SCHOOL OF ENVIRONMENTAL and EARTH SCIENCES
North Maharashtra University, Jalgaon

M. Sc. (Applied Geology)

Semester I
GS 101: Mineralogy and Crystallography.
GS 102: Principles of Stratigraphy and Palaeontology
GS 103: Sedimentology
GS 104: Practicals related to above courses
GS 105: Practicals related to above courses
GS 106: Tutorial 1

Semester II
GS 201: Igneous and Metamorphic Petrology
GS 202: Physics and Chemistry of the Earth.
GS 203: Geomorphology, Structural Geology and Tectonics
GS 204: Practicals related to above courses
GS 205: Practicals related to above courses
GS 206: Tutorial 2

Semester III
GS 301: Indian Stratigraphy.
GS 302: Indian mineral deposits, exploration and mining
GS 303: Remote sensing and GIS
GS 304: Practicals related to above courses.
GS 305: Practicals related to above courses.
GS 306: Seminar 1

Semester IV
GS 401: Petroleum geosciences.
GS 402: Hydrogeology
GS 403: Engineering and environmental geosciences.
GS 404: Practicals related to above courses
GS 405: Dissertation
GS 406: Seminar 2

Note: Industrial training/Geological field mapping/allotted geological project work/ Dissertation is compulsory for M. Sc. (Applied Geology) students.
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**Grand Total: 84**
SEMESTER - I
GS-101: MINERALOGY AND CRYSTALLOGRAPHY

Unit – I: Mineral Optics and Introduction to Instruments
1. Isotropic and anisotropic substances; Reflection, refraction and refractive index; Relief, birefringence and Becke line effect; Optically uniaxial and biaxial minerals; Determination of optic sign of uniaxial and biaxial minerals; interference figures; Pleochroism and determination of pleochroic scheme in minerals
2. X-ray crystallography and Bragg’s equation; Application of X-ray diffraction spectrometry in mineral characterization
3. Application of following techniques in mineralogy: Differential Thermal Analysis (DTA), Thermogravimetric Analysis (TGA), Scanning Electron Microscope (SEM), Transmission Electron Microscope (TEM) and Electron Probe Micro Analyser (EPMA)
4. Application of thermal, magnetic and radioactive properties of minerals.

Unit – II: Introduction to Mineralogy and Study of Non-Silicates
1. Principle of crystal structure; Bonding in minerals; Coordination and co-ordination numbers; Silicate structures and structural formula; Isomorphism and solid solution; Types of ionic substitution; Polymorphism and types of polymorphic transformations and Pseudomorphism Conversions of oxide and element weight percentages; Calculation of mineral formulae.
2. A detailed study of Non-silicates mineral groups with reference to their general formulae, classification, atomic structure, chemistry, experimental work and paragenesis of Non-silicates: Carbonates- Calcite Group, Aragonite Group, Dolomite Group; Phosphates- Apatite, Monazite; Sulphates- Gypsum, Anhydrite, Barite, Alunite Group; Halides- Halite, Sylvite, Fluorite; Nitrates- Trona, Soda niter; Oxides and Hydroxides- Spinel Group, Hematite Group, Rutile Group, Bauxite Group, Periclase.

Unit – III: Mineralogy of Silicates
1. A detailed study of Silicate mineral groups with reference to their general formulae, classification, atomic structure, chemistry, experimental work and paragenesis of Silicates: Nesosilicates- Olivine Group, Garnet Group and Aluminosilicate Group; Sorosilicates- Epidote Group, Scapolite Group; Cyclosilicates- Beryl, Tourmaline; Inosilicates- Pyroxene Group, Amphibole Group; Phyllosilicate- Mica Group, Chlorite Group, Serpentine Group, Pyrophyllite, Talc; Tectosilicates- Quartz, Feldspars, Feldspathoides and zeolite Group.

Unit – IV: Crystallography
1. Crystals, crystalline solids and their formation; Ordered patterns, nets and lattices; Symmetry in crystals; Axial ratio, indices, lettering and
order of the crystallographic axes; Crystallographic notation (Weiss and Miller indices and convention in notation).

2. Classification of crystals, introduction to 32 classes of symmetry; The crystal systems and symmetry types; Stereographic representation of crystal symmetry and their uses; Imperfection of crystals and crystal defects; Twinning- causes, effects and genetic types.

Unit – V: Gemology

1. Physical properties, Optical properties and Chemical properties of inorganic gems like Diamond, corundum, beryl, chrysoberyl, garnet, spinel, topaz, tourmaline, zircon, peridot, jadeite, nephrite, opal, quartz, chalcedony, orthoclase, moonstone, labradorite, lapis lazuli, apatite, cordierite, zoisite, malachite, bowenite, denburite, diopside, enstatite, serpentine, steatite, natural glasses (obsidian and moldavite).

2. Study of Organic gems like Pearl, corals etc., their formation, structure and identification.

3. Introduction to instruments used in the study of gems.

Books Recommended

GS-102: PRINCIPLES OF STRATIGRAPHY AND PALAEONTOLOGY

Unit – I: History and development
1. History and development of Stratigraphy
2. Stratigraphic procedures (Surface and Subsurface)
3. Concept of Litho-facies and Bio-facies

Unit – II: Stratigraphic Correlation
1. Stratigraphic Correlation (Litho-, Bio- and Chrono-stratigraphic Correlation
2. Study of standard stratigraphic code (Lithostratigraphic, Biostratigraphic and Chronostratigraphic)
3. Concepts of Magnetostratigraphy, Chemostratigraphy, Event stratigraphy, and Sequence stratigraphy
4. Techniques in Palaeontology - megafossils - microfossils - nannofossils - ichnofossils - collection, reformation and illustration - binomial nomenclature

Unit – III: Invertebrate Paleontology
1. Invertebrate Paleontology - A brief study of morphology, classification, evolutionary trends and distribution of Molluscs i.e. Bivalves, Gastropods and Cephalopods.
2. Study of morphology, classification, evolutionary trends and distribution of Trilobites, Graptolites, Echinoids, Corals and Brachiopods.

Unit – IV: Vertebrate Paleontology
1. Vertebrate Paleontology - Study of vertebrate life through Geologic time scale.
2. Study of reptiles, birds, fishes and mammals.

Unit – V: Paleontological perspective
1. Introduction to Micropaleontology, Types of Microfossils, Paleopalynology
2. Foraminifera and Ostracods
4. Paleontological perspective : Use of paleontological data in
   a) Stratigraphy   b) Paleo-ecology   c) Paleogeography

Books Recommended

GS-103: SEDIMENTOLOGY

Unit – I: Field procedures
1. Field procedures in Sedimentary Petrology
2. Geologic cycle
3. Sedimentary textures (Granulometric analysis, shape and roundness studies, surface textures)
4. Heavy mineral and Insoluble residue analysis

Unit – II: Petrography
1. Petrography of rocks of clastic, chemical and biochemical origin (Conglomerates, Sandstone, Mudstone, Limestone and Dolomite)
2. Evaporite, Phosphorite, Chert, Iron and Manganese rich sediments
3. Volcanogenic sedimentary rocks

Unit – III: Clastic transport and fluid flow
1. Clastic transport and fluid flow (fluid flow in theory and in nature, Reynold’s Numbers, Froude Number, Sediment lift, transport, deposition, sedimentary gravity flow)

Unit – IV: Sedimentary structures
1. Sedimentary structures (Physical structures, Biogenic sedimentary structures, Diagenetic structures).
2. Sedimentary Textures.

Unit – V: Sedimentation and Tectonics
1. Concept of Sedimentary facies association models (Marine, Nonmarine, and Mixed Depositional Environment)
2. Sedimentation and Tectonics
3. Paleocurrents and Basin Analysis.

Books Recommended
Hota, R.N. (2011) Practical Approach to Petrology, CBS Publisher and Distributors Pvt Ltd., New Delhi
**GS-104: PRACTICALS ON MINERALOGY, CRYSTALLOGRAPHY AND PALEONTOLOGY**

1. Study of interference figures - determination of optical sign of minerals, determination of 2V and 2E, determination of composition of plagioclase feldspars - determination of birefringence of minerals - Scheme of pleochroism
2. Construction of Stereograms and Gnomonograms - measurement of interfacial angle with contact goniometer - study of X-ray diffractograms
3. Study of rock forming minerals in thin sections
4. Study of rock forming minerals in hand specimens
5. Construction of rank charts for lithostratigraphy, biostratigraphy and chronostratigraphy
6. Construction of graphical logs from text descriptions
7. Exercises in correlation from given data or logs
8. Study of palaeontological technique related to megafossils.
9. Study of morphology of Bivalves, Gastropods Echinoids, Brachiopods
10. Separation, Processing, wet sieve analysis, preparation of slides of microfossils.
11. Morphology and morphological descriptions of planktonic and benthonic foraminifera, ostracodes.

**GS-105: PRACTICALS ON SEDIMENTOLOGY**

1. Size Analysis (Procedures, Cumulative curve, Histogram, Visher’s curve and Statistical calculation)
2. Shape analysis (Calculation and Classification)
3. Heavy mineral analysis (Procedure and identification)
4. Insoluble residue analysis (Procedure and identification)
5. Megascopical and studies of conglomerate and breccia
6. Megascopical and microscopic study of sandstone
7. Megascopical and microscopic study of limestone
8. Sedimentary structure (identification and classification)
9. Paleocurrent and basin analysis calculation
SEMESTER – II

GS-201: IGNEOUS PETROLOGY AND METAMORPHIC PETROLOGY

Unit – I: Igneous Petrology
1. Magma- its nature and composition. Factors controlling evolution of magma
2. Classification of Igneous rocks - historic perspective and the IUGS systematic
3. Introduction to mantle petrology mantle metasomatism and mantle heterogeneities;
4. Magmatism in relation to plate tectonics
5. Chemical characteristics of igneous rocks in the following tectonic setting: Mid Oceanic Ridge, Island Arcs, Oceanic plateaus, Continental Margins, Continental Rifts and Continental intraplates; Plume magmatism and hot spots; Large igneous provinces, mafic dyke swarms and layered complexes.
6. Equipments used in petrological study: Scanning electron microscope (SEM), electron Probe Microanalysis (EPMA), Atomic Absorption Spectrophotometry, Inductively Coupled Plasma Mass Spectrometry (ICPMS) and infrared spectrometers.

Unit – II: Igneous Petrology
1. Mantle melting: Partial melting (batch and fractional melting); Crystal fractionation (equilibrium and fractional (Rayleigh) crystallization); Contamination (AFC process) and dynamic melting.
2. Crystallisation of magma, fractional crystallization and differentiation, liquid immiscibility and assimilation. Influence of volatiles and role of oxygen fugacity in magmatic crystallizations.
3. Phase equilibrium studies - binary systems, ternary systems and their relations to magma genesis and crystallization in the light of modern experimental works.

Unit – III: Igneous Petrology
1. Textures and structures of igneous rocks; Petrography and Interpretation of igneous textures in terms of rate of nucleation and crystal growth.
2. Major, Trace and Rare Earth Element systematics in igneous rocks
3. Silica/alumina saturation, variation diagrams (Harker, AFM and TAS diagrams) their applications and limitations; Mg Number, Alteration Index, Saturation Index and other geochemical parameters.
4. Fractional crystallization, liquid lines of descent and lever rule.
5. Indian Igneous Rocks and their genesis
Unit – IV: Metamorphic Petrology

1. Types of metamorphism and their controlling factors
2. Grades of Metamorphism
3. Common minerals of metamorphic rocks
4. Metamorphic Texture and Structures
5. Prograde and retrograde metamorphism, Metasomatism
6. Metamorphic facies

Unit – V: Metamorphic Petrology

1. Phase diagrams and graphic representation of mineral assemblages
2. Metamorphic reactions, elemental exchange and P-T conditions of isograds.
3. Plate tectonics and metamorphic processes.
4. Paired metamorphic belts, Archaean and Proterozoic terrains.
5. Pressure-temperature time paths in regional metamorphic rocks, Polymetamorphism

Books Recommended

- Cox, K. G., Bell, J. D. and Pankhurst, R. J. (1979) The Interpretation of Igneous Rocks, Unwin Hyman.
Harker, Alfred (1964) Metamorphism, Methuen, London.
GS-202: PHYSICS AND CHEMISTRY OF THE EARTH

Unit – I: Universe and Planetary System
1. Origin and components of solar system
2. Meteorites and their classification
3. Earth in relation to the solar system and universe
4. Cosmic Abundances of elements
5. Composition of the planets and meteorites

Unit – II: Physics of the Earth
1. Seismic waves and their velocities
2. Internal structure of the earth,
3. Density distribution, shape and mass of the earth. density Vs depth profile.
4. Gravity and gravitational mechanics, gravity anomalies and their interpretation
5. The earth as Magnet, Earth’s magnetic field, changes in magnetic field, origin of geomagnetic field, palaeomagnetism.

Unit – III: Introduction to Geochemistry
1. Introduction to Geochemistry – its scope, Geochemical Classification of the elements
2. Geochemical Cycle, path finder Elements, threshold values and Mode of Occurrence.
3. Geochemical classification and distribution of elements in the earth
4. Structure and atomic properties of elements
5. The Periodic table
6. Laws of Thermodynamics and phase diagrams
7. Geochemistry of hydrosphere, biosphere and atmosphere
8. Elementary crystal chemistry and thermodynamics

Unit – IV: Geochronology and age of the Earth
1. Law of Radioactivity,
2. Principles of isotopic dating, Decay schemes and Derivation of equation of age.
3. Introduction to isotope geochemistry
4. Rb/Sr, U-Th-Pb methods of dating the rocks.
5. Age of the Earth.
6. Trace elements
**Unit – V: Geochemical Methods**

2. Geological Principles of ore search – Introduction to Assaying and valuation of mineral deposits

**Books Recommended**

GS-203: GEOMORPHOLOGY, STRUCTURAL GEOLOGY AND TECTONICS

Unit – I: Introduction to Geomorphology
1. Introduction to Geomorphology : History, basic concepts type and tools
2. Landforms : Role of lithology, climate and tectonics
3. Denudational processes - weathering, erosion, transportation, weathering products and soils - profiles, types, duricrusts
4. Hillslopes : Their characteristics and development, fluvial processes on hill slopes
5. River and Drainage basin : Drainage patterns, network characteristics, Valleys and their development. Process of river erosion, transportation and deposition

Unit – II: Geomorphic Landforms and Applied Geomorphology
1. Landforms produced by geomorphic agents
   a) Fluvial b) Coastal c) Aeolian, d) Glacial, e) Karst, and Desert landforms
2. Applied Geomorphology : Application of geomorphology in geohydrology, mineral prospecting, engineering geology, watershed management, urban planning and environmental studies
3. Geomorphology of India : Geomorphological features and zones
4. Geomorphic mapping
5. Slope analysis and drainage basin analysis
6. Physiographic zones of Maharashtra
7. Topographical maps

Unit – III: Introduction to Structural Geology
1. Principles of geological mapping and map reading
2. projection diagrams
3. Mechanical principles of rock deformation,
4. Behaviour of rock material under stress, strain analysis
5. Classification and genesis of folds, faults, lineations, foliations, joints and fractures

Unit – IV: Structural Analysis
1. Scope of structural analysis , concept of Tectonite fabric and Tectonite Symmetry
2. Structural analysis on microscopic, mesoscopic and macrosopic scales
3. Introduction to petrofabrics
4. Structural behavior of igneous rocks, diapers and salt domes diapers and salt domes
Unit – V: Tectonics

1. Structure and physical characters of continental and oceanic crust
2. Seismic belts of the earth
3. Continental drift – geological and geophysical evidence, mechanics, objections, present status
4. Sea-floor spreading and Plate Tectonics, Structure and Tectonics of divergent margins, transform faults, convergent margins
5. Geodynamics of the Indian Plate and Tectonic framework of India
6. Heterogeneity of the earth’s crust
7. Seismicity and Plate movements
8. Neotectonics - Features and evidences-characteristic landforms, Methods of analysis
9. Orogeny and epeirogency
10. Isostasy
11. Gravity and magnetic anomalies at Mid-ocean ridges, deep sea trenches, continental shield areas and mountain chains, Island arcs, Oceanic islands and volcanic arcs.

Books Recommended

GS-204: PRACTICALS RELATED TO IGNEOUS AND METAMORPHIC PETROLOGY

1. Characterisation of Igneous rocks, textures and structures.
2. Characterisation of different rock types under microscope.
3. Igneous rocks and Metamorphic rocks
4. CIPW normative calculation for igneous rocks.
5. Variation diagrams (Binary and Ternary)

GS-205: PRACTICALS RELATED TO GEOMORPHOLOGY, STRUCTURAL AND TECTONICS

1. Structural problems by orthographic and stereographic methods.
2. Construction of structural sections and interpretation of geological maps.
3. Plotting and interpretation of mesoscopic structural data
4. Drainage basin and network morphometry
5. Relief and slope analysis - Profiles and maps
6. Identification of landforms on toposheets, aerial photographs and satellite images
7. Study of representative soil profiles
SCHOOL OF ENVIRONMENTAL AND EARTH SCIENCES
North Maharashtra University, Jalgaon

Model for implementation of the

Credit-Grade based Performance and Assessment (CGPA) system

M.Sc. course

In tune with the concept and suggestions of the UGC and NAAC, technological advancement and social needs and to make the teaching effective and meaningful, School of Environmental and Earth Sciences has been permitted to adopt Credit-Grade based Performance and Assessment (CGPA) system from the academic year 2009-2010 for the course M.Sc. (Applied Geology) being run in the school. The modalities and operational details of the credit system shall be as follows.

A. Features of the CGPA System:
1. Master’s degree course, M.Sc. being run in School would be of 84 credits each.
2. One credit for the theory course shall be of the one clock hour per week running for 15 weeks. Thus, each theory course of 4 h per week teaching shall be of 4 credits.
3. Four credits for each practical course shall be awarded to the 8 h of laboratory exercise per week for a semester. As per the guidelines of the work load, each batch for practical course shall consist of 10-12 students and each batch shall perform the laboratory exercise twice in a week. Thus, each practical course shall be of 8 h laboratory exercise per week with 4 credits.
4. Four credits shall be awarded to the Project course, which will commence from III Semester and the final work and report will be completed during IV Semester. The marks and the credits will be allotted in IV Semester.
5. Two credits, one each in first two semesters (i.e. for Semester I and II) have been allocated for the Tutorials/Home assignments. Besides, for every theory course one Take Home Assignments of 25 marks each shall be conducted. Average marks of all the home assignment in the given semester will be considered. No grade will be given for the tutorial. However, the completion of the credit for the tutorial shall be compulsory.
6. Two credits, one each in the III and IV semesters have been allocated for the Seminar. There shall be one seminar per student. Marks out of 25 will be allocated per semester for this as per break up given below in (g). No grade will be given for the seminar. However, the completion of the credit for the seminar shall be compulsory.
7. Every student shall complete 84 credits in a minimum of four semesters. All Semesters will have 21 credits each.
8. Academic calendar showing dates of commencement and end of teaching, internal assessment tests and term end examination shall be duly notified before commencement of each semester every year by the School.
B. Evaluation of the student:

(a) The evaluation of the student shall be divided into two parts viz. *Internal Assessment* and *Term End Examination (semester end examination)* with a weightage in the ratio of 25:75, as approved by the committee.

(b) Standard of passing –

(i) There shall not be pass or fail for the internal assessment. However, the attendance for the internal assessment shall be compulsory.

(ii) Minimum marks for passing the Term End Examination in theory/practical/project course shall be 40%.

(iii) Minimum marks for passing the theory/practical/project course (i.e. sum of the marks obtained in internal and term end examination) shall be 40%.

(c) The distribution of marks for each theory paper of 4 credits at term (Semester) end examination and for continuous internal assessment (Minor tests), as approved by the committee shall be as follows:

<table>
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<th>Theory Examination</th>
<th>Maximum marks</th>
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<td>Internal assessment</td>
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<td>Term end examination</td>
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<td>Total marks</td>
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(d) The distribution of marks for each laboratory course of 4 credits at term (Semester) end examination and for continuous internal assessment (Minor tests), as approved by the committee shall be as follows:

<table>
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<th>Practical Examination</th>
<th>Maximum marks</th>
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<tbody>
<tr>
<td>Internal assessment</td>
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</tr>
<tr>
<td>Term end examination</td>
<td>75</td>
</tr>
<tr>
<td>Total marks</td>
<td>100</td>
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</table>

(e) The Project course will commence from III Semester and the final work and report will be completed during IV Semester. The marks and the credits will be allotted in IV Semester. The distribution of marks for Project course of 4 credits at term (Semester) end examination and for continuous internal assessment (Minor tests), as approved by the committee shall be as follows:

<table>
<thead>
<tr>
<th>Practical Examination</th>
<th>Maximum marks</th>
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<tbody>
<tr>
<td>Internal assessment</td>
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<tr>
<td>Term end examination</td>
<td>75</td>
</tr>
<tr>
<td>Total marks</td>
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(f) Internal Assessment:

(i) Internal assessment for each course would be continuous and dates for each internal test/practical test will be pre-notified in the time table for teaching or placed separately as a part of time table.
Each subject teacher shall coordinate this activity and maintain the record of the internal tests conducted.

(iii) Internal assessment for each course shall be of 25 marks.

(iv) There shall not be pass or fail for the internal assessment. However, the attendance for the internal assessment shall be compulsory.

**For Theory Courses:**

(i) Two internal tests for each theory course comprising of 4 credits shall be conducted by the subject teacher.

(ii) Each test shall be of 25 marks.

(iii) The marks for each test shall be displayed on notice board within seven days of conducting the test.

(iv) It is mandatory to show the answer sheets of all tests to the students.

**For Practical Courses:**
The internal assessment for the practical courses will be based on the following 03 heads:

**For Project course**

(i) The Project course will commence from III Semester and the final work and report will be completed during IV Semester.

(ii) Every student has to undertake a project of interest. The project may be related to a theoretical analysis, an experimental investigation, a prototype design, a new correlation and analysis of data, fabrication and setup new equipment. Ordinarily, the Project Co-ordinator shall be chosen by the student depending on his/her subject interest. The project co-ordinator assigns the topic for the project and the work is done uniformly during both the semesters of the final year.

(iii) The marks and the credits will be allotted in IV Semester.

(iv) On the basis of marks obtained in Seminar, the marks out of 25 will be given for the Seminar.

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<th>Heads</th>
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<td>Performance of the student in the collection of reference material for project work and punctuality</td>
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<td>Concerned Project guide</td>
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<td>Experimental work carried out by the student</td>
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<td>Viva-voce</td>
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</tr>
</tbody>
</table>
For Tutorial:
(i) Two credits based on Tutorial component, one each in I and II semesters will constitute the compulsory part.
(ii) For every theory course one Take Home Assignments of 25 marks each shall be given.
(iii) The evaluation will be based on following two heads:

<table>
<thead>
<tr>
<th>Head</th>
<th>Marks</th>
<th>Evaluating Authority</th>
</tr>
</thead>
<tbody>
<tr>
<td>Take Home Assignment</td>
<td>25</td>
<td>Concerned subject teacher</td>
</tr>
</tbody>
</table>

(iv) On the basis of marks in Tutorials for theory courses, the average will be calculated and the marks out of 25 shall be awarded for the Tutorial.

For Seminar:
(i) Two credits based on Seminar component, one each in the III and IV semesters will constitute the compulsory part.
(ii) Each student shall deliver one seminar per semester and there will be a continuous evaluation of the seminar.
(iii) The evaluation will be based on following four heads:

<table>
<thead>
<tr>
<th>Heads</th>
<th>Marks</th>
<th>Evaluating Authority</th>
</tr>
</thead>
<tbody>
<tr>
<td>collection of reference material for seminar</td>
<td>05</td>
<td>Concerned course teacher</td>
</tr>
<tr>
<td>Content of the seminar</td>
<td>15</td>
<td></td>
</tr>
<tr>
<td>Performance in seminar/presentation</td>
<td>05</td>
<td></td>
</tr>
<tr>
<td>Total marks</td>
<td>25</td>
<td></td>
</tr>
</tbody>
</table>

(iv) On the basis of marks obtained in Seminar, the marks out of 25 will be given for the Seminar.

g) Term end examination:
(i) The term end examination for 75 marks per course would be held about a week after completion of teaching for the semester.
(ii) The term end examination of maximum marks 75 and its assessment work shall be conducted by the School from the academic year 2009-10 under the academic flexibility granted to the School by the University.

For Theory Courses:
(i) The pattern of the question paper for the academic year 2009-2010 remains same as at present.
(ii) Each theory paper of 75 marks shall be of the three hours duration.

For Practical Courses:
(i) The term end practical examination shall be of 75 marks and it is of duration 06 h.
(ii) There shall be two examiners for the practical examination out of which one examiner shall be from the other University/Institute.

For Project course:
(i) The project report should be submitted by the prescribed date. Submission of the project cannot be postponed beyond the date specified in the calendar.
(ii) Students should submit 2 bound typed copies of Project Report to the department. A student who is unable to complete his/her Project may be awarded ‘X’ grade and he/she will be required to register for the next Semester and pay the fees under following circumstances:
Exceptional circumstances beyond students / supervisor control
Medical grounds

(iii) There shall be two examiners for the evaluation of Project, out of which one examiner shall be from the other University/Institute.

(iv) The examiners shall evaluate the report and an oral examination shall be conducted. The assessment of the project work is done on the following basis:

<table>
<thead>
<tr>
<th>Heads</th>
<th>Marks</th>
<th>Evaluating Authority</th>
</tr>
</thead>
<tbody>
<tr>
<td>Performance of the student in the presentation of the project work and report</td>
<td>10</td>
<td>Panel of examiners</td>
</tr>
<tr>
<td>Experimental work carried out by the student</td>
<td>50</td>
<td></td>
</tr>
<tr>
<td>Viva-voce</td>
<td>15</td>
<td></td>
</tr>
<tr>
<td>Total marks</td>
<td>75</td>
<td></td>
</tr>
</tbody>
</table>

C. Grades:
(i) Marks for each course would be converted to grades as shown in Table 1. Table 1: Conversion of marks to grades in credit system

<table>
<thead>
<tr>
<th>Marks obtained</th>
<th>Grade</th>
<th>Grade Points</th>
</tr>
</thead>
<tbody>
<tr>
<td>90-100</td>
<td>A+</td>
<td>10</td>
</tr>
<tr>
<td>80-89</td>
<td>A</td>
<td>9</td>
</tr>
<tr>
<td>70-79</td>
<td>B+</td>
<td>8</td>
</tr>
<tr>
<td>60-69</td>
<td>B</td>
<td>7</td>
</tr>
<tr>
<td>55-59</td>
<td>C+</td>
<td>6</td>
</tr>
<tr>
<td>45-54</td>
<td>C</td>
<td>5</td>
</tr>
<tr>
<td>40-44</td>
<td>D</td>
<td>4</td>
</tr>
<tr>
<td>39 and less</td>
<td>F</td>
<td>0</td>
</tr>
</tbody>
</table>

(ii) The grade point will be given on the total marks (sum of mark obtained in internal assessment and term end examination) obtained in the said subject.

(iii) A student who fails in a course (i.e. He scores less than 30 out of 75 marks in the Term End Examination or less than 40 out 100 marks) shall be given F grade. Student with F grade in course would be granted credit for that course but not the grade for that course and shall have to clear the concerned course within 1.5 year from appearing for first time in the concerned paper.

(v) The total grade points earned in each course shall be calculated as –
Grade points obtained (vide Table-1) X Credits for the course
Maximum grade points that can be earned in a semester are 200.

*(vi)* **Semester Grade Point Average (SGPA)** –

The performance of a student in a semester is indicated by a number called SGPA. SGPA is the weighted average of the grade points obtained in all courses registered by the student during the semester. It shall be calculated as follows:

\[
SGPA = \frac{\sum_{i=1}^{n} C_i p_i}{\sum_{i=1}^{n} C_i}
\]

where \(C_i\) = the number of credits earned in the \(i\)'th course of a semester for which SGPA is to be calculated *(Audit credits should not be included).*

\(p_i\) = grade point earned in the \(i\)'th course

\(i = 1, 2, 3, \ldots n\) represent the number of courses in which a student is registered in the concerned semester.

That is,

\[
SGPA = \frac{\text{Total earned grade points for the semester}}{\text{Total credits for the semester}}
\]

The SGPA is rounded upto one decimal places.

*(vii)* **Final result** – Up to date assessment of the overall performance of a student from the time of his/her first registration is obtained by calculating a number called Cumulative Grade Point Average (CGPA), which is weighted average of the grade points obtained in all courses registered by the student since he/she entered the School/Department.

\[
CGPA = \frac{\sum_{j=1}^{m} C_j p_j}{\sum_{j=1}^{m} C_j}
\]

where \(C_j\) = the number of credits earned in the \(j\)'th course up to the semester for which CGPA is to be calculated

\(p_j\) = grade point earned in the \(j\)'th course. A letter grade lower than D (i.e. grade point < 4) in a course shall not be taken into consideration for the calculation of CGPA.

\(j = 1, 2, 3, \ldots m\) represent the number of courses in which a student is registered up to the semester for which the CGPA is to be calculated.

The CGPA is rounded upto one decimal places.

*(viii)* The final grade earned shall be as per Table 2 given below-
<table>
<thead>
<tr>
<th>CGPA</th>
<th>Grade</th>
</tr>
</thead>
<tbody>
<tr>
<td>8.0-10</td>
<td>A+</td>
</tr>
<tr>
<td>7.0-7.9</td>
<td>A</td>
</tr>
<tr>
<td>6.0-6.9</td>
<td>B+</td>
</tr>
<tr>
<td>5.5-5.9</td>
<td>B</td>
</tr>
<tr>
<td>4.5-5.4</td>
<td>C+</td>
</tr>
<tr>
<td>4.0-4.4</td>
<td>C</td>
</tr>
<tr>
<td>0-3.9</td>
<td>F</td>
</tr>
</tbody>
</table>

*** *** ***