

M.Sc. Sem. I to IV  
Geology

Prospectus No. 20171217

संत गाडगे बाबा अमरावती विद्यापीठ

SANT GADGE BABA AMRAVATI UNIVERSITY

विज्ञान विद्याशाखा  
(FACULTY OF SCIENCE)

अभ्यासक्रमिका  
विज्ञान पारंगत सत्र १ व ४ परिक्षा  
(भुगर्भशास्त्र)

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



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**M.Sc.Part-I (Sem-I to IV)**

**Prospectus No.20171217**

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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 in 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.

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

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

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

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

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

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**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 Honable 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

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## 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 11<sup>th</sup> 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 11<sup>th</sup> 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 an optional course from the basic subject or specialization.

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

### (iii) General Interest Course (GIC)

The General Interest Course shall be the choice of student. The student who chooses 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 3<sup>rd</sup> 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)
<b>O</b>	<b>90-100</b>	<b>10</b>	<b>Outstanding</b>
<b>A+</b>	<b>80-89</b>	<b>9</b>	<b>Excellent</b>
<b>A</b>	<b>70-79</b>	<b>8</b>	<b>Very Good</b>
<b>B+</b>	<b>60-69</b>	<b>7</b>	<b>Good</b>
<b>B</b>	<b>55-59</b>	<b>6</b>	<b>Fair</b>
<b>C+</b>	<b>50-54</b>	<b>5</b>	<b>Average</b>
<b>C</b>	<b>40-49</b>	<b>4</b>	<b>Below Average</b>
<b>F</b>	<b>Below 40</b>	<b>0</b>	<b>Fail</b>

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:

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

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<sub>n</sub> 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<sup>ble</sup> 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 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 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			
				T	P/ TU	Theory	Pract.	Paper Hrs.	Max Theory	Max Internal	Total	Min Passing Grade Points	Max Marks Practical	Max Marks Int. Ass	Total	Min Passing Grade Points
1	4BTB-1	XII	C	04	06	04		3	100	--	100	4	--	--	--	--
2	4BTB-2	XIII	C	04	06	04		3	100	--	100	4	--	--	--	--
3	4BTB-3 and/or 4GIC-Z	XIV	E and/or GIC	04	06	04		3		100	100	4	--	--	--	--
4	4BTB-4	Lab-VI					18						80	20	100	5
5	4BTB-5	Project			06		06						200	--	200	5
		Total		12	24	12	24	-	--	--	300	--	--	--	300	--

**Total Credits: 35**

## Appendix-M

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

M.Sc. (Computer) SEMESTER PATTERN

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

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

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

Total Credits: 40

## Appendix-N

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

M.Sc. (Computer) SEMESTER PATTERN

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

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

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

Total Credits: 40

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

M.Sc. (Computer) SEMESTER PATTERN

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

**Appendix-O**

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

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

**Total Credits: 35**

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

M.Sc. (Computer) SEMESTER PATTERN

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

**Appendix-P**

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

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

**Total Credits: 35**

## 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 30<sup>th</sup>, 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

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

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

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## 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 1<sup>st</sup> March, 2012 and 18<sup>th</sup> 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 5<sup>th</sup>, 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

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**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. Semester-I to IV (Geology)**

Sr. No.	Paper No.	Name of the Theory Paper	Clock Hrs/week	Marks
<b><u>Semester-I</u></b>				
1	I	Mineralogy	4	100 (80+20*)
2	II	Structural Geology and Tectonics	4	100 (80+20*)
3	III	Geochemistry and Analytical Techniques	4	100 (80+20*)
4	IV	Palaeobiology	4	100 (80+20*)
<b><u>Semester-II</u></b>				
1	V	Igneous Petrology	4	100 (80+20*)
2	VI	Metamorphic Petrology	4	100 (80+20*)
3	VII	Sedimentology	4	100 (80+20*)
4	VIII	Geomorphology and Field Geology	4	100 (80+20*)
<b><u>Semester-III</u></b>				
1	IX	Stratigraphy	4	100 (80+20*)
2	X	Ore Geology and Mining Geology	4	100 (80+20*)
3	XI	Hydrogeology	4	100 (80+20*)
4	XII	Exploration Methods	4	100 (80+20*)
<b><u>Semester-IV</u></b>				
1	XIII	Remote Sensing and GIS		100 (80+20*)
2	XIV	Environmental Geology and Engineering Geology	4	100 (80+20*)
3	XV	Indian Mineral Deposits and Mineral Economics	4	100 (80+20*)
4	XVI	Petroleum and Coal Geology	4	100 (80+20*)

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**\*Internal assessment marks for theory paper**

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Sr. No.	Practical No.	Practical	Clock Hrs/week	Marks
1	I	Mineralogy and Structural Geology (40+40) + Practical Record (7) + Viva-Voce (5) + Assignment (8)	09	100
2	II	Geochemistry, Palaeobiology (40+40) + Seminar (8) + Practical Record (7) + Viva-Voce (5)	09	100
3	III	Igneous and Metamorphic Petrology (50+30) + Practical Record (7) + Viva-Voce (5) + Seminar (8)	09	100
4	IV	Sedimentology, Geomorphology and Field Geology (30+25+25) + Field Tour & submission of Report (8) + Practical Record (7) + Viva-Voce (5)	09	100
5	V	Stratigraphy, Ore Geology and Mining Geology (25+30+25) + Practical Record (7) + Viva-Voce (5) + Assignment (8)	09	100
6	VI	Hydrogeology and Mineral Exploration (45+25) + Seminar (8) + Practical Record (5) + Viva-Voce (5)	09	100
7	VII	Remote Sensing, Engineering and Environmental Geology (25+25+30) + Practical Record (7) + Viva-Voce (5) + Field Tour & submission of Report (8)	09	100
8	VIII	Project Work (40) + Submission of Report (20) + Presentation (20) + Seminar (8) + assignment (7) + Viva-Voce (5)	09	100

**SYLLABUS PRESCRIBED FOR M.SC. PART-I****SEMESTER - I****PAPER - I****MINERALOGY**

- Unit-I :** Chemistry of Minerals : elements, compound, mixture; atoms and molecules, atomic structures, atomic number, atomic weight, atomic binding valency; Physical, electrical, magnetic and radioactive properties of minerals; Silicate structures..
- Unit-II:** Optical properties of minerals : birefringence, pleochroism, interference figure, order of colours, extinction angle, optic axis; Uniaxial and biaxial minerals; Optic orientation, dispersion and optical anomalies; Optical accessories. and its uses
- Unit-III :** Systematic mineralogy, atomic structure, mineral chemistry, physical & optical properties, and mode of occurrences of garnet, epidote, pyroxene, amphibole, mica, and feldspar groups.
- Unit-IV:** Systematic mineralogy, atomic structure, mineral chemistry, physical and optical properties and mode of occurrences of feldspathoid, quartz, aluminosilicate groups and carbonates, sulphates, oxides minerals etc.
- Unit-V :** Systematic mineralogy, atomic structure, mineral chemistry, physical properties, optical properties and mode of occurrences of native elements, sulphosalts, phosphates, and hydroxides; Gems and Semiprecious minerals; Radioactive minerals

**Books**

- (1) Deer, W.A., Howie, R.A. and Zussman, J., 1996 : The Rock Forming Minerals, Longman.
- (2) Klein, C. and Hurlbut, Jr., C.S., 1993 : Manual of Mineralogy, John Wiley.
- (3) Putnis, Andrew, 1992 : Introduction to Mineral Sciences. Cambridge University Press.
- (4) Spear, F.S. 1993 : Mineralogical Phase Equilibria and Pressure - Temperature - Time Paths. Mineralogical Society of America Publ.
- (5) Phillips, W. R. and Griffen, D.T., 1986 : Optical Mineralogy, CBS Edition.
- (6) Hutchinson, C.S., 1974 : Laboratory Handbook of Petrographic Techniques. John Wiley.

- (7) L.G. Berry, Brain Mason - Mineralogy 1985 CBS Pub. New Delhi.
- (8) Paul E Kerr, Optical Mineralogy 4th Edn McGraw Hill.
- (9) E.S. Dana, Text book of Mineralogy 4th Ed 2005
- (10) William H. Blackburn, Principles & Mineralogy 1992 Universal book stall. New Delhi.
- (11) Gail Kay Haines. The Elements Franklin Watts Ltd. London
- (12) C.D. Gribble; A.J. Hall Optical Mineralogy principle & practice 1993 Research press New Delhi.
- (13) William E Ford Dana Text book of Mineralogy 4th Edn CBS New Delhi
- (14) Dexter Perkins - Mineralogy 2nd Edn PHI New Delhi
- (15) Winchell, A.N. Elements of Optical Mineralogy, John Wiley, 1962

**PAPER - II****STRUCTURAL GEOLOGY AND TECTONICS**

- Unit-I :** Deformation: Mechanisms of rock deformation, Theories of rock failure, Behaviour of minerals and rocks under deformation conditions; Stress - Concept of stress, forces and stress, normal and shear stress, stress components, principal stresses, stress trajectories;  
Strain - Concept of strain, measurement of strain, principal strain axes and strain ellipsoid, volume changes during deformation, relationship between stress and strain;  
Effect of confining Pressure, Temperature, Pore-fluid pressure, and strain rate in rocks.
- Unit-II :** Faults and fractures: Rock fractures, Fault geometry and nomenclature, Classification, Mechanism of Faulting, Features associated with fault planes, Fault associations, Joints, Thrust system, Extensional fault system, Strike-slip-fault system, Shear zones.
- Unit-III :** Folds: Fold geometry and nomenclature, Fold orientation, Classification of folds, Mechanism of folding, and Relationship between faults, folds and ductile shears.  
Classification of folds based on layer shape, Buckling, Oblique shear or flow folding, Kinking and formation of chevron folds, Foliation, Lineations and fabrics.
- Unit-IV :** Igneous bodies - Significance of igneous bodies in structural geology, Structures found within igneous bodies, Structural classification of igneous bodies.

Emplacement of igneous intrusions - Dilational emplacement of dikes and sills, emplacement of cone- sheets and radial dikes, Mode of emplacement of large intrusions, Large scale structures.

**Unit-V :** Tectonics: Major Structure of earth - continents and oceans, mountain ranges, oceanic ridges and trenches; Present day tectonic activity; Stable and unstable tectonic zones.

Plate tectonics - Concept of lithosphere plates, nature of plate boundaries- constructive and destructive, subduction Zone, geometry of plate motion, driving mechanism for plate motion. Seafloor spreading and Plate Tectonics; Island arcs, Oceanic islands and volcanic arcs; Isostasy, orogeny and epeirogeny; Seismicity and plate movements.

**Practicals :** Preparation and interpretation of geological maps and sections. Stereographic projections of structural data. Study of minor structures in hand specimens.

#### Books :

- (1) Ramsay, J.G (1967): Folding and fracturing of rocks, McGraw Hill.
- (2) Ramsay, J.G. and Huber, M.I. (1983): Techniques of Modern Structural Geology, Vol. I, Strain Analysis, Academic Press.
- (3) Ramsay, J.G. and Huber, M.I. (1987): Techniques of Modern Structural Geology, Vol. II, Folds and Fractures, Academic Press.
- (4) Ramsay, J.G. and Huber, M.I. (2000): Techniques of Modern Structural Geology, Vol. III (Application of continuum mechanics), Academic Press.
- (5) Ramsay, J.G. and Huber, M.I. 1987: Modern Techniques in Structural Geology, Vol.I & II. Academic Press.
- (6) Turner, F.J. and Weiss, L.E. (1963): Structural analysis of Metamorphic Tectonites, McGraw Hill.
- (7) Billings M. P.: Structural Geology, CBS publication.
- (8) Park, R. G. (1989): Fundamentals of Structural Geology.
- (9) Paor, D. (1996): Structural Geology and Personal computer, Pergamon Press.
- (10) Rowland, S. M. and Duebendorfer, E. M. (1994): Structural Analysis and synthesis, Pergamon Press.
- (11) Hatcher, R. D. (1990): Structural Geology principals, concepts and problems.
- (12) Ragan, D. M. (1985): Structural Geology ó An introduction to Geometrical Techniques, John Wiley.

- (13) Price, N.J. and Cosgrove, J.W. 1990 : Analysis of Geological Structure, Cambridge University Press.
- (14) Bayly, B., 1992: Mechanics in Structural Geology : Springer Verlag.
- (15) Ghosh S.K. 1995: Structural Geology Fundamentals of Modern Developments, Pergamon Press.
- (16) Moores, E and Twiss, R.J. 1995: Tectonics, Freeman.
- (17) Keary, P. and Vine, F.J. 1990: Global Tectonics, Freeman.
- (18) Storetvedt, K.N., 1997: Our Evolving Planet Birth & History in New Perspective, Bergen (Norway), Alma Matter Forlag.
- (19) Valdiya, K.S. 1998: Dynamic Himalaya Universities Press, Hyderabad.
- (20) Summerfield, M.A. 2000: Geomorphology and Global Tectonics, Springer Verlag.
- (21) Badgley, P.C. 1965: Structure and Tectonics, Harper and Row.
- (22) Ramsay, J.G. 1967: Folding and Fracturing of Rocks, McGraw Hill.
- (23) Hobbs, B.E.Means, W.D. and Williams, P.E. 1996: An Outline of Structural Geology, John Wiley.
- (24) Davis, G.R. 1984: Structural Geology of Rocks and Region, John Wiley.
- (25) Skinnel B.: Dynamic Earth Introduction to Physical Geology 5Ed.
- (26) Condie, Kent. C. (1982): Plate Tectonics and Crustal Evolution, Pergamon Press Inc.
- (27) Hobbs, B.E., Means, W.D. and Williams, P.F. (1976): An outline of Structural Geology, John Wiley and Sons, New Delhi.
- (28) Gass I.G. (1982): Understanding the Earth. Artemis Press (Pvt) Ltd. U.K.
- (29) Windley B. (1973): The Evolving continents, John Wiley and Sons, New York.

#### PAPER - III

#### GEOCHEMISTRY AND ANALYTICAL TECHNIQUES

- Unit-I :** Origin and abundance of elements in the Earth and its constituents. Atomic structure and properties of elements in the periodic table. Special properties of transition and rare earth elements. Distribution coefficients.
- Unit-II :** Geochemical composition of the Earth. Geochemical classification of elements. Weathering indices Radiogenic isotopes, radioactive decay scheme of U-Pb, Sm-Nd, Rb-Sr, K-Ar.
- Unit-III :** Growth of daughter isotopes, radiometric dating of single minerals, whole rocks, stable isotopes, nature, abundance.



Law of thermodynamics, concept of free energy, fugacity and equilibrium constant.

**Unit-IV :** Principles of ionic substitution in minerals, elements partitioning in mineral and rock formation. Eh-pH diagram and mineral stability in Eh-Ph diagrams, Geochemical cycle and concept of biogeochemical exploration.

**Unit-V :** Sampling techniques. Thin section and polished section making. Dissolution procedure in Geological and environmental samples; Principles and geological applications of UV-VIS Spectrophotometry, atomic absorption spectrometry, inductively coupled plasma Spectrophotometry, X-Ray diffraction, scanning electron microscopy, electron microprobe analysis.

**Practicals:**

Calculation of mineral formulae from the concentration of various oxides in minerals. Calculation of gain and loss in weathering from the chemical analysis of rocks, calculation of weathering indices in soil and sediments, graphic presentation of analytical data.

**Books:**

- (1) Mason, B. and Moore, C.B. 1991 : Introduction to Geochemistry, Wiley Bastern.
- (2) Krauskopf, K.B. 1967 : Introduction to Geochemistry, McGraw Hill.
- (3) Faure, G. 1986 : Principles of Isotope Geology, John Wiley.
- (4) Hoefs, J. 1980 : Stable Isotope Geochemistry, Springer Verlag.
- (5) Marshal, C.P. and Fairbridge, R.W. 1999 : Encyclopaedia of Geochemistry, Kluwer Academic.
- (6) Govett, G.J.S. (Ed.) 1983 : Handbook of Expleist on Geochemistry : Blsevier.
- (7) Nordstorm, D.K. and Munoz, J.L. 1986 : Geochemical Thermodynamics, Blackwell.
- (8) Henderson, P., 1987 : Inorganic Geochemistry, Pergamon Press.
- (9) Andre Authier Dynamical Theo of XRD oxford Press.
- (10) Walther, Essentials of Geochemistry, HB Problem 2005
- (11) Bloss, F.D. (1971): Crystallography and Crystal Chemistry, Holt, Rinehart, and Winston, New York.
- (12) Evans, R.C., (1964): Introduction to Crystal Chemistry, Cambridge Univ. Press.
- (13) Klein, C. and Hurlbut, C.S. (1993): Manual of Mineralogy, John Wiley and Sons, New York.

- (14) Rollinson, H.R. (1993): Using geochemical data: Evaluation, Presentation, Interpretation. Longman U.K.
- (15) Shikazono, N. (2003): Geochemical and Tectonic Evolution of Arc-Backarc Hydrothermal Systems - Implication for the Origin of Kuroko and Epithermal Vein-Type Mineralizations and the Global Geochemical Cycle, Eslevier Science
- (16) Advances in Analytical Geochemistry, Volume 1, Edited by M. W. Rowe and M. Hyman, JAI Press Inc., Greenwich, Connecticut, U.S.A., (1993)
- (17) Modern Analytical Geochemistry [Paperback] Robin Gill (Ed), 1997 Addison Wesley Longman
- (18) Encyclopedia of Geochemistry, Marshall, C.P.; Fairbridge, Rhodes W. (Eds.) 1999, XXXVI, 714 p. Springer.

**PAPER - IV  
PALAEOBIOLOGY**

- Unit-I :** Fossil: mode of preservation, physico-chemical condition for Fossilization, types of fossils, significance of fossils; Fossil record and geological time scale, Preparation and nomenclature of fossils, Classification of organisms
- Unit-II :** Morphology, classification, geological history and evolution of mollusca-bivalve, gastropod, cephalopod; brachiopoda, echinodermata.
- Unit-III :** Morphology, classification, geological distribution and significance of arthropoda, hemichordata, foraminifera, ostracoda and conodonts; Gondwana flora and its significance; Geological distribution and extinction of dinosaurs
- Unit-IV :** Taphonomy, Limiting environmental factors, Modern concepts of origin of life. Chemical and biological evolution; Precambrian life.
- Unit-V :** Evolution: Mechanism of evolution - mutation, adaptation, isolation, variation; Species concept and speciation; Palaeontological evidence of evolution;
- Practical :** Identification and classification of fossils belonging to major phylums.

**Books :**

- (1) Clarkson, E.N.K., 1998 : Invertebrate Palaeontology and Evolution. IV Ed. Blackwell.
- (2) Stearn, C.W. & Carrol. R.I., 1989 Palaeontology; The Record of Life, John Wiley.

- (3) Smith, A.B., 1994 : Systematics and the Fossils, Record-Documenting Evolutionary Patterns. Blackwell.
- (4) Prothero, D.R., 1998 : Bringing Fossils to Life- An Introduction to Palaeobiology, McGraw Hill.
- (5) Pomeroy, C. 1982 : the Cenozoic Era : Tertiary and Quaternary. Ellis Harwood Ltd.
- (6) Goodwin, A.M. 1991 : Precambrian Geology : The Dynamic Evolution of Continental Crust, Academic Press.

**M.Sc. PART - I SEMESTER - II**  
**PAPER - V**  
**IGNEOUS PETROLOGY**

- Unit-I** : Study of textures, structures and their genetic significance. Forms of igneous bodies and their mode of emplacement.
- Unit-II** : Criteria for classification of the Igneous rocks. Norms CIPW and Niggli values - Johanson, IUGS. Petrographic Provinces and associations.
- Unit-III** : Nature and evolution of magma; Introduction to mantle petrology and mantle metasomatism, Factors affecting magma and evolution of magma, Plate tectonics and generation of magmas,
- Unit-IV** : Phase equilibrium of single, binary and ternary silicate systems, its relation to magma genesis and crystallization in the light of modern experimental work, Partial melting, Crystal fractionation and Crustal contamination.
- Unit-V** : Petrogenesis of major igneous rock types such as ultramafic komatiite, basaltic, granitic and alkaline rocks, ophiolites, carbonatite, lamprophyre, and Kimberlites
- Practicals:** Megascopic and microscopic study of various acidic, basic and ultrabasic igneous rocks with emphasis on crystallization history, occurrence and association. Calculation of CIPW norms for various types of Igneous rocks.

**Books :**

- (1) Clarkson, E.N.K., 1998 : Invertebrate Palaeontology and Evolution. IV Ed. Blackwell.
- (2) Stearn, C.W. & Carroll, R.I., 1989 Palaeontology; The Record of Life, John Wiley.
- Books:**
- (1) Best, Myron G. (2002): Igneous and Metamorphic Petrology, Blackwell Science
- (2) McBirney, A.R. 1993 : Igneous Petrology; Jones and Barlet Publ. 3rd Ed
- (3) Bose, M.K. 1997 : Igneous Petrology; World Press.

- (4) Perchuk, L.L. and Kushiro, I. (Eds.), 1991 : Physical Chemistry of Magmas, Springer Verlag.
- (5) Philipotts, A. 1992 : Igneous and Metamorphic Petrology, Prentice Hall.
- (6) William, Turner and Bilbeat; Petrography - An Introduction to Study of Rocks in Their Sections.
- (7) Hatch, Wells and Wells; Petrography of Igneous Rocks. 13 ed.
- (8) Hall, A. (1997): Igneous Petrology, Longman
- (9) Machenzee and Guilford, Atlas of Rock Forming Minerals in thin Sections.
- (10) Cox, K.G, Bell, J.D. and Pankhurst, R.J. (1993): The Interpretation of Igneous Rocks, Chapman and Hall, London.
- (11) Chatterjee S.C. : Igneous & Metamorphic Petrology
- (12) Turner F.J. and Verhoogen : Igneous & Metamorphic Petrology
- (13) Ehlers and Bhatt : Petrology - Igneous, Sedimentary and Metamorphic.
- (14) Bandenzelt Volcanology 2ed. HB Publish
- (15) Bose, M.K. (1997): Igneous Petrology, World Press, Kolkata.
- (16) Faure, G. (2001): Origin of Igneous Rocks, Springer.
- (17) LeMaitre R. W. (2002): Igneous Rocks: A Classification and Glossary of Terms, Cambridge University Press.
- (18) Sood, M.K. (1982): Modern Igneous Petrology, Wiley-Inter science Publ., New York.
- (19) Srivastava, Rajesh K. and Chandra, R., (1995): Magmatism in Relation to Diverse Tectonic Settings, A.A. Balkema, Rotterdam.
- (20) Wilson, M. (1993): Igneous Petrogenesis, Chapman and Hall, London.
- (21) Winter, J.D. (2001): An Introduction to Igneous and Metamorphic Petrology, Prentice Hall, New Jersey.
- (22) Ian S. E. Carmichael, Francis 1982 Igneous petrology, Elsevier Scientific Pub. Co.,
- (23) Paul C. Hess, 1989, Origins of igneous rocks, Harvard University Press,
- (24) Eric A. K. Middlemost, Magmas and magmatic rocks, Longman, 1985 - Nature

### PAPER - VI METAMORPHIC PETROLOGY

- Unit-I :** Agents of metamorphism, kinds of metamorphism, structure and texture of metamorphic rocks Mineralogical phase rule of closed and open systems. Detailed description of low, medium, high and very high pressures facies.
- Unit-II :** Characteristic metamorphic zones and subfacies, Nature of metamorphic reactions, Pressure-temperature conditions of metamorphism, Metasomatism
- Unit-III :** Isoreaction grid, Schreinmake's rule and construction of petrogenetic grids; Metamorphic differentiation.
- Unit-IV :** Anataxis, Regional metamorphism and paired metamorphic belts in reference to plate tectonics. Origin of migmatites in the light of experimental studies.
- Unit-V :** Pressure, temperature and time paths; Ultra high temperature, ultra high pressure .Ocean floor metamorphism& its types Shock metamorphism, polymetamorphism
- Practicals :** Megascopic and microscopic study of metamorphic rocks of different facies. Graphic construction of ACF, AKF and AFM diagrams and their interpretation

**Books :**

- (1) Turner, F.J. 1980 : Metamorphic Petrology, McGraw Hill; New York.
- (2) Yardley, B.W., 1989 : An Introduction to Metamorphic Petrology, Longman, New York.
- (3) Bucher, K. and Frey N. 1994 : Petrogenesis of Metamorphic rocks, Springer-Verlag.
- (4) Kretz, R. 1994 : Metamorphic Crystallization, John Wiley.
- (5) Philipotts, A. 1992 : Igneous and Metamorphic Petrology, Prentice Hall
- (6) Best, M.G. 1986: Igneous and Metamorphic Petrology, CBS Publ.

### PAPER - VII SEDIMENTOLOGY

- Unit-I :** Process of sedimentation - surface processes and rock weathering, mineral stability and source of sediments; Grain size analysis- phi scale, grain size measurement, sieving technique, settling technique; Graphic presentation of grain size data - histogram, frequency curve, cumulative curve; statistical parameter of grain size - mode, mean, standard deviation, skewness, kurtosis.

- Unit-II :** Classification and composition of sandstone, limestone, mud rock and conglomerate. Diagenesis of sandstone and limestone. Origin and significance of trace fossils - preservational and behavioral classifications; Classification and significance of sedimentary structures.
- Unit-III :** Sedimentary environment and facies: alluvial-fluvial, desert, aeolian, glacial, shallow marine and deep marine.
- Unit-IV :** Palaeocurrent and basin analysis, Stromatolite origin and significance, Heavy mineral analysis, Preparation of litho logs, Rock and thin section staining, Cathodoluminescence, X-ray identification of clay minerals.
- Unit-V :** Tectonics and sedimentation of sedimentary basin - down warp basin, rift basin, interior basin, foreland basin, sub-duction basin, pull apart basin, delta type of basin, composite basin.

**Practicals :**

- Petrography and diagenesis of arenaceous, argillaceous and calcareous rocks.
- Identification of important heavy minerals.
- Exercise on granulometric data.

**Books :**

- (1) Allen, J.R.L. 1985 : Principles of Physical Sedimentation, George Allen & Unwin.
- (2) Allen, P. 1997 : Earth Surface Processes, Blackwell.
- (3) Nichols, G. 1999 : Sedimentology and Stratigraphy, Blackwell.
- (4) Reading, H.G. 1996 : Sedimentary Environment, Blackwell.
- (5) Davis, R.A. Jr. 1992 : Depositional Systems, Prentice Hall.
- (6) Einsele, G., 1992 : Sedimentary Basins, Springer Verlag.
- (7) Reineck, H.E. and Singh, I.B. 1980 : Depositional Sedimentary Environments, Springer-verlag.
- (8) Prothero, D.R. and Schwab, F., 1996 : Sedimentary Geology, Freeman.
- (9) Miall, A.D. 2000 : Principles of Sedimentary Basin Analysis, Springer-Verlag.
- (10) Blatt, H., Murray, G. V. and Middleton, R.C. 1980 : Origin of Sedimentary rocks.
- (11) Bhattacharya, A. and Chakraborti, C., 2000 : Analysis of Sedimentary Successions. Oxford-IBH.
- (12) Boggs Sam Jr., 1995 : Principles of Sedimentology and Stratigraphy, Prentice Hall.
- (13) Sengupta S., 1997 : Introduction to Sedimentology, Oxford-IBH.

- (14) Bathurst, R.G.C. (1975) Carbonate Sediments and their Diagenesis, Elsevier Amsterdam 2nd edition
- (15) Procedures in sedimentary petrology Carver R.E. (1971) Wiley-Interscience, New York
- (16) Microfacies analysis of limestones Flugel, E. (1982) Springer, Berlin
- (17) Petrology of sedimentary Rocks, Folk, R.L. (1974) Hemphills, Austin, Texas.
- (18) Introductory Petrography of fossils, Horowitz, H.S. and Potter, P.E., (1971) Springer, Berlin.,
- (19) Sand and Sandstone, Pettijohn, F.J. Potter, P.E. and Siever, R., (1973) Springer, Berlin.
- (20) Calcareous Algae. Wray, J.L. , (1977) Elsevier, Amsterdam.
- (21) Miscellaneous- Trace Fossils and Problematica, In Teichert C.(Ed): Treatise on Invertebrate Palaeontology. Part W. Supplement 1, Hantzschel, W (1975). Geol Soc. Am., New York and Univ. Kansas, Press, Lawrence .
- (22) Trace Fossils. Crimes, T.P (ed.) (1970) Liverpool: Seal House Press.
- (23) Trace fossils-2 Crimes, T.P. and Harper, J.C. (1977) Liverpool: Seal House Press.
- (24) Methods for the study of sedimentary structures Bouna, A.H.(1969) Wiley Interscience, New York .
- (25) Microscopic Sedimentary Petrology, Carozzi, A (1960) John Wiley, New York.
- (26) Basics of Physical Stratigraphy and Sedimentology, Pritz, W.J. and Moore J.N. (1988) John Wiley and Sons, Inc. New York.
- (27) Terrigenous Clastic Depositional Systems. Galloway, E.E. and Hobday S.K. (1983) Springer, Verlag, New York.
- (28) Mechanics of Sediment Transportation and Alluvial Stream Problems. Garde, R.J. and Ranga Raju, K.G. (1977) (A Halsted Press Book) John Wiley & Sons, Inc. New York.
- (29) Facies Models, 2nd ed. Walker, R.G. (ed.) Geol. Assoc of Canada, Toronto, Ont.
- (30) Atlas of Quartz Sand Grain Surface Textures Kinsley D.H. and Doornkamp, J.C. (1973) Cambridge Earth Science Series, Cambridge Uni., Press New York.
- (31) Manual of Sedimentary Petrography. Krumbein, W.C. and Pettijohn, F.J. (1983) Appleton Century Crofts, New York.
- (32) Stratigraphy and Sedimentation Krumbein, W.C. and Sloss, L.L. (1951) W.H. Freeman and Co., San Francisco 2nd ed. (1963)

- (33) Fluvial Processes in Geomorphology, Leopold, L.B. Wolman, M.G. and Miller, J.P. (1964) Freeman, San Francisco.
- (34) Fluvial Sedimentology. Miall A.D. (ed) (1978) Canadian society of petroleum Geologists. Calgary.
- (35) Principles of Sedimentary Basin Analysis Miall, A.D. (1984) 2nd ed. (1989) Springer, New York.
- (36) The Encyclopedia of Sedimentology, Fairbridge, F.W. and Bourgeois Joanne (eds) Dowden, Hutchinson & Ross, Stroudsburg.
- (37) Paleocurrent and Basin Analysis. Potter, P.E. and Pettijohn, F.J. (1963), Sorubger- verlag, New York
- (38) Sedimentology of shale, Potter P.E. Maynard J.B. and Pryor, W.A. (1980) Springer-verlag New York.
- (39) An Introduction to Sedimentology. Selley, R.C. (1976) Academic Press London.
- (40) Principles, Methods and Application of Particle size Analysis, Syvitski, J.P.M. (ed.) (1991) Cambridge university press, Cambridge.
- (41) Physical Processes of Sedimentation. Allen J.R.L. (1970) London: George Allen & Unwin.
- (42) Particle Size Measurements. Allen, T (1968). London: Chapman & Hall.
- (43) Principles of Chemical Sedimentology, Berner, R.A. (1971) New York: McGraw- Hill.
- (44) Early Diagenesis: Theoretical Approach. Berner, R.A. (1980) Princeton, N.J. Princeton Univ. Press.
- (45) Salt Deposits. Borchert, H. and Muri R.O. (1969) London : Van Nostrand Reinhold.
- (46) Sedimentary structures. Collinson, J.D. and Thompson, D.B. (1982) London, George Allen & Unwin.
- (47) Beach and Nearshore Sedimentation, Davis, R.A. and Fittington, R.L. (1976) SEPM Soc. Pub. no. 24 Tulsa.
- (48) Coastal Sedimentary Environments. Davis, R.A. (ed.) (1978) New York : Springer.
- (49) Chemical Oceanography. Riley J.P. and Skerrow, G. (eds). London, Academic Press.
- (50) The study of Trace Fossil, Frey, R.W. (1975) Berlin: Springer.
- (51) Tidal Deposits. Ginsburg, R.N. (ed.) (1975) Berlin Springer.
- (52) Desert Sedimentary Environments. Glennie, K.W. (1970) Amsterdam: Elsevier
- (53) Clay Mineralogy, Grim, R.E. (1968) 2nd edn, New York: McGraw-Hill

- (54) Nearshore Sediment Dynamics and Sedimentation. Hails, J and Carr, A (eds) (1975). London: Wiley
- (55) Introduction to Geochemistry. kraeskp. K. B. (1979) 2nd edn. New York : McGraw. Hill.
- (56) Sedimentary Carbonate Minerals, Lippmann, F (1973) New York : Springer
- (57) Recognition of Invertebrate Fossil Fragments in Rocks and Thin Sections. Majewrke, D.P. (1969) Leiden : Brill.
- (58) Modern and Ancient Lake Sediments, Matter, W A and M.E. Tucker (eds) (1978) Int. Ass. sed. Spec. Pubn. No,2
- (59) Recognition of Ancient Sedimentary Environments, Rigby J.K. and Hanblin W.K. (eds) SEPM Spec. Pubn. No.16
- (60) Ecology and palaeoecology of marine environments, Schafer, W (1972) Edinburg : Oliver & Boyd.
- (61) A colour illustrated guide to carbonate rock constituents, textures, cements and porosities. scholle. P.A. (1978) Mem 27, Tulsa, Okla : AAPG.
- (62) Fluvial Geomorphology, Morisawa M. (Ed) London, George Allen G., Unwin.

### PAPER - VIII GEOMORPHOLOGY AND FIELD GEOLOGY

- Unit-I :** Fundamental concepts of geomorphology; Geomorphic agents and processes - exogenetic, endogenetic and extraterrestrial; Rock weathering and mass wasting; Cycle of erosion, rejuvenation and peneplanation, Karst topography.
- Unit-II :** Fluvial Geomorphology & Drainage system and pattern; Morphometric analysis- basic principles and techniques of river basin analysis; Stream meandering, River terraces analysis and their significance, Fluvial land forms.
- Unit-III:** Geomorphic features of India. Arid, eolian, glacial, volcanic and coastal land forms; Ocean floor topography. Principles and applications of GIS in geomorphology.
- Unit-IV:** Importance and scope of field geology, Study of outcrops, Field observations, Topographic forms, Reconnaissance survey, Topographic maps, Profile section, Interpretation of contour maps, Mapping and analysis of sedimentary, igneous & metamorphic terrains.
- Unit-V :** Geological surveying, Plane table survey, Use of Brunton compass, Clinometer, Prismatic compass, Abney level, Dumpy

level and Theodolite. Air reconnaissance. Air photography & AIV mapping, Stereoscope and stereoscopic vision.

**Practical :** Exercise on morphometric analysis of river basins. Use of clinometer, Brunton compass. Prismatic compass, Abney level, Dumpy level, Theodolite & Plane table.

#### **Books :**

- (1) Surveying Vol.-I & Vol.-II, Kanetkar Kulkarni
- (2) Surveying, Punmia.
- (3) Field Geology - Lahee 1987 CBS Pub New Delhi.

### M.Sc. PART-II SEMESTER-III PAPER-IX STRATIGRAPHY

- Unit-I :** Nomenclature and modern stratigraphic code: lithostratigraphy, biostratigraphy, magnetostratigraphy, event stratigraphy, pedostratigraphy, sequence stratigraphy, geochronology and chronostratigraphy.
- Unit-II :** Stratigraphy, economic significance and correlation of Archaean and Precambrian sequences of Dharwad and Central India, Vindhyan, Cuddapah, Delhi and extra-peninsular part.
- Unit-III :** Stratigraphy, economic significance and correlation of Mesozoic sequences of India - Triassic of Spiti, Jurassic of Cutch and Rajasthan, Cretaceous of south India. Gondwana Super group including palaeoclimate and flora.
- Unit-IV :** Stratigraphy, economic significance and correlation of Tertiary group of rocks- Siwalik, Assam and Andaman-Nicobar.
- Unit-V :** Rise of Himalaya, Precambrian- Cambrian boundary, Permian-Triassic boundary, Age and stratigraphy of Deccan volcanics, Cretaceous-Tertiary boundary.
- Practical :** Preparation of palaeogeographic and stratigraphic maps of important periods of earth history.

#### **Books :**

- (1) Boggs, Sam Jr., 1995 : Principles of Sedimentology and Stratigraphy, Prentice Hall.
- (2) Doyle, P. and Bennett., M.R. 1996 : Unlocking the Stratigraphic Record, John Wiley.
- (3) Brenner, R.E. and McHargue, T.R. 1988 : Integrative Stratigraphy : Concepts and Applications, Prentice Hall.
- (4) Naqvi, S.M. and Rogers, J.J.W. 1987 : Precambrian Geology of India, Oxford Univ., Press.

- (5) Pascoe, E.H. 1968 : A Manual of Geology of India and Burma, Vol.I -IV Govt. of India Press.
- (6) The Nature of Stratigraphical record. Ager D.V. (1973) London: Macmillan.
- (7) Dynamic Stratigraphy, Mathews, R.K. (1974) Englewood cliffs, N.J. Prentice Hall.

### PAPER - X ORE GEOLOGY AND MINING GEOLOGY

- Unit-I** : Introduction to Ore Geology- Modern concepts of ore genesis; Mode of occurrence of ore bodies. Morphology and relationship of host rock, Wall-rock alteration. Classification of ore deposits. Ore deposits and plate tectonics.
- Unit-II** : Texture, paragenesis; Paragenetic sequence and zoning of ores. Ore bearing fluids, movement. Origin and migration. Structural, physiochemical and stratigraphic control of ore localization. Chemical composition of ores. Fluid inclusion in ores - principles, assumption, limitation and application.
- Unit-III** : Trace elements. Rare earth elements. Stable isotopes study of oxygen-hydrogen isotopes, Sulphur isotopes, Carbon isotopes, Radio isotopes; Study of rubidium - strontium, uranium-thorium - lead isotopes.
- Unit-IV** : Petrological ore association. Orthomagmatic ores of mafic felsic association - diamonds in Kimberlites; chromite; Cyprus type Cu-Zn; Kiruna type Fe-P; Pegmatites, Skarns. Porphyry association. Ores of sedimentary affiliation. Ores of metamorphic affiliation.
- Unit-V** : Application of rock mechanics in mining. Planning. Exploration and exploratory mining surface and underground mineral deposits. Diamond drilling, shaft sinking, drifting, cross cutting, winzing, stopping, room and pillaring, top-slicing, sub level, caving & block caving. Cycles of surface and underground mining operation. Exploration for placer deposits. Open pit mining. Ocean bottom mining. Types of drilling methods.
- Practicals:** Megascopic study of structures and fabrics of different ores with their association and uses. Mineralogical and textural studies of common ore minerals under ore-microscope. Exercise on mine sampling and determination of tenor, cut-off grades and ore reserves.

### Books:

1. Craig J.M. Vaughan D.J. 1981 : Ok Petrography and Mineralogy. John Wiley
2. Evans AM 1993, Ok Geology and Industrial Mineral Blackwell.
3. Sawakins F.J. 1984 Metal deposits in relation to Plate tectonics, Springer Verlag
4. Stanton R.L. 1972 Ok Petrology. Mc Graw Hill.
5. Torling DH 1981. Economic Geology and Geotactonics, Blackwell Sci.publ.
6. Branes, H.L. (1979): Geochemistry of Hydrothermal Ore Deposits, John Willey.
7. Klam D. Sch neider H J 1977 Time and Strata Bound ok deposits, Springer Verlag
8. Guel bert J M and Park Jr.C.F. 1986. Te Geology of ore deposits, Freeman Press
9. Mukherjee A. 2000 ok genesis - A Holstic Approach. Allied Publishers.
10. Mc Kinstry HE 1962 Mining Geology IIEd Asia Publishing House
11. Clark GB 1967 Elements of Minng III Ed John Wiley
12. Arogya Swami RPN 1996 Courses in Mining Geology IV Ed Oxford IBH
13. Cuilbert, J.M. and Park, Jr. C.F. (1986): The Geology of Ore Deposits, Freidman.
14. James R. Craig and David J. Vaughan (1994): Ore Microscopy and Petrography.
15. Ramdhor, P. (1969): The Ore Minerals and their Intergowths, Pergamon Press.
16. Wolf, K.H. (1976-1981): Hand Book of Stratabound and Stratiform Ore Deposits, Elsevier Publ..

### PAPER - XI HYDROGEOLOGY

- Unit-I** : Hydrologic cycle and processes : Groundwater origin, types, importance. Water bearing properties of rocks - porosity, permeability, specific yeild, specific retention, hydraulic conductivity, transmissivity and storage coefficient. Water table contour maps and their interpretation, Flactuation of water table
- Unit-II** : Groundwater flow - Darcy's law and its applications, formation constant, flow through aquifers, storage equation, differential equation governing goundwater flow. Evaluation of aquifer properties- aquifer test, confined, semi confined and



unconfined aquifers, bounded and leaky aquifers, partially penetrated aquifers; Water well technology : well types, drilling methods, construction, design and development of wells.

**Unit-III :** Quality of ground water - physical and chemical qualities. Presentation of the results of chemical analysis. Diagrammatic representation of geochemical data. Quality standard of ground water in domestic, agriculture & industries. Sodium absorption ratio, permeability index, CPHEEO standards for drinking water

**Unit-IV :** Groundwater exploration - geomorphic and geologic control on groundwater. Groundwater provenances of India. Geologic and hydrologic methods, Surface geophysical methods, Geophysical well logging.

**Unit-V :** Groundwater development and management groundwater recharge, discharge and balance. Estimation of recharge components. Estimation of groundwater discharge. Groundwater resource evaluation.. Artificial recharge - spreading methods, induced recharge, recharge well method, sub-surface, dams etc. Conjunctive and consumptive use, water logging problems, Rainwater harvesting, Watershed management

#### **Practical : Hydrogeology**

Well Inventory Data Collection.

Preparation and interpretation of water table contour maps. Fence diagrams, groundwater budgeting. Estimation of Porosity and Permeability. Physical analysis of water. Pumping test, groundwater provinces of India.

#### **Books :**

- (1) Todd D.K. 1980 : Groundwater Hydrology, John Wiley.
- (2) Davies, S.N. & De Weist, R.J.M., 1966 : Hydrology, John Wiley.
- (3) Freeze R.A. & Cherry J.A. 1979 : Ground Water, Prentice Hall.
- (4) Fetter, C.W., 1990 : Applied Hydrogeology, Merrill Publishing.
- (5) Raghunath N.M. 1982 : Ground Water, Wiley Eastern.
- (6) Karanth, K.R. 1987 : Groundwater Assessment - Development and Management. Tata Mc-Graw Hill.
- (7) Alley, W.M. 1993 : Regional Ground Water Quality : VNR, New York.
- (8) Subramaniam, V., 2000 : Water, Kingston Publ., London.
- (9) G Matthes, F.H. Frimel. Progress in Hydrogeochemistry Springer Publ

- (10) Gunture Faure. Principals in Isotope Geology(1977) Willey
- (11) Gautam Mahajan Ground water recharge 1993 Ashish Pub Hs. New Delhi.
- (12) W.A. Petty John Introduction to the Artificial Ground water recharge 1988 Scientific Pub Jodhpur
- (13) M.L. Sharma Ground water recharge 1987 AA Balkems Austeliya
- (14) Chow, V.T., 1988 : Advanced in Hydrosience, McGraw Hill.
- (15) Walton, W.C., 1988 : Ground Water Resource Evaluation, McGraw Hill.
- (16) Black, W. & others (Ed.), 1989 : Hydrogeology, Geol. Soc. of America Publ.
- (17) Mahajan G., 1990 : Evaluation and Development of Ground Water, D.K.Publisher.
- (18) Singhal, B.B.S., 1986 : Engineering Geoscience : Savita Prakashan.
- (19) Domenico, P.A. & Schwartz F.W. : Physical and Chemical Hydrogeology, John Wiley and Sons.
- (20) S.P.Garg Groundwater & Tube wells Oxford & IBH
- (21) S M Garg Hydrology & water resource Engn 1996 Khanna Pub. Delhi
- (22) Patel A.S. Water Management
- (23) Murti J.S. Water Shade Management
- (24) Franklin. W.Schawartz 7Hubao Zhang2003 : Fundamental of ground Water Willey Publ.
- (25) Sharma R.K., Sharma T.K.2000;Text book of hydrogeology and water resources Enng Dhanpatrapublications

#### **PAPER - XII**

#### **EXPLORATION METHODS**

- Unit-I :** Geological exploration: Prospecting and exploration - Scope of prospecting and exploration. Surface and subsurface methods. Guides for mineral search-physiographic, stratigraphic, lithological, mineralogical and structural Control of ore localization. Pitting, trenching, and drilling for prospecting, diamond and churn drilling. Sampling methods, Calculation of grade and ore reserves.
- Unit-II :** Electrical methods: resistivity methods - Principles, instruments, field procedures, interpretation and applications. Electromagnetic methods: Principles, instruments, lateral exploration, electromagnetic depth soundings, interpretation

and applications. Induced Polarization methods: Principles, Instruments, field procedures, interpretation and applications, self potential method.

**Unit-III :** Magnetic methods: Principles, instruments, field procedures, reduction of data, preparation of magnetic anomaly maps and profiles, airborne magnetometers, data interpretation and its applications.

Gravity methods: Principles, instruments, field procedures, reduction of gravity datum, gravity anomaly maps, data interpretation and applications.

Well Logging Methods: Classification of well logging methods. Electrical logging - Self potential logging, resistivity logging, induction logging; Radioactivity logging - Sonic logging Interpretations and applications of well logging methods.

**Unit-IV :** Seismic methods - Refraction methods - principle, instruments equipments; Operational Methods - Fan shooting, arc shooting, profile shooting, correlation method of refracted waves, reduction of data, interpretation of data and applications. Seismic surveys, velocity determination, elevation and weathering corrections, data processing, plotting of depth sections, interpretation and applications.

**Unit-V :** Geochemical exploration - Geochemical principles - Geochemical cycle, primary and secondary dispersion patterns, geochemical anomalies and background values, geochemical surveys. Biogeochemical prospecting. Geochemical Prospecting for minerals, oil and natural gas.

#### Practicals:

Problems in interpretation of geophysical logs for geological purpose.  
Problems in geological interpretation of geophysical data (gravity, magnetic, electrical, seismic) in mineral exploration.

Problems in geological interpretation of geochemical data in mineral exploration.

Problems on computation of ore reserves and sampling calculations.

#### Books:

- (1) Sharma P.V., 1986 : Geophysical Methods in Geology, Elsevier.
- (2) Sharma, P.V. 1997 : Environmental and Engineering Geophysics, Cambridge University, Press.
- (3) Vogelsang, D., 1995 : Environmental Geophysics - A Practical Guide, Springer Verlag.

- (4) Dobring, M.B. 1976 : Introduction to Geophysical Prospecting, McGraw Hill.
- (5) Parasins, D.S., 1975 : Principles of Applied Geophysics, Chapman and Hall.
- (6) Stanisalve, M. 1984 : Introduction to Applied Geophysics, Reidel Publ.
- (7) Krynine, D.H. and Jdd., W.R. 1998 : Principles of Engineering Geology, CBS Editon.
- (8) Arogyaswami, R.P.N. (1996): Courses in Mining Geology, Oxford and IBH Publ.
- (9) Bagchi, T.C., Sengupta, D.K., Rao, S.V.L.N. (1979): Elements of Prospecting and Exploration, Kalyani Publ.
- (10) Banerjee , P.K. and Ghosh, S. (1997): Elements of Prospecting for Non-fuel Mineral deposits, Allied Publ.
- (11) Chaussier, Jean ó Bernard and Morer, J. (1987): Mineral Prospecting Manual., North Oxford Academic.
- (12) Dhanraju, R. (2005): Radioactive Minerals, Geol. Soc. India, Bangalore.
- (13) Mineral Concession Rules 1960 (2005), IBM, Nagpur.
- (14) Rajendran S. (2007): Mineral Exploration: Recent Strategies.
- (15) Sinha, R.K. and Sharma, N.L. (1976): Mineral economics, Oxford and IBH Publ.

### M.Sc. PART-II SEMESTER - IV PAPER - XIII REMOTE SENSING AND GIS

**Unit-I :** Principles of remote sensing. Electromagnetic spectrum ó characteristics, remote sensing regions and bands; Photogrammetry. Aerial photos ó types, scale, resolution, properties of aerial photos, stereoscopic parallax, relief displacement Remote sensing Satellite. Global and Indian space missions. Image characters and their relations with ground object based in tone, texture and pattern.

**Unit-II :** Multispectral Sensors : Multispectral remote sensing, multiband cameras, opto-mechanic scanners, modular multispectral scanners, landsat multispectral scanners, thematic mapper, linear imaging self-scanning sensors.

Microwave remote sensing : Microwave radiometer, sidelooking airborne radar, syntheti caperture radar, wind scatterometer, radar polarimetry, radar interferometry.



**Unit-III :** Digital image processing : Introduction, characteristics of digital images, pixel parameters. Image processing techniques applied to satellite imagery - image reduction, image magnification, image enhancement, contrast enhancement, ratioing, principal component analysis. Filtering techniques - discrete linear operations, spatial smoothing operators, spatial sharpening operators, edge detection. Classification / pattern recognition. Configuration of digital analysis system : Hardware and software - Image processing system. Characteristics of Arc view, Arc info, Map info.

**Unit-IV :** Geological applications : Image elements - tone, colour, texture, pattern, shape, size, shadows, sites, associations. Terrain elements - drainage patterns, drainage density, landforms, erosion. Remote sensing for lithological discrimination and geological mapping. Application of thermal remote sensing in geology - basic concepts, thermal properties of material, atmospheric windows for thermal infrared remote sensing.

**Unit-V :** Geographical information system : Definition and importance of GIS; Data input and output; GIS data - Types, representation and sources; Data acquisition, verification and editing, georeferencing, GIS data base and data base management system; Spatial data analysis : Terminology, measurement of length, perimeter and area, reclassification, buffering and neighborhood functions, data interpretation map overlay, spatial interpolation, surface analysis, network analysis, digital terrain visualization.

**Practical :**

Interpretation of aerial photographs and satellite imageries of Geological structure, lithology, landforms, minerals, soils, groundwater; Application of GIS in geological studies.

**Books :**

- (1) Millerm, V.C. 1961: Photogeology, McGraw Hill.
- (2) Sabbins, F.F., 1985: Remote Sensing - Principles and Applications, Freeman.
- (3) Ray, R.G. 1969: Aerial Photographs in Geology, Interpretations, USGS Prof. Paper 373.
- (4) Drury, S.A. 1987: Image Interpretation in Geology, Allen and Unwin.
- (5) Moffit, F.H. and Mikhail, E.M. 1980: Photogrammetry, Harper and Row.
- (6) Lillesand, T.M. and Kieffer, R.W. 1987: Remote Sensing and Image Interpretation, John Wiley.

- (7) Paine, D.P. 1981: Aerial Photography and Image Interpretation for Resource Management, John Wiley.
- (8) Pandey, S.N. 1987: Principles and Applications of Photogeology, Wiley Eastern, New Delhi.
- (9) Gupta, R.P. 1990: Remote Sensing Geology, Springer Verlag.
- (10) Kang-tsung Chang 2006: Introduction to Geographic Information System, Tata McGraw Hill.
- (11) Chandra A.M. and Ghosh S.K. (2006): Remote Sensing & GIS, Narosa Pub. House, New Delhi.
- (12) Preben: Future Trends in Remote Sensing, T & F Publishers
- (13) Verbyala: Satellite Remote Sensing of Natural Resource, T & F Publisher
- (14) Chandra A. M. (2006): Remote Sensing & GIS, Narosa Publishing House. Delhi.

**PAPER - XIV**

**ENVIRONMENTAL GEOLOGY AND ENGINEERING GEOLOGY**

**Unit-I :** Concept and principle of environmental geology. land capability classification; Landuse pattern. Assessment of impact of landuse & reclamation of land. Soil : Soil as a resource-nature, profile, origin and classification. Soil conservation, soil weathering; soil degradation and remedial measures. Desertification and degradation of land, causes of desertification, measures to combat desertification. Organic and inorganic contaminations of ground water and its remedial measures.

**Unit-II :** Impact of man on environment. Open cast mining & quarrying, Disposal of industrial & radioactive waste, Fertilizer and pesticides. Impact of mining activities on the environment. Environmental impact assessment and management of mining areas, dumping of overburdens. Global warming. Green house effect.

**Unit-III:** Earthquake and seismic hazards; Origin and severity of earthquake, effects of earthquakes, seismic zones of India. Landslides : Destabilizing forces, Types,. Identification of landslide zones. Controlling landslides - methods for prevention or control of landslides. Floods and Floods Management : Causes of floods of excess flows, reduced carrying capacity of rivers, runoff versus infiltration, Management of floods - reservoirs, water spreading, groundwater recharge, stream channelization, flood embankments, hazard zoning and flood forecasting and warnings.

**Unit-IV :** Engineering Properties and Classification of Rock Masses: Strength characteristics - unconfined compressive strength, uniaxial tensile strength, shear strength, Deformational characters - modulus of elasticity, poisson ratio., Residual stress Engineering classification of rock masses ó Classification based on strength and modulus, rock quality designation, rock structure rating, rock mass rating system, rock quality index system. Susceptibility of rocks towards weathering, test for assessing weathering, Engineering classification of weathered rock masses.

**Unit-V :** Site Investigation and ground Improvement : Geological investigation, geophysical investigation, drilling and logging. Ground improvement - grouting, types, procedures, grouting applications.

Geology investigation for dams and reservoirs sites : types of dams, forces acting on a dam, geological consideration, geological investigation for site location, seepage problem, silting problem. Geology investigation for tunnel alignment : types of tunnels, geological consideration, geological investigation for tunnel alignment, excavation through blasting, stress distribution during excavation, ground failure in tunnels, tunnel supports. Methods of tunnelling in hard rocks and in Soft soils

#### **Practicals :**

Study of maps and models of importance engineering structure as dam sites & tunnels.

Interpretation of geological maps for land slide problems.

Study of properties of common rock with reference to their utility in engineering project.

Physical and chemical analysis of ground water. Piper Diagrams, SAR Problems

Classification of ground water for use in drinking, irrigation in Industrial.

#### **Books :**

- (1) Valdiya, K.S., 1987 : Environmental Geology - Indian Context. Tata McGraw Hill.
- (2) Keller, E.A., 1978 : Environmental Geology, Bell and Howell, USA
- (3) Bryant, E., 1985 : Natural Hazards, Cambridge University Press.
- (4) Patwardhan, A.M., 1999 : The Dynamic Earth System, Prentice Hall.
- (5) Subramaniam, V., 2001 : Text Book in Environmental Science, Narosa International.
- (6) Bell, F.G., 1999 : Geological Hazards, Routledge, London.

- (7) Smith, K. 1992 : Environmental Hazards, Routledge, London
- (8) Vogelsang, D., 1995 : Environmental Geophysics - A Practical Guide, Springer Verlag.
- (9) Krynine, D.H. and Judd.W.R., 1998 : Principles of Engineering Geology, CBS Edition.
- (10) Reddi MTM A Text Book of Applied Engineering Geology
- (11) Goel P.K. Water Pollution - causes, effect & Control

#### **PAPER - XV**

##### **INDIAN MINERAL DEPOSIT AND MINERAL ECONOMICS**

**Unit-I :** Process of formation of mineral deposits : magnetic concentration, sublimation, contact metasomatism, hydrothermal, sedimentation, bacteriogenic, submarine exhalative and volcanogenic, evaporation, residual and mechanical concentration, oxidation and supergene enrichment.

**Unit-II :** Classification of mineral deposit, wall rock alteration; Mineralogy, mode of occurrence, origin, geological association, geographical distribution and use of gold, copper, lead, zinc, aluminum, magnesium, iron, manganese, chromium, nickel.

**Unit-III :** Mineralogy, mode of occurrence, origin, geological association, geographical distribution and use of atomic minerals, ceramic materials, metallurgical and refractory materials; Industrial and manufacturing materials; Abrasive and abrasion minerals.

**Unit-IV :** Mineral economics and its concept, Mineral Legislation in India, Economic consideration in mineral exploration, National mineral policy, Mineral processing, Economics of mineral production, Co-products-byproducts of mining and mineral processing, Mineral dressing.

**Unit-V :** International scenario of mineral wealth; Strategic, critical and essential minerals of India, War minerals, Internal and external mineral trade, consumption and substitution of minerals, economical mineral conservation.

#### **Books:**

- (1) Sinha and Sharma: Economics Geology
- (2) Umeshwar Prasad (1996) : Economic Geology, CBS Publication, New Delhi .
- (3) Chatterjee, K. K. ((1993): An introduction to Mineral Economics, Wiley Eastern Limited.
- (4) Jain, S. K. (2001): Mineral Processing, PB Publication.
- (5) S.K. Babu, D.K. Sinha (1988) - Practical Manual of Exploration & prospecting, CBS New Delhi

- (6) A.H.G. Mitchell & M.S. Garson (1981): Mineral Depositor & Global tectonics Setting, Academic press, London.
- (7) Dannel Muller David Groves: Pottassic Igncous Rock & Associated Gold Copper Mineralization (3rd Edn Springer)
- (8) James R. Graig & David J. Vaughan (1981): Ore Microscopy and Ore Petrology, Wiley Eastern Limited.
- (9) G.D.Price N.L. Rose (1992): The Stability of Minerals, Chapman & Hall
- (10) U. Aswathanarayana : Principles of Nuclear Geology, Oxonian Press, New Delhi.

### PAPER - XVI

#### PETROLEUM AND COAL GEOLOGY

- Unit-I :** Petroleum: Origin, chemical composition, Occurrence. Reservoir rocks : general attributes and petrophysical properties. Classification of reservoir rocks-fragmental and chemical reservoir rocks. Reservoir rocks ó petrology, porosity and permeability; Reservoir traps ó structural, stratigraphic and combination traps. Migration of oil and gas: primary and secondary migration.
- Unit-II :** Hydrocarbon traps: Definition, anticlinal and trap theory, classification of hydrocarbon traps (Structural, stratigraphic and combination), time of trap formation and time of hydrocarbon accumulation, cap rock - definition and general properties. Oil reservoir fluids - water, oil and gas; Oil and source rock correlation.
- Unit-III :** Prospecting for oil and gas, well drilling methods and logging procedures. Coring and core analysis.  
Application of logs in petrophysical and facies analyses. Estimation of oil and gas reserves.  
Geology of the productive oilfields of India. Petroliferous basines of India. Onshore and offshore petroliferousbasins of India; future prospects and the economic scenario of Petrolium.
- Unit-IV :** Coal : Definition and origin of coal; Sedimentology of coal bearing strata. Rank, grade and type of coal. Indian and international classifications. Chemical analysis of coal (proximate and ultimate analysis). Macroscopic ingredient and microscopic constituents, Physical properties of coal. Coal Petrology and its significance in industrial and geological problems. coal carbonization (coke manufacture), coal gasification and coal hydrogenation.

**Unit-V :** Coal bed methane : A new energy resource. Maturation of coal and generation of methane in coal beds. Fundamentals of coal bed methane exploration and production. Coal forming epochs in the geological past. Coal as a source rock for oil and gas; Geological and geographical distribution of coal and lignite deposits in India; Gondwana coals - Classification, Conditions of deposition and petrography. Metho ds of coal prospecting and estimation of coal reserves. Reserves and production of coal in India.

#### Books :

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- (2) Taylor, G.H., Teichmuller, M., Davis, A., Diessel, C.F.K., Littke, R. and Robert, P., 1998 : Organic Petrology, Gebruder, Borntraeger, Stuttgart.
- (3) Chandra, D., Singh, R.M., and Singh, M.P., 2000 : Textbook of Coal (Indian Context), Tara Book Agency, Varanasi.
- (4) Singh, M.P. (Ed.), 1998 : Coal and Organic Petrology, Hindustan Publ. Corp., New Delhi.
- (5) Stach., E., Mackowsky, M.T.H., Taylor G.H., Chandra, D., Teichmuller, M., and Teichmuller, R., 1982 : Stachø Text Book of Coal Petrology, Gebruader Borntraeger, Stuttgart.
- (6) Holson, G.D. and Tiratsoo, E.N., 1985 : Introduction to Petroleum Geology, Gulf Publ. Houston, Texas.
- (7) Tissot, B.P. and Welte, D.H., 1984 : Petroleum Formation and Occurrence, Springer - Verlag.
- (8) Selley, R.C., 1998 : Elements of Petroleum Geology, Academic Press.
- (9) Durrance,, E.M., 1986 : Radioactivity in Geology. Principles and Application. Ellis Hoorwool.
- (10) Boyle, R.W. 1982 : Geochemical Prospecting for Thorium and Uranium Deposits, Elsevier.
- (11) Tissat B.P. and Welte D.N., 1984 : Petroleum Formation and Occurrence, Springer Verlag.
- (12) Leuerson, 2006: Geology of Petrolium 2nd Ed
- (13) Khilyuk Gas Migration : Events Precoding Earthquakes.
- (14) Chilingan Geology and Geochemistry of oil and gas. 2005.

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