FACULTY OF SCIENCE

SYLLABI

FOR

M.SC. (HONOURS SCHOOL) PETROLEUM GEOLOGY

1st To 4th SEMESTER

EXAMINATIONS 2011-2012

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Outlines of Tests, Syllabi and Courses of Reading for M.Sc. (Honours School) Petroleum Geology (Semester System) Examination 2011-2012

M.Sc. (Petroleum Geology) 1st Semester Examination, December 2011

<table>
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<tr>
<th>Paper Marks</th>
<th>Course</th>
<th>Title</th>
<th>Mid-Sem Test</th>
<th>End-Sem Exam</th>
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<td>Theory</td>
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Note for Theory paper setter:
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<tr>
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<td><strong>Theory</strong></td>
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<td>Well site geological techniques</td>
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SEMESTER –I

Objective: The objective of the syllabus for Semester-I is to teach the fundamentals of various disciplines of Geology which are helpful in Petroleum Exploration and Development. The knowledge of the Geological Structure and Sedimentology has been emphasized in this Semester.

GEOL 0701: Structural Geology & Geotectonics

UNIT –I
Description and mechanics of folds, Folds and thrust belts, Stresses, Stressfields and brittle failure; Ductile features and stress-strain material relationships; Description and classification of faults and fault rock types; Fault scaling relationships, and fluid flow through rocks; Axial planar cleavage and other deformation fabrics.

UNIT-II
Introduction and tensional brittle structures; Deformation at the lattice scale; Ductile shear zones and crustal strength profiles; Diapirs and intrusive structures; Structural traps; Burial and compaction structures; Fold and thrust belts; Structures of rift zones; Structures associated with strike-slip zones; Stereographic projection of linear and planar structures; Balanced cross section; Polyphase deformation analysis; Contour maps, Isopach maps, Facies maps.

GEOL 0702: Stratigraphy & Micropaleontology

UNIT-I
Principles of stratigraphy, Graphic correlation of stratigraphic data in oil industries; Unconformities: processes of formations & their use in petroleum geology; Principles of Lithostratigraphy-Biostratigraphy-Chronostratigraphy and Magnetostratigraphy; Litho-Bio-Chronostratigraphy of petroliferous basins of India; Sequence stratigraphy: Falling stage system tract (FSST), low stand system tract (LST), transgressive system tract (TST) and Highstand system tract (HST); Seismic sequence stratigraphy.

UNIT-II
Introduction to techniques for collection and separation of microfossils; Types of Microfossils; morphology, ecology, palaeoenvironments, phylogeny and geological distribution of foraminifera, ostracod, dinoflagellates and pollens. High resolution micropaleontology in Oil exploration.
GEOL 0703: Petroleum Geology-I (Fundamentals of Petroleum Geology)

UNIT-I
Hydrocarbons; Kerogen; Oil origin & generation process; Migration: Physio-chemical and Geological-Geochemical properties of primary and secondary migration, modes of primary and secondary migration, parameters controlling the primary and secondary migration; Accumulation of Hydrocarbons, traps and types of traps;

UNIT-II
Surface indication and direct methods of hydrocarbons detection; Distribution of oil and gas in Indian sedimentary basins.

GEOL 0704: Sedimentology

UNIT-I
Textures of clastic and non-clastic rocks; Sedimentary structures and their processes of formation; Paleo-current analysis from sedimentary structures; Provenience and interpretation of provenance, sea-level-curve, Limestone classification, digenesis, and lithification; Sandstone-classification, digenesis, and lithification.

UNIT-II
Physical and chemical parameters of depositional environments; Classification of depositional environments; Vertical sequences and facies analysis of Alluvial fan, Delta, coastal, Eolian, Deep sea and carbonate environments and their respective SP and Gamma log interpretations; Basin analysis methods and case study from Indian sedimentary basins.

Practical (SEM-I)

GEOL 0705: Structural Geology & Geotectonic
Stereographic projections of linear and planar structures, map and cross sections, structure contour maps, isopach maps

GEOL 0706: Stratigraphy & Micropaleontology
Map projections of different oil horizons in Indian sedimentary basins, their stratigraphic order, and study of microfossils like foraminifera, ostracod, dinoflagellates and pollens.

GEOL 0707: Sedimentology
Paleo-current analysis based on sedimentary structures, facies reconstructions based on lithological associations, petrography of sandstone (fine, medium and coarse), limestone, and shale; Granulometric analysis, seismic facies analysis, seismic profile interpretation, preparation of different lithologs (with use of LogPlot7 software).

GEOL 0708: Seminar
SEMESTER-II

Objective: The objective of the Syllabus for Semester-II is to teach various techniques in the Petroleum Exploration and Development with special emphasis of Geo-physics and Geo-chemical Exploration. The Study of Reservoir has special attention in this part.

GEOL 0801: Well site Geological techniques-I

UNIT-I
Well, types of well, well exploration, appraisal and development, deviate hole, horizontal and multilateral wells, well design, pre-drill operations in inshore and offshore environment; Geotechnical order.

UNIT-II
Drilling methods; Drilling fluids & types; Cutting and core analysis; Mud logging unit; Sub-surface pressures; Electrologging (SP, GR, resistivity, Neutron, Density, Dipmeter etc.); Formation evaluation.

GEOL 0802: Petroleum Geology –II (Geochemistry)

UNIT-I
Chemical structure of Hydrocarbons; Source rocks; Oil shale; Soil analysis of surface seepage of oil and gas and surface geochemical exploration;

UNIT-II
Modeling petroleum generations; Abnormal pressures; Crude oil correlation; Oil to source rock correlation; Petroleum system in Indian sedimentary basins; Petroleum evaluation

GEOL 0803: Geophysical exploration

UNIT-I
Basic concept of potential, magnetic, gravity and seismic methods of geophysical exploration; Seismic data acquisition (2D, 3D); Seismic data processing and interpretation; Profiling and stacking; Common depth point (CDP).

UNIT-II
Time corrections applied to seismic data; VSP data acquisition, processing and interpretation; Preparation of synthetic seismograms and calibration of well data with seismic signatures; Interpretation of geological and seismic data; Attribute analysis (Amplitude, frequency, phase, cosine, semblance, sweetness etc.; Inversion; Identification of geobodies; Prospect identifications; Introduction to 4D-seismic.
GEOL- 0804: Reservoir study-I

UNIT-I
Definition, Petro-physical properties of reservoirs rocks; capillary properties of reservoir rocks; types of reservoirs: carbonate and sandstone, deep water reservoirs; reservoir fluids, phase behavior.

UNIT-II
Reservoir pressure measurement and its significance; reservoir drive mechanisms; oil, water and gas saturations; fluid displacement; calculation of reservoir parameters from well logs; reservoir simulation.

Practical’s (SEM II)

GEOL 0805: Well site Geological techniques-I
Interpretation of different well log datas from different sedimentary environment with the use of Electro-logging (SP,GR, resistivity, Neutron, Density, Dipmeter etc.) (with use of software PDSview 32), Core sample studies(identifications of sedimentary structures, lithology, facies and paleoenvironment from core data)

GEOL 0806: Geophysical exploration
Time corrections applied to seismic data; Preparation of synthetic seismograms and calibration of well data (With use of software: RadExPro Plus)

Books & References for Semester I & II

Semester-I
Chapman R E, Petroleum geology; Elsevier Amsterdam New york,p-415.
Deshpande B.G. The World of Petroleum.
Ingot, G., 1985: Elements of Micropalaeontology
Levorson A.I., Geology of Petroleum. CBS Pub.
Seward, A.C., 1931: Plant Life through the Ages. Cambridge Univ. Press.
Sokolov V, Petroleum ; Mir Publishers Moscow, p-334.
Steiner H, Petroleum and its products (General); Pergamon Press Oxford, p-200.
Thorn W T, Petroleum and coal, the keys to the future; Princeton University Press New Jersey,
Tiratsoo E N, Petroleum geology; Methuen & Co. Ltd London, p-449.
Semester-II
Deviney Marvin L, Petroleum derived carbons; American Chemical society Washington, p-46.
Gatlin Carl, Petroleum engineering: drilling and well completions; Prentice-Hall, Inc. New Jersey, p-333.
McCray Arthur W, Petroleum evaluations and economic decisions; Prentice Hall New York, p-448.
Geol. publ.

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<td>GEOL: 901</td>
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**GEOL-0901: Reservoir Study-II**

Estimation of hydrocarbon reserves, classification of reserves, development of oil and gas field, recovery of hydrocarbon, enhanced oil recovery, improved oil recovery. Reservoir management, well test analysis and pressure transient studies, bore hole studies and their importance.

**GEOL-0902: Production operation**

Geologic considerations in producing operations, reservoir considerations in well completion, well testing, Primary cementing, Well completion design, Tubing strings, Packers, Surface control equipment, Perforating oil and gas wells, Well completion and work over fluids. Problem well analysis, through tubing production logging, squeeze cementing-remedial cementing, sand control, formation damage, surfactants for well treatments, acidizing, hydraulic fracturing, scale deposition, removal and prevention, corrosion control, work over jobs and work over planning.
GEOL-0903: Alternative source of Fuel

Gas hydrates, structures, compositions, world occurrences; exploration methods, potential locations on Indian off-shores; environmental impacts and future prospects.

Coal bed methane (CBM): introduction, evaluation of coal properties, global coal bed methane potential, CBM exploration and exploitation, environmental problems-water quality and utilization, CBM policy / regulations

GEOL-0904: Coal Geology & National Economic Policy (NELP)

Underground coal classifications: concept, development of UGC to date, implications of burning UGC, estimation of coal reserves for UGC, environmental benefits of UGC, global potential areas, UGC process, advantages, policy on UGC, tar sands and oil shales: occurrences, exploration and exploitations. NELP (New Exploration Licensing Policies- Implementation of NELP-speculative surveys. NELP-I-IX

GEOL-0905: Project work (field based three months compulsory project)

Work to be carried out under the guidance of faculty members of the Centre, on any one of the fields of petroleum geosciences i.e. Sedimentology/ Paleontolog/Micropaleontology /Reservoir study / Petroleum explorations / Stratigraphy / Structural Geology.

GEOL: 906: Seminar / Viva voice

Books & References for Semester III

Ingot, G., 1985: Elements of Micropalaeontology.
Deviney Marvin L,Petroleum derived carbons; American Chemical society Washington,p-46
Mc Cray Arthur W, Petroleum evaluations and economic decisions; Prentice Hall New York,p-448.


**SEMESTER-IV**

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