

Nepal Engineering Council Registration Examination

Petroleum Engineering Syllabus (APtE)

Chapters 1-4 are fundamentals/principles of concepts in civil engineering; chapters 5-9 are related to application of engineering principles in practice; and the last (10th) chapter is related to project planning, design and implementation.

1. **General Geology and Petroleum Reserves** (APtE01)
 - 1.1. Geology of Nepal Himalayas, Stratigraphy, Faults and Folds, Seismicity. (APtE0101)
 - 1.2. Chemical Formation of Rock Forming Minerals, Igneous Rocks, Sedimentary Rocks, Metamorphic rocks, Classifications and forms of Igneous, Sedimentary and Metamorphic Rocks. (AMiE0202)
 - 1.3. **Rock Disturbances:** Folds, monoclines, anticlines and synclines, Unsymmetrical Folds, Dip and Strikes, Classifications of faults, fault breccias, Drag, Slickensides, Horses, Shear Zones, Fault Scarp, Joint, Unconformities, Outcrops, Erosions. (AMiE0203)
 - 1.4. **Guides to Prospecting:** Geological (Physiographic, Stratigraphic, Lithological, Structural and Mineralogical Guides), Geophysical, Geo-chemical and Geo-botanical Guides. (AMiE0301)
 - 1.5. **Methods of Prospecting:** Geological Methods (Reconnaissance maps, Detailed Geological Maps), Geophysical Methods (Magnetic, Gravitational, Seismic, Electrical Methods), Geochemical Methods. (AMiE0302)
 - 1.6. **Surveying:** Different methods of Surveying. Significance. Challenge.

2. **Petroleum Geology** (APtE02)
 - 2.1. **Paleontology and Micropaleontology:** Introduction to fossils and their formation. Overview of micropaleontology, focusing on microfossils like foraminifera, Radiolaria, conodonts, Ostracodes, and diatoms, and their importance in oil exploration. (APtE0201)
 - 2.2. **Source Rocks:** Definition and types of source rocks, focusing on claystone/shale. Processes of diagenesis, catagenesis, and metagenesis in source rock formation. Subsurface pressure and temperature conditions for oil and gas generation (oil window). (APtE0202)
 - 2.3. **Reservoir Properties:** Reservoir pore space: porosity (primary, secondary, effective, fracture) and permeability. Relationship between porosity, permeability, and texture. Definition and characteristics of cap rocks. (APtE0203)
 - 2.4. **Hydrocarbon Migration and Entrapment:** Geological framework of migration and accumulation. Concept of hydrocarbon migration from source beds to reservoirs. Free-pathways for migration and evidence for migration. Entrapment and accumulation of hydrocarbons. Classification and types of traps, including those associated with salt domes. (APtE0204)
 - 2.5. **Grade and Reserve:** Estimation of Reserves, Procedures for Estimation of Reserves, Evaluation of Assets. Drawings of Geological and Reserve Maps, Compile Maps. (APtE0205)

- 2.6. **Stratigraphic Geology:** Definite periods of time, Era, Period, Epoch, Age, Phase, Precambrian, Paleozoic, Mesozoic, Cenozoic (Tertiary) and Quaternary. (APtE0206)
3. **PETROLEUM EXPLORATION METHODS** (APtE03)
- 3.1. **Introduction:** Overview of petroleum exploration. Global petroleum exploration scenario with Nepal's context. Geological and Geochemical methods of hydro carbon exploration. (APtE0301)
- 3.2. **Concepts of well logging:** What is well logging- Logging terminology Borehole Environment- Borehole temperature and pressure. Log header and depth scale-Major components of well logging unit and logging setup. (APtE0302)
- 3.3. Classification of well logging methods. Log presentation. Log quality control. (APtE0303)
- 3.4. **Open hole logging:** (Spontaneous potential) SP Logging- uses of SP log, Caliper log: Principle and application of caliper tool. Gamma ray log: principle of radioactivity. Uses of Gamma ray log. Natural Spectral Gamma ray log: Principle and application, Resistivity log: Single point resistance log (SPR Principle and application Micro Resistivity log. Conventional and focused micro Resistivity logs and their application. (APtE0304)
- 3.5. Induction log: Principle of induction tool and the advantages, Density log: Principle of density tool and application. Neutron log: Principle and application of Neutron tool, Sonic log: Principle and application of Sonic log, Cased hole logging: Gamma ray spectral log, Neutron decay time log. (APtE0305)
- 3.6. **Direct Methods:** Mud logging, coring – conventional and Sidewall coring. (APtE0306)
4. **Reservoir Engineering:** (APtE04)
- 4.1. **Introduction to reservoir engineering:** Characteristics of crude oil and natural gas, classification of crude and its physicochemical properties. (APtE0401)
- 4.2. **Reservoir Rock Properties:** Porosity and permeability determination, combination of permeability in parallel & series beds, porosity permeability relationship, fluid saturation determination and significance, effective and relative permeability, wettability, capillary pressure characteristics, measurements and uses. Coring and Core Analysis. (APtE0402)
- 4.3. **Reservoir Fluids:** Phase behavior of hydrocarbon system, ideal & non ideal system, equilibrium ratios, reservoir fluid sampling, PVT properties determination. (APtE0403)
- 4.4. **Flow of Fluids through Porous Media:** Darcy's law, single and multiphase flow, linear, radial & spherical flow, steady state & unsteady state flow, GOR, WOR equations. (APtE0404)
- 4.5. **Special type of flow:** flow through fractures, Water and gas coning. Reservoir Pressure Measurements and Significance: Techniques of pressure measurement. (APtE0405)
- 4.6. **Reservoir Drives:** Reservoir drive mechanics and recovery factors. Reserve estimation: resource & reserve concept, Different reserve estimation techniques: Volumetric, MBE. (APtE0406)

5. **Petroleum Production Technology** (APtE05)
- 5.1. **Artificial Lift Methods:** Fundamental aspects of sucker rod pumping, Gas lift, Other artificial lift methods. (APtE0501)
- 5.2. **Production Stimulation:** Well problem identification, Matrix acidizing, Hydraulic fracturing. (APtE0502)
- 5.3. **Well Equipment:** Well Head Equipment, Christmas tree, Valves, Hangers, Flow control devices, Packers Tubular and flow lines. (APtE0503)
- 5.4. **Well Completion Design:** Well completion methods, Perforating Oil & Gas Wells, Conventional and unconventional techniques, Type, size, and orientation of perforation holes, well activation using compressed air & liquid nitrogen, Down-hole equipment selection, servicing, installation & testing, Smart wells and intelligent completions. (APtE0504)
- 5.5. **Well Production Problems and Mitigation:** Scale formation, Paraffin deposition, Formation damage, Water production, Gas production, Sand deposition. Mitigation: Water shut off and gas shut off, Chemical treatment and conformance control, Wire-line operations, Workover & completion fluids. (APtE0505)
- 5.6. **Introduction to Shale Oil, Shale Gas and Oil Shale:** Concept of exploration and production strategies. Offshore Engineering: Types of offshore platforms (e.g., fixed platforms, floating platforms) and their design considerations:- Structural components and construction methods for offshore structures. (APtE0506)
6. **Drilling and Well Completion** (APtE06)
- 6.1. **Overview of Drilling & Well Completion:** Drilling Planning Approaches, Types of Drilling. Rotary Bit Technology and Drilling string basics. Drilling fluids and Hydraulics-Drilling fluid economics-Drilling fluid properties. (APtE0601)
- 6.2. **Casing & Cementation:** Casing standards, Casing coupling Cementing: Introduction cement slurries, Cementing nomenclature - cement additives. (APtE0602)
- 6.3. **Directional drilling:** Objectives, Types of deflection tools, tool orientation, Directional well profiles, applications. (APtE0603)
- 6.4. **Horizontal Well Drilling:** Horizontal well objectives and selection, Different profiles, Drilling techniques, Mud requirements & characteristics, casing and drill string requirements and completion programs. (APtE0604)
- 6.5. **Waste Disposal:** Disposing of the drilling fluids waste and drill cuttings waste. (APtE0605)
- 6.6. **Well completion:** Types of wells, Completion functions, Types of completion. Packers: Function, Application, Proper selection; water / gas shot off, horizon separation, etc (APtE0606)
7. **Pipeline Engineering** (APtE07)
- 7.1. **Elements of pipeline design:** Fluid properties – Environment - Effects of pressure and temperature - Supply / Demand scenario, Pipeline Preliminary route selection - Key factors for route selection - Engineering survey - Legal survey - Construction / As-built survey - Geotechnical design. (APtE0701)

- 7.2. **Gas compression and coolers:** Types of compressors – Compressor drivers – Compressor station configuration – Enthalpy / Entropy charts (Mollier diagram) – Centrifugal compressor performance. (APtE0702)
- 7.3. **Operations:** Pipeline coating – Cathodic protection – Cathodic protection calculations for land pipelines – Internal corrosion – Flow meters and their calibration – Sensors – Pigs-Pipeline Operations and maintenance. (APtE0703)
- 7.4. **Oil recovery processes:** Introduction, types, methods. (APtE0704)
- 7.5. Miscible flooding, Carbon dioxide flooding, Polymer flooding, Alkaline flooding: Introduction, Application. (APtE0705)
- 7.6. Microbial oil recovery. Field application of microbial enhancement of oil recovery-Microbes associated with oilfield problems. (APtE0706)
8. **Refinery** (APtE08)
- 8.1. **Refined Petroleum Products:** Overview of gasoline, distillate fuels, diesel fuels, heating oils, residual fuel oils, wax, asphalt, and blending processes. (APtE0801)
- 8.2. **Thermal & Catalytic Processes:** Description of visbreaking, hydrovisbreaking, thermal cracking, catalytic cracking, fluidized bed catalytic cracking, hydrocracking, and their respective yields. (APtE0802)
- 8.3. **Coking Operations:** Types of petroleum coke, process descriptions of delayed coking, flexi-coking, fluid coking, and their properties and uses. (APtE0803)
- 8.4. **Hydrogen Production and Purification:** Processes for hydrogen production, purification, gas processing units, acid gas removal, sulfur recovery, and waste water treatment. (APtE0804)
- 8.5. **Refinery Operations:** Overview of refinery operations. Hydrotreating, isomerization, alkylation, polymerization: Definition, Significance, Application. (APtE0805)
- 8.6. **Advanced refinery Operations:** Desulfurization, catalytic reforming, aromatics production, solvent extraction, gasoline additives: Definition, significance, processes, applications. (APtE0806)
9. **Health Hazards in Petroleum Production Refining and Utilization:** (APtE09)
- 9.1. Toxicity, Physiological, Asphyxiation, respiratory and skin effect of Petroleum Hydrocarbons (including mixtures), sour gases (eg: Hydrogen sulphide and carbon monoxide etc) with their thresh-hold limits. (APtE0901)
- 9.2. Effect of corrosive atmosphere and additives during acidizing, sand control and fracturing jobs etc. (APtE0902)
- 9.3. Manual & automatic shutdown system, blow down systems. (APtE0903)
- 9.4. Gas detection system, Fire detection & suppression systems, Personal protection systems & measures. (APtE0904)
- 9.5. Environment concepts, impact on eco-system, air, water and soil: The impact of drilling & production operations on environment, Off shore environmental studies, offshore oil spill and oil spill control. (APtE0905)
- 9.6. Waste treatment methods, waste disposal method, remediation of contaminated sites (APtE0906)

10. Project Planning, Design and Implementation (AALL10)

- 10.1. **Engineering drawings and its concepts:** Fundamentals of standard drawing sheets, dimensions, scale, line diagram, orthographic projection, isometric projection/view, pictorial views, and sectional drawing. (AALL1001)
- 10.2. **Engineering Economics:** understanding of project cash flow; discount rate, interest and time value of money; basic methodologies for engineering economics analysis (Discounted Payback Period, NPV, IRR & MARR); comparison of alternatives, depreciation system and taxation system in Nepal. (AALL1002)
- 10.3. **Project planning and scheduling:** project classifications; project life cycle phases; project planning process; project scheduling (bar chart, CPM, PERT); resources levelling and smoothing; monitoring/evaluation/controlling. (AALL1003)
- 10.4. **Project management:** Information system; project risk analysis and management; project financing, tender and its process, and contract management. (AALL1004)
- 10.5. **Engineering professional practice:** Environment and society; professional ethics; regulatory environment; contemporary issues/problems in engineering; occupational health and safety; roles/responsibilities of Nepal Engineers Association (NEA). (AALL1005)
- 10.6. **Engineering Regulatory Body:** Nepal Engineering Council (Acts & Regulations). (AALL1006)