

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

Prospectus No. 2017129

संत गाडगे बाबा अमरावती विद्यापीठ

SANT GADGE BABA AMRAVATI UNIVERSITY

विज्ञान विद्याशाखा
(FACULTY OF SCIENCE)

अभ्यासक्रमिका
विज्ञान पारंगत सत्र-१ ते ४
(गणित)

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



2016

(Visit us at www.sgbau.ac.in)

Price Rs...../-

PUBLISHED BY
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Amravati University
Amravati-444602

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

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

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

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

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

PATTERN OF QUESTION PAPER ON THE UNIT SYSTEM.

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

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

%ORDINANCE NO. 4 of 2008

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

- Notes:-**(1) Minimum pass marks for theory and practical examination including internal assessment shall be 36% separately.
- (2) (a) Topic of project work shall be given by concerned supervisor with prior approval of Head of Department.
There shall be no duplication of the topic of the project work. Project shall be based on research in the laboratory and / or field work. Project work shall be allotted at the beginning of third semester and the student shall have to submit it atleast 15 days before commencement of practical examination of the fourth semester. Project work will be evaluated by external and internal examiners.
- (b) There should be atleast 2 to 3 external examiner for a batch of 10 students or 3 to 5 external examiner for a batch more than 10 students.
- (3) There shall be separate exemption in theory and / or practical on getting minimum pass marks.
- (4) Internal Assessment marks for all semesters shall be granted on the basis of - performance of students in any of the following activities:-
(i) Study tour, (ii) Seminar, (iii) field visits, (iv) Industrial visits, (v) visit to research institute / organisation.
(vi) Assignments, (vii) Unit test and any other co-curricular activities.
- (5) The concerned Department or College shall have to maintain the record of award of internal assessment marks.

DIRECTION

No. : 14 / 2009

Date : 29.6.2009

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

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

AND

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

AND

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

AND

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

AND

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

AND

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

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

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

Amravati
Date : 29/6/2009

Sd/
(Dr.Kamal Singh)
Vice-Chancellor

DIRECTION

No. : 26 / 2010

Date : 24/06/2010

Subject : Scheme for Choice Based Credit System (CBCS) and Awarding Grades to the Post Graduate Students in the Faculty of Science, Direction, 2010.

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

AND

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

AND

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

AND

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

AND

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

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 student having attendance less than 75% may apply to the H.O.D. for condonation of attendance upto 15% under the provision of para 6-A (i) of Ordinance No.6.

IV. Registration for General Interest Course :-

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

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

V. Programme Committee :-

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

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

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

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

VI. Departmental Committee

1. Every P.G. programme of the University/College shall be monitored by a committee constituted for this purpose by the Department.

The Committee shall consist of H.O.D. as a Chairman and all the teachers of the Deptt. of its members including one student members per class. There shall be atleast one student member on the committee.

VII. Grievances Redressal Committee

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

VIII. Total credits per semester :-**Table-I**

**For all subjects other than Mathematics,
Biotechnology & Computer Science**

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

**Table-II
For Mathematics**

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

**Table-III
For Biotechnology**

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

**Table-IV
For Computer Science**

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

IX. Grade Awards :-

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

TABLE –I

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

TABLE-II: Final Grade Points for SGPA and CGPA

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

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

Table III. Equivalence of Class/Division to CGPA

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

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

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

X. Computation of SGPA & CGPA

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

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

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

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

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

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

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

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

XI. Internal Evaluation Method :-

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

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

XII. Grade Card

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

The grade card shall list:

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

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

XIV. Power to modify and remove difficulties :-

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

sd/-

Amravati
Date : 2/6/2010

(Dr.Kamal Singh)
Vice-Chancellor

Appendix-A

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

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

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

Total Marks : 600; Minimum Total Credits : 26

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

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

M.Sc. Part-I

Semester-II

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

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

Total Marks : 600; Minimum Total Credits : 26

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

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

M.Sc. Part-II

Semester-III

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

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

Total Marks : 600; Minimum Total Credits : 26

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

Appendix-D

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

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

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

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

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 of total marks of theory and internal assessment taken together then he/she will be declared to have clear with (04+01) 05 credits.
- (2) If the student has score Minimum Marks or Minimum Grade Points in either theory or in 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**

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

Total Marks : 500; Total Credits : 25

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

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

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

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

Total Marks : 500; Total Credits : 25

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

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

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

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

Total Marks : 500; Min.Total Credits : 25

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

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

M.Sc. Part-I

Semester-IV

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

Total Marks : 500; Min.Total Credits : 25

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

Appendix-I

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

M.Sc. (Biotechnology) SEMESTER PATTERN

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

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

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

Total Credits: 40

Appendix-J

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

M.Sc. (Biotechnology) SEMESTER PATTERN

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

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

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

Total Credits: 40

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

M.Sc. (Biotechnology) SEMESTER PATTERN

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

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

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

Total Credits: 35

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

M.Sc. (Biotechnology) SEMESTER PATTERN

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

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

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

Total Credits: 35

Appendix-M

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

M.Sc. (Computer) SEMESTER PATTERN

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

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

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

Total Credits: 40

Appendix-N

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

M.Sc. (Computer) SEMESTER PATTERN

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

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

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

Total Credits: 40

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

M.Sc. (Computer) SEMESTER PATTERN

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

Appendix-O

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

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

Total Credits: 35

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

M.Sc. (Computer) SEMESTER PATTERN

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

Appendix-P

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

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

Total Credits: 35

Appendix-Q

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

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

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

DIRECTION

No. : 27 / 2010

Date : 24.6.2010

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

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

AND

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

AND

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

AND

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

AND

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

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

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

- (a) for admission to M.Sc. Pharmaceutical Chemistry a candidate shall have offered Chemistry or Industrial Chemistry or Biochemistry as a subject of study and examination at the B.Sc. Degree.
- (b) following shall be the eligibility for admission to M.Sc. Semester-I (Biotechnology) -
 - (i) B.Sc. in any discipline of Life Sciences, Bio Sciences or Bachelor's Degree in Agriculture, Veterinary and fishery Sciences, Pharmacy, or Bachelor of Medicine and Bachelor of Surgery (M.B.B.S.) or Bachelor of Dental Surgery or equivalent examination recognized by Sant Gadge Baba Amravati University are eligible to appear in entrance test as given in para (iii) below.
 - (ii) The student should have minimum 50% marks as aggregate in the degree course.
 - (iii) The student will have to pass entrance examination for admission in M.Sc. Semester-I (Biotechnology) as per the Sant Gadge Baba Amravati University rules.
- (c) following shall be the eligibility for admission to M.Sc. Semester-I (Computer Science) -
 - i. A person who has passed the Degree of Bachelor of Science of this university with Computer Science / Computer Application (Vocational) as on the subjects.
OR
 - ii. A person who has passed B.A. / B.Sc. with Mathematics plus Post Graduate Diploma in Computer Science of this University.
OR
 - iii. A person who has passed a Degree of Bachelor of Computer Science.
6. The following subject be inserted in para 9) of the Ordinance after Sr.No. 15. Bioinformatics.
 16. Computer Software,
 17. Computer Science
 18. Biotechnology, and
 19. Pharmaceutical Chemistry.
7. A person who desire to improve the division obtained by him/her at M.Sc. examination shall be eligible for improvement of division under the provision of Ordinance No.6 of 2008. However, for improvement of division he/she shall have to offer the core courses only. In no case he/she shall be allowed for improvement of division/grade/CGPA by offering General Interest Course.

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

Amravati
Date : 21/6/2010

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

DIRECTION

No. :39/ 2011

Date :23.8.2011

Subject : Corrigendum to Direction No. 26/2010

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

AND

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

AND

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

AND

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

AND

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

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

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

- i) In para II, sub para (i) of para 3 in the fifth line after the words "less than" the figure, sign, and words "72 (52 core and elective)" be substituted by the figures, sign, and words "88(64 core and elective)"
- ii) In para VI: the title "Departmental Committee" be replaced as "Programme Monitoring" and Para 1 be completely deleted. Instead of this, the new para should be "Every P.G. programme of the University/College shall be monitored by the Head of the Department of the University/College of the concerned subject."
- iii) The para VII shall be substituted as given below -
"VII. Grievance Redressal
All the grievances regarding Internal Assessment shall be settled by H.O.D. or the teacher of the department nominated by H.O.D. / Principal."
- iv) In para IX : Table I: the grades in column No.2 shall be substituted as under -

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

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

Amravati
Date : 22/8/2011

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

DIRECTION

No. : 25 / 2012

Date : 29/6/2012

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

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

AND

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

AND

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

AND

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

AND

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

AND

Whereas, it is necessary for carryout the corrections in the above said Direction immediately.

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

1. This Direction may be called "Corrigendum to Direction No.26/2010 and 39/2011".
2. This direction shall come into force from the date of its issuance.

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

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

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

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

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

- (a) the figures shown 7.49, 5.99 and 5.49 against Sr.Nos.3, 4 & 5 in Column No.2 (CGPA) be substituted by the figures 7.50, 6.00 and 5.50 respectively.

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

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

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

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

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

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

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

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

Amravati
Date : 28/6/2012

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

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

No. : 7 of 2014

Date: 07/05/2014

Subject : Corrigendum to Direction No.25 of 2012

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

AND

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

AND

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

AND

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

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

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

Date : 3/5/2014

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

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

No. : 8 of 2014

Date : 07/05/2014

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

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

AND

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

AND

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

AND

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

AND

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

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

- 1) This Direction may be called, "Corrigendum to Direction No. 14 of 2009 in respect of Examinations leading to the Degree of विज्ञान पारंगत (Master of Science) (Four Semester Degree Course) 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 विज्ञान पारंगत (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 differentiation. 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.

- Unit-III :** Rearrangement of terms of a series, Riemann's theorem. Power series, Uniqueness theorem for power series, Abel's limit theorem, Tauber's first theorem.
- Unit-IV :** Functions of several variables, linear transformation, derivatives in an open subset of R^n , chain Rule, partial derivatives, interchange of order of differentiation, Derivatives of higher order, Taylor's theorem.
- Unit-V :** Inverse function theorem. Implicit function theorem, Jacobians, Extremum problems with constraints, Lagrange's multiplier method, Examples on Maxima and Minima, Differentiation of integrals.

References :

- (1) Apostol T .M., Mathematical Analysis, Narosa Publishing House, New Delhi, 1985.
- (2) Eurl D. Rainville : Infinite series, The Macmillan Company, New York.
- (3) Friedman A., Foundations of Modern Analysis, Holt Rinehart and Winston, Inc, New York, 1970.
- (4) Hewitt E. and Starnberg, Real and Abstract Analysis, Berlin, Springer 1969.
- (5) Jain P. K. and Gupta V. P., Lebesgue Measure and Integration, New Age international (P) Ltd., Published, New Delhi, 1986, (Reprint 2000)
- (6) Gabriel Klambauer, Mathematical Analysis Marcel Dekker, Inc., New York, 1975.
- (7) Natanson I.P., Theory of Function of real variables, Vol.-I, Frederick Ungar Publishing Co. 1961.
- (8) Parthasarathy K.R., Introduction to Probability and Measure, Macmillan Company of India, Delhi, 1977.
- (9) Royden H.L., Real Analysis, Macmillan Pub. Co. Inc., 4th Edition, New York, 1993.
- (10) R.R. Goldberger : Real Analysis, Oxford & I.B.H. Publishing Co., New Delhi - 1970.
- (11) Serge Lang, Analysis I & II, Addison - Wesley Publishing Company Inc., 1969.
- (12) S.C. Malik and Savita Arora: Mathematical Analysis, Wiley Eastern Ltd., New Delhi.
- (13) S.C. Malik and Savita Arora : Mathematical Analysis, New Age International (P) Ltd. 2010, Fourth Edition.

- (14) Shani Narayan : A Course of Mathematical Analysis, S.Chand and Company, New Delhi.
- (15) White A.J., Real Analysis, an introduction.
- (16) Karade T .M. and Salunke J.N., Lectures on Advanced Real Analysis, Sonu Nilu Publication, 2004.34
- (17) Walter Rudin, Real & Complex Analysis, Tata McGraw Hill Publishing Co. Ltd., New Delhi
- (18) Robert ,G.Bartle,Donald R.Sherbert:Introduction to Real Analysis Wiley India Edition 2010
- (19) B.Chaudhari and D.Somasundarm: Mathematical Analysis, Narosa Publishing House, New Delhi
- (20) N.P.Bali ,Real Analysis:Golden Math Series (2011)Publish by Firewall Media
- (21) Walter Rudin; Principles of Mathematical Analysis, Mc Graw HillBooks Company, Third Edition 1976, international student edition.

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 :

- 1) I.N. Herstein, Topics in Algebra, Wiley Eastern Ltd., New Delhi, 1975.
- 2) M. Artin, Algebra, Pretice-Hall of India, 1991.
- 3) P.M. Cohn, Algebra, Vols. I, II & III, John Wiley & Sons, 1982,1989,1991.

- 4) N. Jacobson, Basic Algebra, Vols. I & II, W.H. Freeman, 1980.
- 5) S. Lang, Algebra, 3rd edition, Addison & Wesley, 1993.
- 6) I.S. Luthar and I.B.S. Passi, Algebra, Vol. I-Groups, Vol. II & Rings, Narosa Publishing House.
- 7) D.S. Malik, J.N. Mordenson, and M.K. Sen, Fundamentals of Abstract Algebra, McGraw-Hill, International Edition, 1997.
- 8) K.B. Datta, Matrix and Linear Algebra, Pretice Hall of India Pvt. Ltd., New Delhi, 2000.
- 9) S.K. Jain, A.Gunawadena and P.B. Bhattacharya, Basic Linear Algebra with MATLAB, Key College Publishing (Springer & Verlag), 2001.
- 10) S. Kumarsena, Linear Algebra, a Geometric Approach, Pretice Hall of India, 2000.
- 11) Vivek Sahai and Vikas Bist, Algebra, Narosa Publishing House, 1999.
- 12) I. Stewart, Galois Theory, 2nd Edition, Chapman and Hall, 1989.
- 13) J.P. Escofier, Galois Theory, GTM Vol.204, Springer, 2001.
- 14) T.Y. Lam, Lectures on Modules and Rings. GTM Vol.189, Springer Verlag, 1999.
- 15) D.S. Passman, A Course in Ring Theory, Wadsworth and Brooks/ Cole Advanced Books and Softwares, Pacific Groves, California, 1991.
- 16) J.A. Gallian, Contemporary Abstract Algebra, Narosa Publication.
- 17) A.R. Vashistha, Modern Algebra, Krishna Prakashan Media (P) Ltd.
- 18) V.K. Khanna and Bhambri, a Course in Abstract Algebra, Vikas Publication, House (P) Ltd. (2010).
- 19) John B. Fraleigh, a First Course in Abstract Algebra (Seventh Edition).
- 20) Abstract Algebra (Third Edition) By David S. Dummit, Richard M. Foote, Wilay India Edition.
- 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, Casorti-Wierstrass 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:

- 1) S. Ponnusamy, Foundation of Complex Analysis, Narosa Publishing House, 1967.
- 2) H. S. Kasana, Complex variables: Theory and Application, PHI Learning Pvt. Ltd., New Delhi.
- 3) Schaum's outline series Complex Analysis, Tata McGraw Hill Education Pvt. Ltd., New Delhi (2010).
- 4) J. N. Sharma, Complex Variables, Pragati Publication.
- 5) A. R. Vashistha, Complex Variables, Krishna Publication.
- 6) Murray R. Spiegel, Seymour Lipschutz, Jon J. Schiller, Dennis Spellman., Schaum's outline series Complex Analysis, Tata McGraw Hill Education Pvt. Ltd., 3rd Edition, New Delhi 2010.
- 7) Walter Rudin, Real & Complex Analysis, McGraw Hill Book Co., 1966.
- 8) J. Ward Brown, Ruel V. Churchill, Complex variables and Application, McGraw Hill International Edition (2009).
- 9) H. A. Priestly, Introduction to Complex Analysis, Clarendon Press, Oxford, 1990.
- 10) Liang-Shin Hahn & Bernhard Epstein, Classical Complex Analysis, Jones & Berlett Publishers. International London, 1996.
- 11) L. V. Ahlfors, Complex Analysis, McGraw Hill, 1979.
- 12) S. Lang, Complex Analysis, Addison Wesley, 1977.1998.
- 13) D. Sarason, Complex Function Theory, Hindustan Book, Agency, Delhi, 1994.
- 14) Mark J. Ablowitz and A. S. Fokar, Complex variables: Introduction & Application, Cambridge University Press, South Asian Edition, 56.
- 15) E. Hille, Analytic Function Theory (2 Vols), Gonn & Co. 1959.
- 16) W. H. J. Fuchs, Topics in the Theory of Function of Complex Variable, D. Van Nostrand Co., 1967.

- 17) C. Carathedory, Theory of Functions (2 Vols), Chelsea Publishing Company, 1964.
- 18) M. Heins, Complex Function Theory, Academic Press, 1968.
- 19) S. Saks & A. Zygmund, Analytic Functions, Monografie, Matematyczne, 1952.
- 20) E. C. Titchmarsh, the Theory of Functions, Oxford University Press, London.
- 21) W. A. Veech, A Second Course in Complex Analysis, W. A. Benjamin, 1967.
- 22) Complex variables and Applications, Jams Ward Brown, Ruel V. Churchill, McGraw Hill International Edition (2009).
- 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.
- 25) Functions of one complex variable - J.B.Conway , Springer Verlag International Students Edition, Narosa Publishing House, 1980.

Paper-IV (104) : TOPOLOGY –I

- Unit-I :** **Cardinal and Ordinal Numbers :** Equipotent sets, cardinal numbers, order types, ordinal numbers, Axiom of choice.
- Unit-II :** **Topological Spaces :** Definition and examples of topological spaces. Open sets and Limit points. Closed sets and closure. operators and neighbourhoods. Bases and Relative Topologies.
- Unit-III :** Connectedness, Compactness and Continuity : Connected sets and components, compact and countably compact spaces. Continuous functions. Homeomorphisms. Arcwise connectivity .
- Unit-IV :** Separation and Countability Axioms : T_0 , T_1 & T_2 spaces. T spaces and sequences. First and Second axiom spaces, separability .
- Unit-V :** Separation and Countability Axioms (Contd.) : Regular and normal spaces, Completely regular spaces.

References :

- (1) Foundations of General Topology by William J. Pervin. Publisher : Academic Press

- (2) Theory and Problems of Set Theory and Related Topics by Seymour Lipschutz Publisher: Schaum Publishing Co., New York.
- (3) J.R. Munkres, Topology : A First Course Publishers Prentice Hall of India.
- (4) K.D.Joshi, Introduction to General Topology, Publisher , Wiley Eastern Ltd.
- (5) By R.S.Aggarwal A Text Book on Topology, Publisher : S.Chand & Company .
- (6) J.N. Sharma, General and Algebraic Topology, Krishna prakashan

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-IV** : Review of tensor calculus, Vector spaces, the dual space, Tensor product of vector spaces, Transformation formulae, contraction special tensors, Inner product. Associated tensors Exterior Algebra.
- 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) Weatherburn, C. Riemannian Geometry and Tensor Calculus
- (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)
- (5) D. Somasundaram, Differential Geometry a first course, Narosa Publishing House, 2008

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

- Unit-I** : Formal Logic : Statements, symbolic representation and Tautologies. Quantifiers, Predicates and validity. Propositional logic.
- 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. Sub-semigroups 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.
- Unit-IV** : Boolean Algebras : Boolean algebra as a lattice. Various Boolean identities. The switching algebra examples. Subalgebras. Direct products and Homomorphisms. Joint irreducible elements.
- Unit-V** : Boolean Algebras (Continue) : Atoms and minterms. Boolean forms and their equivalence. Minterm Boolean forms. Sum of products. Canonical forms. Minimization of Boolean functions. Applications of Boolean algebra of switching theory .(Using AND, OR and NOT gates). The Karnaugh map method.

References :

- (1) J.P. Tremblay and R.Manohar , Discrete Mathematical Structure with Application to Computer Science, McGraw Hill Book Co. 1997.
- (2) Seymour Lipschutz, Finite Mathematics (International Edition 1983). McGraw Hill Book Company .
- (3) S . Wiitala, Discrete Mathematics - A Unified Approach, McGraw Hill Book Co.
- (4) J.L. Gersting : Mathematical Structure for Computer Science (3rd Edition), Computer Science Press, New York.
- (5) C.L.Liu, Elements of Discrete Mathematics, McGraw Hill Book Co.

M.SC. –I SEMESTER-II**Paper-VI (201) : MEASURE AND INTEGRATION THEORY**

- Unit-I** : Lebesgue outer measure, measurable sets, Regularity, Measurable functions, Borel and Lebesgue measurability.
- Unit-II** : Integration of Non-negative function, the general integral, integration of series, Riemann and Lebesgue 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,
- Unit-V** : The L^p uniqueness of Extension, completion of a measure, measure spaces, integration with respect to a measure. spaces, convex functions, Jensen's inequality. Holder and Minkowski inequality. Completeness of L^p convergence in measure. Almost Uniform convergence.

References :

- (1) Bartle R.G., The Elements of Integration, John Wiley & Sons, Inc., New York, 1966.
- (2) G. de Barra, Measure Theory and Integration. Wiley Eastern Limited, 1981.
- (3) Halmos P. R. Measure Theory, Van Nostrand Princeton, 1950.
- (4) Hawkins T. G., Lebesgue's Theory of Integration, its origins and Development, Chelsea, New York, 1979.
- (5) Inder K. Rana, An Introduction to Measure and Integration, Narosa Publishing House, Delhi, 1997.
- (6) Karade T. M., Salunke J. N., Lectures on Advanced Real Analysis, Sonu Nilu Publication, Nagpur, 2004.
- (7) Royden H. L., Real Analysis, Macmillan Pub. Co. Inc., 4th Edition, New York, 1993
- (8) P. K. Jain and V. K. Gupta, Lebesgue Measure and integration, June-2010

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 III** : Algebraic extension of fields: Irreducible polynomials and Einstein criterion, Adjunction of roots, Algebraic extension, Algebraically closed fields.
- 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:

- 1) I. N. Herstein, Topics in Algebra, Wiley Eastern Ltd., New Delhi, 1975.
- 2) M. Artin, Algebra, Prentice-Hall of India, 1991.
- 3) P. M. Cohn, Algebra, Vols. I, II & III, John Wiley & Sons, 1982, 1989, 1991.
- 4) N. Jacobson, Basic Algebra, Vols. I & II, W. H. Freeman, 1980.
- 5) S. Lang, Algebra, 3rd edition, Addison & Wesley, 1993.
- 6) I. S. Luthar and I. B. S. Passi, Algebra, Vol. I-Groups, Vol. II & Rings, Narosa Publishing House.
- 7) D. S. Malik, J. N. Mordenson, and M. K. Sen, Fundamentals of Abstract Algebra, McGraw-Hill, International Edition, 1997.
- 8) K. B. Datta, Matrix and Linear Algebra, Prentice Hall of India Pvt. Ltd., New Delhi, 2000.
- 9) S. K. Jain, A. Gunawadana and P. B. Bhattacharya, Basic Linear Algebra with MATLAB, Key College Publishing (Springer & Verlag), 2001.
- 10) S. Kumarsena, Linear Algebra, a Geometric Approach, Prentice Hall of India, 2000.
- 11) Vivek Sahai and Vikas Bist, Algebra, Narosa Publishing House, 1999.
- 12) I. Stewart, Galois Theory, 2nd Edition, Chapman and Hall, 1989.
- 13) J. P. Escofier, Galois Theory, GTM Vol. 204, Springer, 2001.
- 14) T. Y. Lam, Lectures on Modules and Rings. GTM Vol. 189, Springer Verlag, 1999.
- 15) D. S. Passman, A Course in Ring Theory, Wadsworth and Brooks/ Cole Advanced Books and Softwares, Pacific Groves, California, 1991.

- 16) J.A. Gallian, Contemporary Abstract Algebra, Narosa Publication.
- 17) A.R. Vashistha, Modern Algebra, Krishna Prakashan Media (P) Ltd.
- 18) V.K. Khanna and Bhambri, a Course in Abstract Algebra, Vikas Publication, House (P) Ltd. (2010).
- 19) John B. Fraleigh, a First Course in Abstract Algebra (Seventh Edition).
- 20) Abstract Algebra (Third Edition) By David S. Dummit, Richard M. Foote, Wiley India Edition.
- 21) Matrices by A.R. Vashistha and A. K. Vashistha (Krishna).
- 22) Basic Abstract Algebra by P.B. Bhattacharya, S.K. Jain, S.R. Nagpaul

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's 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's 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
- 3) R.P. Kanwal, Linear Integral Equation, Theory and Techniques, Academic Press, N.Y. (1971).
- 4) S.G. Mikhlin, Linear Integral Equations, Hindustan Book Agency, (1960).
- 5) A.M. Viazwaz, A First Course in Integral Equations, World Scientific (1997).
- 6) L.I.G. Chambers, Integral Equation: A Short Course, International Text Book Company Ltd. (1976).
- 7) Larry Andrews, Bhimsen Shiramoggo, Integral Transform for Engineers, Prentice Hall of India (2003).
- 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-III :** Product Spaces : Finite Products, product invariant properties. Metric Products. Tichonov Topology, Tichonov Theorem.
- Unit-IV :** Function and Quotient Spaces : Topology of pointwise convergence. Topology of compact convergence. Quotient topology .
- 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 : WileyEastern Ltd.
- (3) William J. Pervin Foundation of General Topology, Publisher: Academic Press.

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's 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 cartesian, 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's tensor for static and non-static spherically symmetric and R-W space times, the Bianchi identity. Geodesic deviation : Equations of Geodesic deviation.

- Unit-V :** Riemannian curvature, space of constant curvature, flat space, tensor derivatives, dual tensors, intrinsic symmetries and killing vectors.

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 in Differential Geometry
- (3) J. L. Synge, Tensor Calculus ó Schild.
- (4) C.E. Weatherburn, An introduction to Riemannian geometry and tensor calculus, Cambridge university press, (1963)
- (5) L.P. Eisenhard, 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
- (9) S. Kobayashi and K. Nomizu, Foundations of differential geometry, Vol. I and II Wiley Interscience publisher 1963 (Vol.I), 1969 (Vol. II)

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.
- Unit-II :** Graph Theory (Continue): Spanning trees, cut sets, fundamental cut sets, and cycles. Minimal spanning trees and Kruskal's algorithm. Matrix representations of graphs. Euler's theorem on the existence of Eulerian paths and circuits. Directed graphs. Indegree and outdegree of a vertex. Weighted undirected graphs. Dijkstra's algorithm. Strong connectivity and Warshall's algorithm. Directed trees. Search trees. Tree traversals.
- Unit-III :** Introductory Computability Theory : Finite state machines and their transition table diagrams. Equivalence of finite state machines. Reduced machines. Homomorphism. Finite automata acceptors. Non-deterministic finite automata and equivalence

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

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

Unit-V : Turing machine and partial recursive functions. notation. 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.
- (2) J.R.Tremblay and R. Manohar , Discrete Mathematical Structure with Application to Computer Science, McGraw Hill Book Co., 1997.
- (3) J.E. Hopcroft and J.D.Ullman, Introduction to Automata Theory , Language and Computation, Narosa Publishing House.
- (4) C.L. Liu, Elements of Discrete Mathematics, McGraw Hill Books co.
- (5) F.H. Harary - Graph Theory , Narosa Publishers, New Delhi (1989)
- (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	}	(304): Fluid Dynamics-I
Paper-XV		(305): General Relativity
		(306): Difference Equations-I
		(307): Advanced Complex Analysis
		(308): Banach Algebras-I

M. Sc. Part-II Semester-IV: Compulsory Papers

Paper-XVI	(401): Functional Analysis-II
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Paper-XVII (402): Partial Differential Equations

Paper-XVIII (403): Numerical Analysis

Optional Papers: Choose Any Two from the following.

(404) : Fluid Dynamics-II

Paper-XIX (405) : Relativistic Cosmology

Paper-XX (406) : Difference Equations-II

(407) : Lie Groups

(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's inequality, complete orthogonal sets, Parseval's identity , structure of Hilbert spaces.

References :

- 1) Serge Lang, Analysis I & II, Addison-Wesley Publishing Company , Inc. 1967.
- 2) G .Bachman and L.Narici, Functional Analysis, Academic Press, 1966.
- 3) N. Dunford and J.T .Schwartz, Linear Operators, Part-I, Interscience, New York, 1958.
- 4) R.E.Edwards, Functional Analysis, Holt Rinehart and Winston, New York, 1965.
- 5) C.Goffman and Pedrick, First Course in Functional Analysis, Prentice Hall of India, New Delhi, 1987.

- 6) P.K. Jain, O.P. Ahuja and Khalil Ahmad, Functional Analysis, New Age International (P) Ltd. & Wiley Eastern Ltd., New Delhi, 1997.
- 7) R.B. Holmes, Geometric Functional Analysis and its Applications, Springer -Verlag, 1975.
- 8) K.K. Jha, Functional Analysis, Students Friends, 1986.
- 9) E. Kreyszig, Introductory Functional Analysis with Applications, John Wiley and Sons, New York, 1978.

Paper-XII (302): ADVANCED MECHANICS

- Unit-I** : Variational principle and Lagrange's Equations : Hamilton's principle, some techniques of the calculus of variations. Derivation of Lagrange's Equations from Hamilton's Principle.
- 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's bracket & other canonical invariants (Lagrange's Bracket), Poisson's 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
- (4) I.D. Landau and E.M. Lifchitz, Vol. I third edition, Perguman press, New Delhi
- (5) H. Goldstein, Classical Mechanics, Second edition, Narosa Publishing House, New Delhi.
- (6) N.C. Rana & P.S. Joag, Classical Mechanics, Tata Mc Graw Hill

- (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** : Queuing system, basic properties of queuing system, Element of Queuing system, Poisson and Non-Poisson Queuing system.
- Unit-V** : Game and strategies, two person, zero sum games, the maximum-minimum principle, games without saddle point, mixed strategies, graphics solution of $2 \times n$ and $m \times 2$ games, dominance properties, general solution of $m \times n$ rectangular games.

Reference:

- 1) G. Hadley, Linear Programming, Narosa publishing House, 1995.
- 2) G. Hadley, Nonlinear and Dynamic Programming, Addison-Wesley, Reading Mass.
- 3) Mokhtar S. Bazaraa, Hohn J. Jarvis and Hanif D. Sherali, G. Hadley, Linear Programming and Network flows, John Wiley and Sons. New York, 1990.
- 4) H. A. Taha, Operation Research- an Introduction, Macmillan Publishing Company, Inc, New York.
- 5) S. S. Rao, Optimization Theory and Applications, Wiley Eastern Ltd., New Delhi.
- 6) Prem Kumar Gupta and D. S. Hira, Operation Research- an Introduction, Chand & Company Ltd., New Delhi.
- 7) N. S. Kambo, Mathematical programming Techniques. Affiliated East-West Press Pvt. Ltd., New Delhi, Madras.
- 8) F. S. Hillier and G. J. Lieberman, Introduction to Operations Research (6th Ed.) McGraw Hill International Edition, Industrial Engineering Series, 1995.
- 9) Kantiswaroop, P. K. Gupta and Manmohan, Operations Research, Sultan Chand & Sons, New Delhi-2007.

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. Axis-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 sink, line sinks, line system.
- Unit-IV** : The Milne-Thomson circle theorem, some application of the circle theorem, extension of the circle theorem, the theorem of conformal transformation. Vortex rows, single infinite row of line vortices. The Kármán 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:

- (1) Besant and A.S. Ramsay, A Treatise on Hydrodynamics, Part-II, CBS Publishers, Delhi, 1988.
- (2) G.K. Batchelor, An Introduction to Fluid Mechanics, Foundation Books, New Delhi, 1994.
- (3) H. Schlichting, Boundary Layer Theory, McGraw Hill Book Company, New York, 1971.
- (4) M.D. Raisinghani, Fluid Mechanics (With Hydrodynamics), S. Chand and Company Ltd., New Delhi.

- (5) L.D. Landau and E.M. Lifschitz, Fluid Mechanics, Pergamon Press, London, 1985.
- (6) F. Chorlton, Text Book of Fluid Dynamics, CBS Publishers, Delhi
- (7) R.K. Rath, An Introduction to Fluid Dynamics, Oxford and IBH Publishing Company, New Delhi, 1976.
- (8) A.D. Young, Boundary Layers, AIAA Education Series, Washington, DC, 1989.
- (9) S.W. Yuan, Foundation of Fluid Mechanics, Prentice Hall of India Private Limited, New Delhi, 1976.

(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 g_{00} 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 tetrad 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:

- (1) Elements of General Relativity: T.M. Karade, K.S. Adhav, S.D. Katore, M.S. Bendre, Sonu Nilu Publication, Einstein Foundation International, Nagpur, first edition June-2014.
- (2) Introduction to General Relativity - Ronald Adler, Maurice Bazin, Menahem, Schiffer, 2nd Edition, McGraw Hill Company.
- (3) Mathematical Theory of Relativity: A.S. Eddington, Cambridge University Press, 1965.
- (4) Relativity: The General Theory - J.L. Synge, North Holland Publishing Company, 1976.

- 5) The Classical Theory of Fields - I.D. Landau and E.M. Lifshitz, Pergamon Press, 1980.
- 6) An Introduction to Riemannian geometry and the Tensor Calculus - C. E. Weatherburn, Cambridge University Press, 1950.
- 7) Classical theory of fields by L.D. Landau and E.M. Lifshitz.

(306) : DIFFERENCE EQUATIONS-I (OPTIONAL)

- Unit-I** : Introduction : Difference calculus. The difference operator. Generating function and approximate summation.
- Unit-II** : Linear Difference Equations : First Order Equations, General results for linear equations. Equations with constant coefficients. Applications, Equations with variable coefficients. Non-linear equations that can be linearized.
- 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.
- Unit-IV** : Stability Theory : Initial value problems for linear systems. Stability of linear systems. Stability of non-linear system. Chaotic behaviour .
- Unit-V** : Asymptotic Methods : Introduction, Asymptotic analysis of sums, linear equations, non-linear equations.

Reference Books :

- (1) Eugenio Hernandez & Guido Weiss, A First Course on Wavelets, CRC Press, New York, 1996.
- (2) Chui C.K., An Introduction to Wavelets, Academic Press, 1992.
- (3) M.W . Wang : Wavelet Transforms & Localization Operators, Berkhauser B Verlag.
- (4) Gerald Kaiser : A Friendly Guide to Wavelets, Birkhauser , 1994.
- (5) Walter G. Kelley and Allan C. Peterson, Difference Equations : An Introduction with Applications, Academic Press, Inc. Harcourt Brace Jorovich Publishers, 1991.

(307) : ADVANCED COMPLEX ANALYSIS (OPTIONAL)

- Unit-I** : Montel's Theorem, Spaces of Meromorphic functions, The Riemann mapping Theorem, The Weierstrass factorization Theorem, Factorization of Sine function.

- Unit-II** : The Gamma Function and its properties, The Riemann Zeta function, Riemann's functional Equation, Euler's Theorem, Mittag-Leffler's Theorem.
- Unit-III** : Monodromy theorem and its consequences, The Sheaf of Germs of Analytic function on an open set, Harmonic function on a disc, Harnack's inequality, Dirichlet's problem, Green's function.
- Unit-IV** : Canonical Products, Jensen's formula, Poisson-Jensen's formula, The genus and order of an entire function, exponent of convergence, Hadamard's factorization Theorem.
- Unit-V** : The range of an Analytic function, Bloch theorem, Little Picard's theorem, Schottky's theorem, univalent function, Bieberbach's conjecture theorem, Cote's $1/4$."

References:

- 1) S. Ponnusamy, Foundation of Complex Analysis, Narosa Publishing House, 1967.
- 2) H. S. Kasana, Complex variables: Theory and Application, PHI Learning Pvt. Ltd., New Delhi.
- 3) Schaum's outline series Complex Analysis, Tata McGraw Hill Education Pvt. Ltd., New Delhi (2010).
- 4) J. N. Sharma, Complex Variables, Pragati Publication.
- 5) A. R. Vasistha, Complex Variables, Krishna Publication.
- 6) Murray R. Spiegel, Seymour Lipschutz, Jon J. Schiller, Dennis Spellman., Schaum's outline series Complex Analysis, Tata McGraw Hill Education Pvt. Ltd., 3rd Edition, New Delhi 2010.
- 7) Walter Rudin, Real & Complex Analysis, McGraw Hill Book Co., 1966.
- 8) J. Ward Brown, Ruel V. Churchill, Complex variables and Application, McGraw Hill International Edition (2009).
- 9) H. A. Priestly, Introduction to Complex Analysis, Clarendon Press, Oxford, 1990.
- 10) Liang-Shin Hahn & Bernhard Epstein, Classical Complex Analysis, Jones & Berlett Publishers. International London, 1996.
- 11) L. V. Ahlfors, Complex Analysis, McGraw Hill, 1979.
- 12) S. Lang, Complex Analysis, Addison Wesley, 1977.1998.
- 13) D. Sarason, Complex Function Theory, Hindustan Book, Agency, Delhi, 1994.
- 14) Mark J. Ablowitz and A. S. Fokar, Complex variables: Introduction & Application, Cambridge University Press, South Asian Edition, 56.

- 15) E. Hille, Analytic Function Theory (2 Vols), Gonn & Co. 1959.
- 16) W. H. J. Fuchs, Topics in the Theory of Function of Complex Variable, D. Van Nostrand Co., 1967.
- 17) C. Carathodory, Theory of Functions (2 Vols), Chelsea Publishing Company, 1964.
- 18) M. Heins, Complex Function Theory, Academic Press, 1968.
- 19) S. Saks & A. Zygmund, Analytic Functions, Monografie, Matematyczne, 1952.
- 20) E. C. Titchmarsh, the Theory of Functions, Oxford University Press, London.
- 21) W. A. Veech, A Second Course in Complex Analysis, W. A. Benjamin, 1967.
- 22) Complex variables and Applications, Jams Ward Brown, Ruel V. Churchill, McGraw Hill International Edition (2009).
- 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.
- 25) Functions of one complex variable - J. B. Conway, Springer Verlag International Students Edition, Narosa Publishing House, 1980.

(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-II** : The Spectral radius. Gelfund formula. Multiplicative linear functionals and the maximal ideal space. Gleason Kahane Zelazko theorem.
- Unit-III** : The Gelfand Transforms, the spectral mapping theorem. Isometric Gelfand transform. Maximal ideal spaces for disc algebra and the algebra $l(Z)$.
- Unit-IV** : C^* -algebras : Definition and examples, self-adjoint, unitary, normal, positive and projection elements in C^* -algebras.
- Unit-V** : Commutative C^* algebras. C^* - homomorphisms. Representation of commutative C^* -algebras.

References:

- (1) M.A. Naimark, Normed Algebras, Groningen, Netherlands, 1972.

- (2) C.E. Rickart, General Theory of Banach Algebras, V o n Nostrand, 1960.
- (3) T. W. Palmer , Banach Algebras V ol.-I, Cambridge University Press,1994.

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:

- 1) Serge Lang, Analysis I & II, Addison-Wesley Publishing Company , Inc. 1967.
- 2) G .Bachman and L.Narici, Functional Analysis, Academic Press, 1966.
- 3) N. Dunford and J.T .Schwartz, Linear Operators, Part-I, Interscience, New Y ork, 1958.
- 4) R.E.Edwards, Functional Analysis, Holt Rinehart and Winston, New York, 1965.
- 5) C.Goffman and Pedrick, First Course in Functional Analysis, Prentice Hall of India, New Delhi, 1987.
- 6) P.K. Jain, O.P. Ahuja and Khalil Ahmad, Functional Analysis, New Age International (P) Ltd. & Wiley Eastern Ltd., New Delhi, 1997.
- 7) R.B. Holmes, Geametric Functional Analysis and its Applications, Springer -Verlag,1975.
- 8) K.K. Jha, Functional Analysis, Students Friends, 1986.

- 9) E.Kreyszig, Introductory Functional Analysis with Applications, John Wiley and Sons, New York, 1978.

Paper-XVII (402) : PARTIAL DIFFERENTIAL EQUATIONS

- Unit-I** : Curves and Surfaces, Genesis of first order P.D.E., Classification of integals, 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.
- Unit-IV** : Laplace's Equation, Boundary value problems, Maximum and Minimum Principles, The Cauchy problem, The Dirichlet Problem for the upper half plane, The Neumann problem for the upper half plane, The Dirichlet problem for a circle, The Dirichlet Exterior problem for a circle, The Neumann problem for a circle, The Dirichlet problem for a Rectangle, Harnack's Theorem, Laplace's equation- Green function, The Dirichlet problem for a half plane, The Dirichlet problem for a circle.
- Unit-V** : Heat conduction problem: Heat conduction- Infinite rod case, Heat conduction-finite rod case, Duhamel's principle: Wave equation, Heat conduction equation. Classification in the case of n variables, Families of equipotential surfaces, Kelvin's inversion theorem.

References :

- (1) I.N. Sneddon : Elements of Partial Differential Equation, Mc Graw Hill, International Editon, New York.
- (2) Phoolan Prasad, Renuka Ravindram : Partial Differential equations, New Age and International Publishers.
- (3) Lawrence C. Evans: Partial Differential Equations, Vol. 19, AMS, 1998.
- (4) T. Amaranath : An elementary course in Partial Differential Equations, 2nd Ed. Narosa Publishing House, New Delhi.
- (5) R.J. Leveque, Finite difference methods for ordinary and partial differential equations, July-2007

Paper-XVIII (403) : NUMERICAL ANALYSIS

- Unit I** : Solution of Algebraic and Transcendental equations: The Bisection Method, The Method of False Position, The Iterative Method, Newton-Raphson Method, Secant Method, Muller's Method. System of Nonlinear equations by Iterative and Newton-Raphson Method, Rate of Convergence. Solved problems.
- Unit II** : Finite Differences: Forward and backward differences, Newton's for 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.
- Unit III** : Numerical differentiation and integration: Numerical differentiation, error in Numerical differentiation, The Cubic Spline Method. Numerical integration: Trapezoidal rule, Simpson's 1/3 Rule, Simpson's 3/8 Rule, Use of Cubic Splines, Romberg integration. Newton-Cotes integration formulae, Euler-Maclaurin formula.
- Unit IV** : Solution of system of linear equations: Direct method, Matrix Inversion Method, Gauss Elimination Method, Gauss-Jordan Method, Modification of Gauss Method, LU Decomposition, LU Decomposition from Gauss Method, Solution of system by Iterative Methods. The Eigen value problems, Eigen value of a symmetric Tridiagonal matrix.
- Unit V** : Numerical Solution of Ordinary Differential Equation: Solution by Taylor's series, Picard's Method of Successive approximations, Euler's Method, error estimate for the Euler's Method, Modified Euler's Method, and Runge-Kutta Method. Simultaneous and Higher-Order equations. Boundary value problems: Finite-difference Method, The Shooting Method, The Cubic Spline Method.

References:

- (1) S. S. Sastry, Introductory Methods of Numerical Analysis, 4th edition. PHI Learning Pvt. Ltd., New Delhi, 2010.
- (2) Francis Scheid, Schaum's outline Numerical Analysis, Tata McGraw Hill Education Pvt. Ltd., 2nd Edition, New Delhi 2009.
- (3) M. K. Jain, S. R. K. Iyengar and R. K. Jain, Numerical Methods Problems and Solutions, Wiley Eastern Ltd, New Delhi, 1994.
- (4) M. K. Jain, S. R. K. Iyengar and R. K. Jain, Numerical Methods Problems and Solutions, New Age International Ltd, 1996.

- 5) M. K. Jain, S. R. K. Iyengar and R. K. Jain, Numerical Methods for Scientific and Engineering Computation, New age International publisher, India, 5th Edition, 2007.
- 6) C. F. Gerald and P. O. Wheatley Applied Numerical Analysis, Pearson Education, India, 7th Edition, 2008.
- 7) M. Pal, Numerical Methods for Scientific and Engineering Computation, Narosa Publication.
- 8) S. D. Comte and Carl de Boor, Elementary Numerical Analysis- An algorithmic approach, 3rd Edition, McGraw Hill, International Book Company, 1980.
- 9) F. B. Hildebrand, Introduction to Numerical Analysis, McGraw Hill, New York, 1956.
- 10) C. E. Froberg, Numerical Mathematical Analysis, 2nd Edition, Addison-Wesley, 1979.

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 cocentric 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 Renolds number , Alfvens theorem, the magnetic body force, Ferraro's laws of isorotation.

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

References:

- (1) Besaint and A.S.Ramsay , A Treatise on Hydrodynamics, Part-II, CBS Publishers, Delhi, 1988.
- (2) G .K.Batchelor , An Introduction to Fluid Mechanics, Foundation Books, New Delhi, 1994.
- (3) H. Schlichting, Boundary Layer Theory , McGraw Hill Book Company , New Y ork, 1971.
- (4) M.D.Raisinghanian, Fluid Mechanics (With Hydrodynamics), S.Chand and Company Ltd., New Delhi.
- (5) L.D.Landen and E.M.Lipschitz, Fluid Mechanics, Pargamon Press, London, 1985.
- (6) F .Chorlton, Text Book of Fluid Dynamics, CBS Publishers, Delhi
- (7) R.K.Rathy , An Introduction to Fluid Dynamics, Oxford and IBH Publishing Company, New Delhi, 1976.
- (8) A.D. Young, Boundary Layers, AIAA Education Series, Washington, DC, 1989.
- (9) S.W.Yuan, Foundation of Fluid Mechanics, Prentice Hall of India Private Limited, New Delhi, 1976.

(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, Hubble's 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.
- 2) Mathematical Theory of Relativity: A.S. Eddington, Cambridge University Press, 1965.
- 3) Relativity: The General Theory - J. L. Synge, North Holland Publishing Company, 1976.
- 4) The Classical Theory of Fields - I.D. Landau and E.M. Lifshitz, Pergamon Press, 1980.
- 5) An Introduction to Riemannian geometry and the Tensor Calculus - C. E. Weatherburn, Cambridge University Press, 1950.
- 6) Classical theory of fields by L.D. Landau and E.M. Lifshitz.
- 7) Lectures on Relativity: T .M. Karade, et al Einstein Foundation International, Nagpur.

(406) : DIFFERENCE EQUATIONS-II (OPTIONAL)

- Unit-I :** The Self-adjoint Second Order Linear Equations : Introduction, Sturmian theory , Green's functions. Disconjugacy , the Riccati equations. Oscillation.
- Unit-II :** The Sturm-Liouville Problem : Introduction, Finite Fourieranalysis, A non-homogeneous problem.
- Unit-III :** Discrete Calculation of Variation : Introduction. Necessary conditions. Sufficient conditions and disconjugacy .
- Unit-IV :** Boundary Value Problems for Non Linear Equations : Introduction, the Lipschitz case. Existence of solutions. Boundary value problems for differential equations.
- Unit-V :** Partial Differential Equations. Discretization of partial differential equations. Solution of partial differential equations.

References :

- (1) Calvin Ahlbrandt and Allan C. Peterson, Discrete Hamiltonian Systems. Difference Equations, continued Fractions and Riccati Equations : Kluwer , Boston, 1996.
- (2) Pundir S.K. and Pundir R., Difference Equations, Pragati Prakashan, Meerut, 2006.
- (3) Walter G.Kelley and Allan C. Peterson, Difference Equations : An Introduction with Applications, Academic Press, Inc., Harcourt Brace Jorovich Publishers, 1991.

(407) : LIE GROUPS (OPTIONAL)

- Lie Groups :** Topics for Review Only : (No question to be set on this topic) Charts and coordinates, analytic structures. Real functions on a manifold. Tangent vectors. The dual vector space. Differentials. Infinitesimal. Transformations and differential forms. Mappings of manifolds. Submanifolds. Product of manifolds.
- 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's theorem for Lie groups. The Exponential mapping.
- Unit-V :** The Exterior algebra of a vector space. The algebra of differential forms. Exterior differentiation. Maurer-Chartan forms. The Maurer Cartan relations. Statement of the lie fundamental theorems. The converses of Lie's first and second theorems.

References:

- (1) P .M. Cohn ,Lie Groups , Cambridge University Press, 1961.
- (2) A.S. Sagale and R.E.Walde, Introduction to Lie Groups and Lie Algebras ,Academic Press, 1973.

- (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-I : Sub algebras of C^* - algebra and the spectrum. The spectral theorem. The continuous functional calculus. Positive linear functionals and states in C^* -algebras. The GNS construction.
- Unit-II : Strong and weak operator topologies. Von Neumann Algebras. Monotone Sequence of Operators. Range Projections.
- Unit-III : The Commutant. The double commutant theorem. The Kaplansky Density theorem. L as V on Neumann Algebra, Maximal Abelian Algebras.
- Unit-IV : Abelian V on Newman Algebras. Cycling and Seperating vectors. Representation of Abelian V on Newmann Algebras, the L functional calculus. Connectedness of the Unitary group.
- Unit-V : The Projection lattice. Kaplansky's formula. The centre of a V on Newmann Algebra. Various types of projections. Centrally orthogonal projections, type decomposition.

Reference Books:

- (1) C.E. Ricart, General Theory of Banach Algebras, V on-Nostrand, 1960.
- (2) T.W.Palmer , Banach Algebras, V ol.-I, Cambridge University Press, 1994.
- (3) M.A.Naimark, Normed Algebras, Noordhoff, Groningen, Netherlands, 1972..
