

M.Sc. DEGREE COURSE IN PETROLEUM GEOLOGY



DEPARTMENT OF GEOLOGY
FACULTY OF SCIENCE
THE MAHARAJA SAYAJIRAO UNIVERSITY OF BARODA



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Year 2014–2016

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Date of Entrance Examination: 28 June, 2014 at 11.00 am onwards

Place: DEPARTMENT OF GEOLOGY

POST- GRADUATE DEGREE IN PETROLEUM GEOLOGY

Globalization has resulted in many oil companies setting up base in the Indian subcontinent for exploration of energy fuels. This has boosted job opportunities as well as need for education and training in the field of petroleum geology. The geology department of The Maharaja Sayajirao University of Baroda, has more than five decades of intensive and professional teaching in the subjects of geology, has chalked out the course for those who wish to make a career in oilfields. During the last four year, since the course was started, our students have got placement in ONGC, private hydrocarbon companies as well as in the GSI.

M.Sc. PROGRAMME

This is a two year programme leading to the degree” Master of Science” in Petroleum Geology. The course is aimed at developing the professional Geologists in the exploration of Hydrocarbons and related fields.

ELIGIBILITY

Graduate degree in **Geology (B.Sc.) or its equivalent degrees, with physics and chemistry as desirable subjects at B.Sc. level.** Intake capacity is minimum 15 and maximum 20.

ADMISSION PROCEDURE

The entrance test will be conducted by the Faculty of Science for admission to the course. Syllabus for the entrance test shall be of **Graduate level Geology as main subject and Physics and Chemistry as subsidiary subjects.** The admissions will be given entirely on the basis of merit of the candidate’s performance in the entrance test. Admission to the course will be confirmed only after paying the necessary fees. Fees once paid will not be refunded.

THE SCHEME OF TEACHING

There shall be FOUR Semesters; each semester shall be of 90 days. The academic program shall consist of Course Work which includes Theory and Laboratory courses, Field Work, Seminar, and Placement cum Project. The weekly contact hours will vary from 22 to 27 per week.

The course teaching is mainly done by the visiting faculties from ONGC, IIT and other related oil industry experts as well as teaching faculty from the Department of Geology, Faculty of Science.

COURSE CONTENT

Course No.	Course Name	Hours/Week	Marks/ Credits
Semester -I			
GEO2123	Structural Geology.	4	100/4
GEO2124	Stratigraphy and Micropaleontology & Palynology	4	100/4
GEO2125	Fundamentals of Petroleum Geology	4	100/4
GEO2126	Sedimentology	4	100/4
GEO2127	Micropaleontology & Palynology-Lab	3	50/2
GEO2128	Structural Geology-Lab	3	50/2
GEO2129	Sedimentology –Lab.	3	50/2
GEO2130	Seminar	2	50/2
GEO2131	Viva-voce	-	50/1

			25 Credits
Contact Hours: Theory = 4x4 =16; Practical 3x3=09; Seminar 02; Total = 27. Marks: 400+150+50+50=650 Semester-II			
GEO2213	Basin Analysis	4	100/4
GEO2214	Geochemistry.	4	100/4
GEO2215	Basic Geophysics	2	50/2
GEO2216	Seismic Exploration and Interpretation (Including Lab)	4	100/4
GEO2217	Reservoir Study-I	4	100/4
GEO2218	Formation Evaluation(Including Lab)	4	100/4
GEO2219	Field work (Sedimentary Terrain)	Two weeks (2)	50/2
GEO2220	Seminar	2	50/2
GEO2221	Viva-voce		50/1
			27 credits
Contact Hours: Theory = 4x4 =16; 2x2=4; Seminar 02; Total= 22, Fieldwork: 02 Weeks. Marks: 400+100+50+50+50=650 Semester-III			
GEO2331	Reservoir study-II	4	100/4
GEO2332	Well site Geological Techniques	4	100/4
GEO2333	Alternative source of fuel	2	50/2
GEO2334	Economics, and Managements	4	100/4
GEO2335	New Exploration Licensing Policy and Environment aspects	4	100/4
GEO2336	Attachment training at oil companies	Two weeks	50/2
GEO2337	Seminar	2	50/2
GEO2338	Viva-voce		50/1
			23 Credits
Contact Hours: Theory = 4x5=20; Training-2 Weeks; Seminar 02= 22 Marks: 500+50+50+50=650 Semester-IV			
GEO2431	Project work (Inter.200+ Exter.250)	3 month	450/18
GEO2432	Seminar on project		100/3
GEO2433	Viva-voce		100/4
			25 credits
Contact Hours: Marks: 450+100+100=650			

Details of the Course Contents Semester-I

Course No: GEO2123 Structural Geology

Concept of Stress and Strain; Translation, Rotation and Deformation. Kinematics and Dynamic Analysis, Description of Folds, Joints, Faults, Unconformities and Salt Domes. Mechanisms of the above Structures. Cleavage, Lineation and Foliation. Stereographic Projections of Linear and Planar Structures, Maps and Cross Sections. Balanced Cross-Section, Their Importance in Unraveling The Geological History.

Course No: GEO2124 Stratigraphy and Micropaleontology and Palynology

Stratigraphy: Basic principles of Stratigraphy, International code of stratigraphic nomenclature and principles of Lithostratigraphy, Biostratigraphy, Chrono-Stratigraphy, Magnetostratigraphy, Seismic Stratigraphy, Correlation, Changing concepts in Stratigraphy, Graphic representation of stratigraphic data, Sequence Stratigraphy, Stratigraphic maps and relationships.

Micropaleontology: Introduction, Scope and branches, Types of microfossils, Description and uses. Selected groups of microfossils, Foraminifera, Ostracods, Bioherms – stromatolites, Cocoliths, Sampling for micro-paleontological studies, Biostratigraphic applications, Age and environmental interpretations, Foraminifera as bathymetric indicators, nano-fossils.

Palynology: Introduction, Scope of Palynology, Types and groups of palynofossils, Spore – pollen, Dinoflagellate, Diatoms, Silicoflagellates, Dating, depositional environment and biostratigraphy. Relative sea level changes, High resolution biostratigraphy, Sequence biostratigraphy, High impact biostratigraphy in hydrocarbon exploration, Biostratigraphy in production and development geology.

Indian Stratigraphy: Cuddapah basin, Vindhyan basin, Gondwana Super Group, Kutch basin, Cauvery basin, Krishna, Godavari Deccan Traps, Tertiary of Himalayas, Assam –Arakan basin, Cambay basin, Bombay off-shore basin, Rajasthan basin.

Course No: GEO2125 Fundamentals of Petroleum Geology

Introduction, Occurrence, Surface Indications and Seepages. Origin, Migration and Accumulation of Oil and Gas. Physical Properties of Reservoir Rocks. Petroleum Traps and Fluids. Reservoir Mechanism Petroleum Habitats / Systems. Global Distribution of Oil and Gas.

Course No: GEO2126 Sedimentology

Introduction, Scope of Sedimentology, Processes of Sedimentation, Classification of Sedimentary rocks, Textures of Sediments and their Analysis, Interpretation of Grain Size Data. Hydrodynamic conditions of Sediment Transportation and Sedimentary Structures of Mechanical Origin. Statistical Treatment of Paleocurrent Data. Classification of Terrigenous Rocks; Gravels, Sandstones – Light and Heavy Minerals and their Relationships with Provenance and Plate Tectonic Setting, Mudrock – Classification, Identification of Clays. Limestone – Classification. Diagenesis and Lithification.

Course No: GEO2127 Micropaleontology and Palynology – Lab

Preparation of Microfossils and Pollen slides. Identification of the fossils, description, etc

Course No: GEO2128 Structural Geology – Lab

Stereographic projections of linear and planar structures. Maps and cross sections including balanced cross-sections. Structure contour maps, Isopach map and other facies maps.

Course No: GEO2129 Sedimentology-Lab

Thin section studies of terrigenous and carbonates rocks. Paleocurrent analysis. Granulometric analysis. Heavy minerals analysis.

Semester II

Course No: GEO2213 Basin Analysis

Physical and Chemical Parameters of Depositional Environments, Classification of Environments, Facies analysis, Structures and Vertical Sequences formed in Alluvial, Deltaic, Coastal, Deep Sea and Desert Environments. Carbonate Environments. Concepts of plate tectonics, and its role in hydrocarbon exploration. Tectonics and Sedimentation. Basin analysis -Environmental criteria based on instrumental well logs.; Case Histories of Important Petroliferous Basins.

Course No: GEO2214 Geochemistry

Introduction, the Development of Petroleum Geochemistry, Carbon Cycle and the Origin of Life. Petroleum and its Products. Origin and generation of Hydrocarbons (Oil and Natural Gas), Migration and Accumulation, Modelling Petroleum Generations, Abnormal Pressures. Source Rock, Coals, Oil Shales and Other Terrestrial Source Rocks for hydrocarbon generation. Soil analysis of surface seepages of Oil and Gas and Surface Geochemical Exploration, Geochemical Programme for Petroleum Exploration. Crude Oil Correlation, Oil to Source correlation. Petroleum System. Prospect Evaluation.

Course No: GEO2215 Basic Geophysics

Basic concepts of Magnetic, Gravity Electrical and Seismic methods (Reflection & Refraction of 'P' & 'S' waves). Introduction to reflection Seismic Data Acquisition (2D, 3D, Common depth point (CDP)). Time correction applied to Seismic data, Seismic Data Processing. Profiling and Stacking; VSP Data acquisition, processing.

Course No: GEO2216 Seismic Exploration and Interpretation (Including Lab)

Concepts of wave theory, Principles of seismic reflections, Calibration of seismic data with well log data, Preparation of Synthetic seismogram, Interpretation of 2D seismic data for structural and stratigraphic analysis, Identifying the faults and interpretation of their nature, Preparation of time structure and time thickness maps, Preparation of structure and thickness maps, Concepts of Seismic stratigraphy and its application in hydrocarbon prospecting, Basic seismic attribute analysis and its application in reservoir characterization, Seismic facies analysis, Understanding the seismic pitfalls, Basics of Basin Evaluation & Generation of hydrocarbon prospects.

Course No: GEO2217 Reservoir Study -I

Reservoir rocks, Rock Properties, Porosity, Permeability, Reservoir Fluids, Fluid flow, Oil-Water Contact, Displacement of oil and gas, Oil Recovery Mechanisms, oil gas well performance, Water Influx, MBE approach, over saturated and under saturated Reservoir, Gas and Gas Condensate Reservoirs, Reservoir performance prediction, Reservoir characterization, Bottom Hole Studies

Course no: GEO2218 Formation Evaluation

Open Hole Logging:

Introduction, Principles, factors and limitations of SP log, Gamma ray, Caliper and Dip meter logs. Various Resistivity logs, their characteristics, advantages. Porosity logs, density, Neutron and Sonic logs, Principles and porosity determination. Principles of log interpretation, qualitative

and quantitative interpretations for lithology, minerals and reservoir definition. Determination of various rocks, fluid and invasion parameters. Estimation of water saturation. Net Pay Estimation Computer applications in log interpretation. New developments in well logging techniques and tools. How well logging programme is made.

Case Hole Logging:

Cement – bond and temperature logs, their application, perforation of well-casing. **Other logging operations:** Side -wall coring, formation fluid sampling, pressure measurement, drill stem testing, core analysis.

Semester-III

Course No: GEO2331 Reservoir Study – II

Estimation Of Hydrocarbon Reserves, Classification Of Reserves, Development Of Oil And Gas Fields , Monitoring Of Recovery Of Hydrocarbon And Integrated Approach To Reservoir Management, Water Flooding And Pressure Maintenance, Water Flood Surveillance Techniques , Enhanced Oil Recovery(EOR) And Improved Oil Recovery Techniques, EOR Field-Pilot Design And Performance Evaluation, Field Wide Application Of EOR , Advantages Of Early Introduction Of EOR-Balol-Santhal Field Study, Introduction To Mathematical Simulation.

Course no: GEO2332 Well Site Geological Techniques

Introduction, Type of well locations, Geotechnical Order, Mud Logging Unit, Cutting and Core Analysis, Sub-Surface Pressures & Temperature, Drilling Complications, Well Testing, Well Completion, off-shore Technology, Documentation, Drilling Technology including off-shore, Drilling Fluids, Casing and Cementation, Surface Control Equipments, Well Design, Well Problems & Analysis. Formation Damage, Production Logging, Well Stimulation, Work over Jobs, Well Repair.

Course No: GEO2333 Alternative Sources of Fuel (Synfuels)

Gas Hydrates: Definition, Structures, Compositions, World Occurrences, Exploration Methods, Potential Locations on Indian Off-shores, Environmental Impacts and Future Prospects.

Coal Bed Methane: Definition, Evaluation of Coal Properties, Global Coal Bed Methane Potentials, Reserves, CBM Exploration and Exploitation, Environmental Problem – Water Quality and Utilization, CBM Policy/ Regulations.

Underground Coal Gasification: Definition, Concept, Development of UCG to date, Implications of Burning UCG, Estimation of Coal Reserves for UCG, Environmental Benefits of UCG, Global Potentials Areas, UCG Process, Advantages, Policy on UCG.

Tar sands and Oil Shales: Occurrences, Exploration and Exploitations.

Course no: GEO2334 Economics and Management

Forecasting Oil Production Profiles. Defining ‘Reserves’, Economic analysis of Petroleum Exploration & Production. Risk, Uncertainty: Mathematical Techniques, Probabilistic Models, Uncertainty in Economic Analysis. Financing, Ownership in the Oil and Gas Industry: Business Arrangements between Operators.

Course no: GEO2335 New Exploration Licensing Policy (NELP) and Environmental Aspects

Implementation of NELP Assessment methods of blocks Including Reserves, Preparation of Data Packages. Basic Ideas Of Bidding, Etc., Monitoring Of Blocks, Approvals/Review – Development Plans, Appraisal Programme, Annual Work Programme And Budgets (BE And RE) Monitoring of safety and environment aspects under PSC – Regular safety and environment audits and their compliance are carried out for companies operating under Production Sharing Contract.

E.I.A. ISO Certification.

SEMESTER-IV

Course No: GEO2431 Project Work

EXAMINATION

There shall be Internal as well as Semester end evaluation for theory courses. The weightage for Internal and End Semester evaluation shall be 30% and 70% respectively. Other than the theory courses, the evaluation shall be 100% internal. The Project work shall be evaluated by internal and external referees.

PASSING STANDARD:

To pass the Semester examination of M. Sc in Petroleum Geology a candidate must obtain 40% of marks in each theory paper; a minimum of 40% in each practical and 40% in viva-voce examinations. The candidate shall clear all deficiency courses before submitting the Project work. Candidate obtaining 50%, 60% and 70% will be placed in second, first, and First class with Distinction respectively, considering the total aggregate marks obtained at all the semesters

The breakup of the Internal and University examination weightage may be changed as and when University Academic Bodies decide to change. FEES:* (Subject to change as and when the Faculty/ University revises the Fee policy/structure)

The total fee of First year (semester I and semester II) shall be Rupees 82,000/= on yearly basis, plus other fees as specified for Faculty of Science Higher Payment P.G. Courses.* In addition to this students are also required to pay Examination Fees also for both the semesters on annual basis as prescribed by the university.

**** The Fee is subject to revision as and when University desires if the need arises**

*** The Examination Fee is as per the Regular M.Sc. courses and is revised as and when University desires.**

Note: * The admission policy and fees structure are subject to revision as per guidelines of The Maharaja Sayajirao University of Baroda as and when applicable

INSTRUCTIONS TO THE APPLICANTS

1. **The online application form are available** from our website <http://www.msubaroda.ac.in> and <http://msub.digitaluniversity.ac>
2. The receipt of the online application need to be produced at the time of the admission process along with the original certificates.
3. Attested copies of the following certificates should be attached with the application form:
a) H.S.C. (12Science) or equivalent Mark sheet (b) B.Sc. or equivalent Mark sheet c) Birth certificate or School Leaving Certificate Note: Original Certificates and statements of marks are required to be submitted on being admitted to the Faculty.
4. Certificates for SC/ST/SEBC from competent authority be attached, if applicable. SEBC applicants must submit Creamy Layer Certificate from the competent authority. Reservations for SC/ST/SEBC are as per Gujarat Government norms.

Competent Authority for SC/ST (any one of the following from Gujarat)

- a. The Collector b. The Prant Officer c. The Mamlatdar d. The Mahalkari
- e. The Director of Social Welfare f. The District Social Welfare Officer

For SEBC (any one of the following from Gujarat)

- a. The Collector b. The District Development Officer
- c. The Asst. Collector/ Dy. Collector d. The Dy. District Development Officer
- e. The Mamlatdar f. The Taluka Development Officer g. The Mahalkari
- h. The District Social Welfare Officer.

5. “Medical Check-up” is compulsory for new entrants who join for the first time in any course of studies in any of the Institutions of this University so that they are medically checked during the First Year of their studies in the University.
6. No correspondence will be entertained in the matter of admission.
7. No separate intimation regarding the entrance examination will be sent
 - a. All those who have applied and fulfill the minimum qualification should appear for the entrance examination.
 - b. Those who have appeared for qualifying examination can also appear for test and their admission will be considered, subject to passing qualifying examination.

GENERAL RULES GOVERNING THE CONDUCT OF STUDENTS IN THE UNIVERSITY.

1. A student must do nothing either inside or outside the University that will interfere with its orderly working and discipline (as per the new ordinance 290). This comprehensive rule covers most cases that are likely to arise. It forbids, for instance:
 - a. Impolite or unseemly behavior in class-room or university premises during working hours of the Department and the Faculty.
 - b. Attempt to persuade other students to abstain themselves from classes.
 - c. Damage to or defacement of University furniture, fitting and property.
 - d. Disobedience of notifications or instructions issued by the Dean/Head of the Department /Coordinator of the Programme and Members of the staffs duly authorized.
2. No Society in Faculty may be formed and no person may be invited to address any existing society or meeting without the previous permission of the Head of the Institution concerned.
3. As per UGC regulation, 75% attendance is required for permitting students to appear for final examination. Unavoidable absenteeism on account of health, urgent private affairs or other reasons, they must be prepared to state the exact reason for absenteeism.
4. Students are expected to behave with courtesy towards the members of the staff, their fellow students and all visitors to the Institution.

Prof. A.C. Sharma
Course Director & Dean, Faculty of Science