) : ADVANCED LINEAR ALGEBRA AND FIELD THEORY

Unit-I : Canonical forms: Eigen values and eigenvectors. The minimal polynomial, Diagonalizable and triangular operators, The Jordan form, The rational form.

Unit-II : Quadratic forms, Linear transformation, Congruence of matrices, Reduction of real quadratic form, Canonical or Normal form of a real quadratic form, Signature and index of a real quadratic form, Sylvester’s law of inertia, Definite and semi-definite real quadratic Forms, Hermitian forms.


Unit-IV : Normal and separable extension: Splitting fields, Normal extension, multiple roots, finite fields, Separable extension.

Unit-V : Galois theory and Applications: automorphism groups and fixed fields, Fundamental theorem of Galois theory, Fundamental theorem of algebra, Roots of unity and cyclotomic polynomials, Cyclic extension, Polynomials solvable by radicals, Symmetric functions, Ruler and compass constructions.

Reference:
Paper-VIII (203) : INTEGRAL EQUATIONS

Unit I : Definition of integral equations, Types of integral equations: Fredholm integral equations of the first and second kind, homogeneous Fredholm integral equations of the second kind, Volterra integral equations of first and second kind, Homogeneous Volterra integral equations of the second kind, special kinds of kernels, symmetric kernels, separable and degenerate kernels, Leibnitz rule, solution of integral equations, solved examples, Method of converting an initial value problem into integral equations, solved examples, method of converting a boundary value problems into a Fredholm integral equations. Solved examples.

Unit II : Eigen values and Eigen functions: (a) Solution of homogeneous Fredholm integral equations of the second kind with separable kernels, solved examples based on (a). (b) Solution of Fredholm integral equation of the second kind with separable kernels, Solved examples based on (b).

Unit III : Definition of iterated kernels or functions, definition of resolvent kernels or reciprocal kernel, solution of Fredholm integral equation of the second kind by successive substitutions, solution of Volterra integral equation of the second kind by successive substitutions, Neumann series, some important theorems, determination of iterated kernels, determination of resolvent kernels for Fredholm integral equations, solution of Fredholm integral equation with the help of resolvent kernels, solution of Fredholm integral equations by method of successive approximation to find solutions up to third order. Solve examples.

Unit IV : Solution of Volterra integral equations of second kind, determination of resolvent kernels for Volterra integral equations, solution of Volterra integral equations with the help of the resolvent kernels, solved examples, Neumann series, Method of successive approximation for solving Volterra integral equations of second kind, Volterra integral equations of first kind, solution of Volterra integral equations of the first kind, solved examples, some fundamental properties of Eigen values and Eigen functions for symmetric kernels.

Unit V : Applications of integral equations and Green's function to ordinary differential equations, definition of Green's functions, Important theorems, constructions of Green's functions, solved examples, solution of boundary value problems using Green's functions, solved examples, solution of boundary value problems using Green's functions, solved examples, the case of homogeneous and conditions of boundary value problems.

Reference books:
1) Integral equations by Shanti Swaroop, Shiv Raj Singh
2) Linear integral equation, Theory and techniques, Academic press, New York 1971
8) Integral equations and boundary value problems by M. D. Raisinghania, S. Chand publication

Paper-IX (204) : TOPOLOGY – II

Unit-I : Metric Spaces : Metric Spaces as topological spaces. Topological properties. Hilbert (e2) space. Frechet space. Space of continuous functions.

Unit-II : Complete Metric Spaces : Cauchy sequences, completions, Equivalent conditions, Baire Theorem.


Unit-V: Metrization and Paracompactness: Urysohn's metrization theorem, paracompact spaces, Nagata-Smirnov metrization theorem.

Reference Books:
(1) S.R. Munkres, Topology: A First Course, Publisher: Prentice Hall of India.
(2) K.D. Joshi Introduction to General Topology, Publishers: Wiley Eastern Ltd.

Paper-X (205): RIEMANNIAN GEOMETRY (OPTIONAL)

Unit-I: Riemannian metric, metric tensor, Christoffel symbol, Christoffel symbol of first kind, second kind, properties of Christoffel symbols. Computations of Christoffel symbols for static and non-static spherically symmetric and R-W space-times, transformation of Christoffel symbols, derivatives of tensor, absolute derivative. Covariant derivatives, divergence, gradient, Laplacian.

Unit-II: Parallel Vector Fields: Parallel vector field of constant magnitude, parallel displacement of covariant vector field, parallelism of a vector field of variable magnitude. Geodesic: Differential equations of a geodesic, special co-ordinate system, Local cartesians, Riemannian co-ordinates, Normal co-ordinates, Geodesic normal co-ordinates.

Unit-III: Curvature Tensor: Covariant curvature tensor of Riemann tensor, curvature tensor in Riemannian co-ordinates, properties of curvature tensors, on a cyclic property, number of independent components of R.

Unit-IV: Ricci tensor, curvature invariant, Einstein tensor, Computations of Einstein tensor for static and non-static spherically symmetric and R-W space times, the Bianchi identity. Geodesic deviation: Equations of Geodesic deviation.

Reference Books:
(1) T. M. Karade, G. S. Khadekar and Maya S. Bendre, Lectures on General Relativity Sonu Nilu Publication.
(2) T. J. Willmore, An Introduction to Differential Geometry
(3) J. L. Synge, Tensor Calculus in Schild.
(5) L.P. Eisenhardt, Riemannian geometry, University press Princeton (1926)
(6) J.A. Schouten, Ricci Calculus, Springer Verlag, Berlin
(7) T.Y. Thomas, Concepts from tensor analysis and differential geometry, Academic press, New York
(8) W. Boothby, Introduction to differentiable manifold and Riemannian geometry, Academic press, 1975

Paper-X (206): ADVANCED DISCRETE MATHEMATICS-II (OPTIONAL)

Unit-I: Graph Theory: Definition of (undirected) graphs, paths, circuits, cycles and subgraphs. Induced subgraphs. Degree of a vertex. Connectivity planar graphs and their properties. Trees, Euler formula for connected planar graphs. Complete and complete bipartite graphs. Kuratowski's theorem (statement only) and its use.


of its power to that of deterministic finite automata. Moore and Mealy machines.

**Unit-IV:** Grammars and Languages: Phrase structure grammars. Rewriting rules, Derivations, sentential forms. Language generated by a grammar. Regular, context free and context sensitive grammars and languages. Regular sets, regular expressions and the pumping lemma. Kleene's theorem.

**Unit-V:** Turing machine and partial recursive functions. Notions of syntax analysis, polish notations. Conversion of infix expressions to polish notations. The reverse polish

**References:**

1. N. Deo, *Graph Theory with Applications to Engineering and Computer Sciences*, Prentice Hall of India.
6. K.R. Parthasarthy, *Basic Graph Theory* (TMH)

**M.Sc. Part-II**
**MATHEMATICS**
**SEMESTER-III & IV**

**Semester III: Compulsory Papers**
- Paper-XI (301): Functional Analysis-I
- Paper-XII (302): Advanced Mechanics
- Paper-XIII (303): Operations Research

**Optional Papers: Choose Any Two from the following.**
- Paper-XIV (305): General Relativity
- Paper-XV (306): Difference Equations-I
- Paper-XVI (308): Banach Algebras-I

**M. Sc. Part-II Semester-IV: Compulsory Papers**
- Paper-XVII (401): Functional Analysis-II
- Paper-XVIII (403): Numerical Analysis

**Optional Papers: Choose Any Two from the following.**
- Paper-XIX (405): Fluid Dynamics-II
- Paper-XX (406): Difference Equations-II
- Paper-XXI (407): Lie Groups
- Paper-XXII (408): Banach Algebras-II

**SEMESTER-III**

**Paper-XI (301): FUNCTIONAL ANALYSIS-I**

**Unit-I:** Normal linear spaces, Banach spaces and examples. Quotient spaces of normed linear spaces and its completeness, equivalent norms, Riesz lemma.

**Unit-II:** Basic Properties of finite dimensional normed linear spaces and compactness. Weak convergence and bounded linear transformations, normed linear spaces of bounded linear transformations, Dual spaces with example.

**Unit-III:** Boundedness theorem and some of its consequences, Open mapping, Hahn Banach theorem for real linear spaces, complex linear spaces and normed linear spaces.

**Unit-IV:** Reflexive Spaces, Weak sequential compactness, compact operators, solvability of linear equations in Banach spaces, the closed graph theorem.

**Unit-V:** Inner product spaces, Hilbert spaces, orthogonal sets, Bessel inequality, complete orthogonal sets, Parseval identity, structure of Hilbert spaces.

**References:**

Paper-XII (302): ADVANCED MECHANICS


Unit-II: Generalised coordinates, Holonomic & Non-holonomic systems, Scleronomic and Rheonomic systems, Generalized potential, Lagrange's Equations of first kind and second kind, uniqueness of solution, Energy equations for conservative fields.

Unit-III: Legendre transformations and the Hamilton equations of motion, cyclic coordinates and conservation theorems, Routh's equations. Derivation of Hamilton's equations from a variational principle, the principle of least action.

Unit-IV: Canonical transformations: The equations of Canonical transformation, examples of canonical transformations. Poisson bracket & other canonical invariants (Lagrange Bracket), Poisson identity

Unit-V: The Hamilton-Jacobi Equation for Hamilton's principle function, The harmonic Oscillator problem as an example of the Hamilton-Jacobi method. The Hamilton-Jacobi Equation for Hamilton's characteristic function, Separation of variables in the Hamilton-Jacobi equation.

References:
1. A.S.Ramsey Dynamics Part-II, the English Language Book Society and Cambridge University Press.
2. Gupta, Kumar and Sharma, Classical Mechanics
3. T.M. Karade, G.S. Khadekar, Lectures on Advanced Mechanics, Sonu-Nilu publication
7. L.M. Katkar, Classical Mechanics (Mathematics), Shivaji University Kolhapur, 2007

Paper-XIII (303): OPERATIONS RESEARCH

Unit-I: Operation Research & its scope, linear programming, Mathematical formulation, Graphical solution, General linear programming (LP), Simplex method, Use of Artificial variable, (Big-M method), Duality in LP, Economic Interpretation, dual simplex method.

Unit-II: Integer Programming, Branch and Bound technique, Fractional cut plane method, Goal programming, Advanced techniques in LP (upper bound technique)

Unit-III: Parametric linear programming, Transportation problem and assignment problems.

Unit-IV: Queing system, basic properties of queuing system, Element of Queing system, Poisson and Non-Poisson Queing system.

Unit-V: Game and strategies, two person, zero sum games, the maximum-minimum principle, games without saddle point, mixed strategies, graphics solution of 2 x n and m x 2 games, dominance properties, general solution of m x n rectangular games.

Reference:
2) G Hadley, Nonlinear and Dynamic Programming, Addison-Wesley, Reading Mass.
Paper-XIV & Paper-XV : Choose Any Two from the Following.

(304) : FLUID DYNAMICS-I (OPTIONAL)

Unit-I : Kinematics of fluid in Motion : Real fluids and ideal fluids. Velocity of a fluid at a point stream lines and path lines. Steady and unsteady flows. Velocity potential, vorticity vector, local and particles rates of change. Equation of continuity, worked examples. Acceleration of a fluid. Conditions at a rigid boundary, general analysis of fluid motion.

Unit-II : Pressure of motion of a fluid : Pressure at a point in a fluid at rest. Pressure at a point in a moving fluid, conditions at a boundary of two inviscid immiscible fluids, Euler’s Equation of motion. Bernoulli’s equation, worked examples. Discussion of the case of steady motion under conservative body forces, some potential theorem, some special two dimensional flow. Some further aspects of vortex motion.

Unit-III : Sources, sinks and Doublets, images in a rigid infinite plane. Images in a solid spheres. Asci-symmetric flow, Stokes stream function. Some two dimensional flows, meaning of two dimensional flow, use of cylindrical polar coordinate, the stream function, the complex potential for two dimensional, irrotational incompressible flow. Complex velocity potentials for standard two-dimensional flows, uniform stream, line source and link sinks, link system.

Unit-IV : The Milne-Thomson circle theorem, some application of the circle theorem, extension of the circle theorem, the theorem of W a sins, the use of conformal transformation. Vortex rows, single infinite row of line vortices. The Karnar vortex street.

Unit-V : Elements of Thermodynamics : The equation of state of substance, the first law of Thermodynamics, internal energy of a gas. Specific heat of a gas. Function of state, Entropy, Maxwell’s Thermodynamics relation. Iso-thermal Adiabatic and Isentropic Process.

References:


(305) : GENERAL RELATIVITY (OPTIONAL)

Unit-I : Einstein’s relativity: SR to GR, Principle of equivalence, Principle of covariance and Mach’s Principles, Einstein’s field equations, Derivation of Einstein’s field equations from action principle, Newtonian approximation: Relation between and V, Einstein equations compared with Poisson equation.

Unit-II : Schwarzschild exterior solution and its isotropic form, Birkhoff’s theorem, planetary orbits, General relativistic Kepler problem, Advance of Perihelion of a planet, Bending of light ray in a gravitational field, gravitational red shift in spectral lines

Unit-III : Schwarzschild interior solutions, field of charged mass point the boundary conditions, covariant conservation law, the tetroid representation of Einstein equations, Eddington’s form of Schwarzschild solution.

Unit-IV : Gravitational collapse of spherical body, black hole, gravitational collapse of a dust like sphere, Kerr metric, gravitational collapse of a non spherical and rotating body.

Unit-V : Gravitational waves, weak gravitational waves, gravitational waves in curved space time, strong gravitational waves, radiation of gravitational waves.

References:


(306) : DIFFERENCE EQUATIONS-I (OPTIONAL)

Unit-I : Introduction : Difference calculus. The difference operator. Generating function and approximate summation.


Unit-III : The Z-transform : Properties, initial and final value theorems, partial sum theorem, convolution theorem. Inverse Ztransforms, solution of difference equation with constant coefficients by Z-transforms.


Reference Books :

(307) : ADVANCED COMPLEX ANALYSIS (OPTIONAL)


Unit-IV : Canonical Products, Jensenâ€™ formula, Poisson-Jensenâ€™ formula, The genus and order of an entire function, exponent of convergence, Hadamardâ€™ factorization Theorem.

Unit-V : The range of an Analytic function, Bloch theorem, Little Picardâ€™ theorem, Schottkyâ€™ theorem, univalent function, Bieberbachâ€™ conjecture theorem, Cobeâ€™/4".

References:
4) J. N. Sharma, Complex Variables, Pragati Publication.
5) A. R. Vasistha, Complex Variables, Krishna Publication.
15) E. Hille, Analytic Function Theory (2 Vols), Ginn & Co. 1959.
23) Dennis G. Zill, Patrick D. Shanhan Jones and Burtlett, A First Course in Complex Analysis with application (Second edition) Publisher (2010).
24) John Mathew and Howell, Complex Analysis for Mathematician and Engineers.

(308) : BANACH ALGEBRAS-I (OPTIONAL)

Unit-I : Definition of Banach Algebra and Examples. Singular and non-singular elements. The abstract index. The spectrum of an element.


Unit-IV : C*-algebras : Definition and examples, self-adjoint, unitary, normal, positive and projection elements in C*-algebras.


References:


SYLLABUS PRESCRIBED FOR M.Sc. II SEMESTER-IV
Paper-XVI (401) : FUNCTIONAL ANALYSIS-II

Unit-I : Riesz Representation theorem, adjoint of an operator on a Hilbert space, Reflexivity of Hilbert spaces, self adjoint operators, normal and unitary operators.

Unit-II : Spectral properties of bounded linear operators, basic concepts, further properties of solvent and spectrum, use of complex analysis in spectral theory.

Unit-III : Compact linear operators on normed spaces, further properties of compact linear operators, spectral properties of compact linear operators on normed spaces.

Unit-IV : Spectral properties of bounded self-adjoint linear operators, further spectral properties of bounded self-adjoint linear operators.

Unit-V : Positive operator, square root of positive operator, projection operators, spectral family.

References:
Paper-XVII (402) : PARTIAL DIFFERENTIAL EQUATIONS

Unit I: Curves and Surfaces, Genesis of first order P.D.E., Classification of integrals, Linear Equations of the first order, Pfaffian differential Equations, Compatible systems, Charpit's Method, Jacobi's Method, Integral Surfaces through a given curve.

Unit II: Quasi-Linear equations, Non-linear first order P.D.E., genesis of second order P.D.E., Classification of second order P.D.E.

Unit III: One dimensional Wave equation, Vibrations of an infinite string, Vibrations of a Semi-infinite string, Riemann's Method, Vibrations of a string of finite length.


References:


References:


Paper-XVIII (403) : NUMERICAL ANALYSIS


Unit II: Finite Differences: Forward and backward differences, Newton's formulae Interpolation, Central difference interpolation formulae, Stirling's formula, Bessel's formula, Lagrange's interpolation formula, Error in Lagrange's interpolation formula. Hermite interpolation, Divided differences and their properties, Spline interpolation.


References:


Paper-XIX & Paper-XX : Choose Any Two from the Following.

(404) : FLUID DYNAMICS-II

Unit-I : Gas Dynamics : Compressibility effects in real fluids, the elements of wave motion, one dimensional wave equation, wave equation in two and in three dimensions, spherical waves, progressive and stationary waves, the speed of sound in gas equation of motion of a gas, subsonic, sonic and supersonic flows, isentropic gas flow, Reservoir discharge through a channel of varying section. Investigation of maximum mass flow through a nozzle. Shockwaves, formation of shockwaves, elementary analysis of normal shock waves.

Unit-II : Viscous Flow : Stress components in a real fluid, relation between cartesian components of stress, translation motion of fluid element, the rate of strain quadric and principal stresses. Some further properties of the rate of strain quadric and principal stresses, stress analysis in fluid motion, relation between stress and rate of strain, the coefficient of viscosity and laminar flow.

Unit-III : The Navier stokes equations of motion of a viscous fluid, some solvable problem in viscous flow, steady motion between parallel planes, steady flow through tube of uniform circular cross section, steady flow between co-centric rotating cylinders, diffusion of vorticity energy dissipation due to viscosity steady flow past a fixed sphere.

Unit-IV : Magnetohydrodynamics : Nature of Magnetohydrodynamics, Maxwell's electromagnetic field equation, medium at rest, medium in motion, the equation of motion of a conducting fluid rate of flow of charge, simplification of the electromagnetic field equations, the magnetic Reynolds number, Alfvens theorem, the magnetic body force, Ferraro's laws of isorotation.

Unit-V : Dynamical similarity, Buckingham p-theorem, Reynolds number, Prandtl's boundary layer, Boundary layer equations in two dimensions, Blasing solutions, boundary layer thickness, displacement thickness, Karmar integral conditions, seperation of boundary layer flow.

References:
6) F. Chorlton, Text Book of Fluid Dynamics, CBS Publishers, Delhi

(405) : RELATIVISTIC COSMOLOGY (OPTIONAL)

Unit-I : Einstein Field Equations with Cosmological term, static cosmological models of Einstein and De-sitter, their derivations, properties and comparison with the actual Universe.

Unit-II : Cosmological principle, Hubble's law, Weyls Postulate, Steady State Cosmological models, Derivation of Roberson-Walker Metric, Further Properties.
Unit-III : Motion of particles and light rays in R-W model: Material particles, Radial motion of a particle, General motion, light rays. The red shift in R-W model, Hubbleâ€” and Deceleration parameters.

Unit-IV : Fundamental equation of dynamical cosmology: Density and pressure of present universe, the matter dominated era of the present universe, Friedman models: closed model, Flat model, Open model.

Unit-V : Gravitational lensing, weak gravitational waves, gravitational waves in curved space time, strong gravitational waves, radiation of gravitational waves

References:
1) Introduction to General Relativity - Ronald Adler, Maurice Bazin, Menahem, Schiffer.

(406) : DIFFERENCE EQUATIONS-II (OPTIONAL)


References:

(407) : LIE GROUPS (OPTIONAL)


Unit-I : Topological Groups. The family of nuclei of a topological group. Subgroups and homomorphic images. Connected topological groups.

Unit-II : Local Groups : Lie groups. Local lie groups. Analytic subgroups of a lie group. One dimensional lie groups.

Unit-III : The Commutator of two infinitesimal transformations. The algebra of infinitesimal right translations. Lie groups of transformations.

Unit-IV : The lie algebra of sub-group. One parameter subgroup. Taylor â€”s theorem for Lie groups. The Exponential mapping.


References:
(3) Lie Groups and Compact Groups by John F. Price (Cambridge University Press)
(4) Theory of Lie Groups by Claude Cherallay (Princeton University Press)

(408) **BANACH ALGEBRAS-II (OPTIONAL)**


Unit-III: The Commutant. The double commutant theorem. The Kaplansky Density theorem. L as V on Newmann Algebra, Maximal Abelian Algebras.


**Reference Books:**
(3) M.A. Naimark, Normed Algebras, Noordhoff, Groningen, Netherlands, 1972..

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