# B.Sc. IV Year

# Geology (GEO.401)

**Subject: Exploration Geology and Mining Geology**

Nature of course: Theory | Course No.: GEO.401

Full marks: 100 | Total class period: 150

Pass marks: 35

## A. Exploration Geology

Total period: 75 | Total Marks: 50

| Main Topics | Contents | Period |
|---|---|---|
| **Introduction** | Importance of mineral resources. Stages of mineral resource development: prospecting, exploration, mining, processing and marketing. Factors affecting the distribution and localization of mineral deposits. Prospecting criteria, guides, wall rock alteration, primary and secondary haloes, metallogeny, metallogenic epochs, provinces, prognostic maps. | **20** |
| **Exploration** | Reconnaissance, prospecting, pre-feasibility, feasibility, engineering and mine exploration. Exploration methods: geological reconnaissance traverse, panning, remote sensing-landsat system, photogeology. Application of geophysical methods for mineral exploration: magnetic survey, gravity survey, radiometric survey, resistivity, seismic methods, Ground Penetration Radar (GPR) and borehole geophysics.<br><br>Application of geochemical methods for mineral exploration: geochemical anomalies, background, threshold, pathfinder elements, geochemical methods: metallometric, hydrochemical, geobotanical and gas prospecting. | **30** |

| | | |
|---|---|---|
| | Exploration openings: pitting and trenching, drilling and underground excavations, sampling and acquiring geological and geotechnical data. | |
| **Evaluation of deposits** | Reserve estimation, grade calculation,workable standards. Economic, sub-economic and non-economic deposits. | **10** |
| **Mineral Resources of Nepal** | Geological controls, current status and future prospects of different mineral resources of Nepal. Metallic, nonmetallic and fossil fuels. | **15** |

**Text books**:

Barrett W. M. et al. (2012): Introduction to mineral exploration, Blackwell Publication, 481p.
Kreiter V. M. (2004): Geological prospecting and exploration, University Press of the Pacific, 384p.
Rose, A. W., Hawakes, H. E. and Webb, J. S. (1970). Geochemistry for mineral exploration, Academic Press, 657 p.

**Reference books**:

DMG (2004): Mineral resources of Nepal.
ESCAP (1993): Atlas of mineral resources of Nepal, vol. 9, UN Publication.

### B. Mining Geology

Total period: 75 Total Marks: 50

| Main Topics | Contents | Period |
|---|---|---|
| **Introduction** | Introduction to Minerals, Mines and Exploration Methods: Mineral resources, Mineral/Ore deposit/ prospect, Mine/ Quarry, Mining of Metallic and Nonmetallic Minerals: Ore Minerals, Industrial Minerals, Precious and Semi-precious stones, Dimension/ decorative stones, Construction Materials/Minerals. Fuel Minerals. | **2** |

| | | |
|---|---|---|
| **Mining Terminology** | Mine opening, important parts of a mine, trench, pit, shaft, tunnel, adit, excavation, level, crosscut, stopping, loading, dumping, mine environment, mine ventilation, mineral transport system, mine drainage, light system, fire safety measures. | **10** |
| **Mining methods and Technology** | Definition, Mine and Mining, Stripping ratio, Ore and waste, Mine development, Mining plan, Mining methods and their selection, Type of Mines, Surface and Underground mine with examples from Nepal, Mine operation, Production, Sequences in the life of mine, Mine safety, Occupational health, Mine excavation. | **15** |
| **Drilling and blasting methods, Mining equipments and machines** | Shot hole drilling, Explosives, blasting methods, Excavator, loader, dumper, bulldozer, rock breakers. | **10** |
| **Ore processing and dressing** | Crushing, Grinding, washing, pulverizing, concentration, storage/stockpile/dumping site and waste management. | **8** |
| **Mineral Industries** | Basic infrastructures, mineral based industries examples, regular supply of materials (ore/ raw materials) to the industries, industrial production, quality of the product, quality control, regular supply in the market, market study. | **3** |
| **Basic Mineral economics** | Mine operation cost, production cost, market price/ selling price, internal and external price (ROM/CIF/FOB), Demand and supply situation, introduction to cost benefit analysis, Net Present value (NPV), Internal Rate of Return (IRR), Contribution to National GDP from mineral, mine, mining and Mineral industry sector. | **15** |
| **Existing Mines and Mineral Act** | Existing Mines and Mineral Act-2042 and Mines and Mineral Regulations-2056, Lease system, Prospecting License, Mining License, Government Policy, License fee, surface rental, Government taxes, royalties, local taxes and benefits, royalty in production. Petroleum act-2040 and regulation-2041, | **12** |

| | | |
|---|---|---|
| | environmental act-2053 and regulation-2054 with amendments. | |

**Text books**:


1. Marjoribanks, R., (2010): Geological Methods in Mineral Exploration and Mining, Springer-Verlag Berlin Heidelberg, 238p.
2. Peters, W. C., 1978. Exploration and Mining Geology, John Willy & Sons.
3. Cummins, A. B. and Given, I. A. (1973): Mining Engineering Hand Book. Society of Mining Engineers; New York.


**Reference books**:


Mines and Mineral Act 2042 BS and Mines and Mineral Regulation 2056.

Mines and Petroleum act-2040 and regulation-2041, environmental act-2053 and regulation-2054 with amendments.

NGS website, DMG website, PEPP website etc.

Publications of Department of Mines and Geology, Journals and Bulletins of Nepal Geological Society and Central Dept. of Geology.

# B.Sc. IV Year
# Geology (GEO.402)

**Subject: Exploration Geology and Mining Geology**

Nature of course: Practical
Full marks: 50
Pass marks: 20

Course No.: GEO.402
Total class period: 150

## A. Exploration Geology

**Lab 1-6**: Study of metallic and non-metallic economic minerals in hand specimens.

**Lab 7-9**: Study and interpretation of geophysical data related to mineral exploration.

**Lab 10-12**: Statistical analysis of geochemical data, preparation and interpretation of geochemical maps and sections.

**Lab 13-16**: Computation of ore reserves and grading of ores.

**Lab 17-20**: Study of geological controls of important economic deposits of Nepal and other countries from maps and sections.

## B. Mining Geology

**Lab 1-4**: Draw diagrams of open pit/open cast and underground mine with examples from Nepal.

**Lab 5-8**: Calculation of grade and tonnage of an ore deposit on the basis of given data: surface trench and drill hole data and chemical analysis of ore samples.

**Lab 9-12**: Placer gold mining process and evaluation of placer gold deposit from given data.

**Lab 13-16**: Preparation of mining plan from given data.

**Lab 17-20**: Interpretation of the geophysical and borehole logging data.

**Text and Reference books**:


Babu, S. K. and Sinha, D. K. (1988): Practical manual of exploration and prospecting. CBS publishers, India, 167 p.

ESCAP (1993): Atlas of mineral resources of Nepal, vol. 9, UN Publication.

Smirnov, V. I. (1976): Geology of mineral deposits, Mir Publications.

# B.Sc. IV Year
# Geology (GEO.403)

**Su**bject: Engineering Geology and Hydrogeology
Nature of course: Theory Course No.: GEO.403
Full marks: 100 Total class period: 150
Pass marks: 35

## A. Engineering Geology

Total marks: 50 Total Period: 75

| Main Topics | Contents | Period |
|---|---|---|
| **Introduction to engineering geology** | Development of engineering geology, aims of engineering geology, essential definitions. | **2** |
| **Description, properties and behavior of soils and rocks:** | Engineering soil classification, coarse soils, silts and loess, clay deposits, tropical soils, dispersive soils, soils of humid and arid regions, tills and glacially associated soil, frost action in soil, organic soils, peat, description of rocks and rock masses, engineering aspects of igneous, metamorphic and sedimentary rocks. | **5** |
| **Geological materials** | Important characteristics of geological materials, sediments, intact rock materials, fluids and gasses, description of geological materials, material properties and their measurement, types of test, limitations of testing, size and shape of sample, standards, density and unit weight, porosity and permeability, strength, types of rock deformation, consolidation of soils, Abrasiveness, environmental reactivity, index tests, range of values for soils and rocks, field test of soils and estimation of soil parameters. | **8** |
| **Geological masses** | Discontinuities, shear strength and discontinuities surface characteristics, field estimate of discontinuity friction angle, persistence, orientation, spacing, influence of weathering on rock | **7** |

| | | |
|---|---|---|
| | mass properties, standard weathering description and weathering zonation, drilling and sampling in soils, drilling and sampling in soil and rocks, core logging for ground description. | |
| **Engineering geology of slopes** | Landslides and their classifications, landslide recognition and identification, rate of landslide movement, extent of landslide, causes and mechanism of failures, the stability of slopes in soil, benching on slopes, slope drainage, effect of excavation technique on slope stability, slope stability analysis in rock, kinematic analysis of rock slopes, use of stereonets for rock slope failure analysis, rock mass rating (RMR) and Q-system, slope mass rating (SMR), severity of slope instabilities and remedial works. | **8** |
| **Engineering geological maps** | Published geological and engineering geological maps, engineering geological map making, understanding of geological maps, interpretation of geological maps for engineering purpose, mapping at a small scale, mapping at a large scale specially for foundation areas and excavations, rock slopes, outcrops, tunnels, mines, natural cavities, symbology in engineering geological maps, quality of published information | **6** |
| **Geological materials used in construction** | Building or dimension stone, roofing and facing materials, armourstone, Crushed rock: concrete aggregate; road aggregate; gravels and sands; lime, cement and plaster; clays and clay products. | **5** |
| **Excavation and ground loading** | Excavation issues, blasting, ground improvement, site investigation for underground excavations, subsidence, types of foundation, ultimate bearing capacity, safe bearing capacity and allowable pressures, bearing capacities on boulder bearing soils, settlement on soils, bearing capacity on rock masses, foundation settlement on rock, Foundations on slopes. | **7** |
| **Engineering geology and construction** | Open excavation, tunnels and tunnelling, underground caverns, shafts and raises, reservoirs, dams and dam sites, highways, railroads, bridges, buildings. | **5** |
| **Field tests and measurements** | Tests in boreholes, tests in large diameter boreholes, shafts and tunnels, measurements in boreholes and excavations, choice of geophysical methods, seismic methods and their particular applications, use of electrical resistivity methods, magnetic | **7** |

| | | |
|---|---|---|
| | methods and gravity methods in engineering geological site investigation. | |
| **Engineering geology and earthquakes** | Characteristics of Earthquakes (magnitude, intensity), ground response analysis, assessing seismic risk and seismic hazard, ground engineering design against earthquake hazards. | **5** |
| **Design and reporting of site investigations** | Introduction, stages of Investigation, design of site investigations, progressive evaluation of site investigation data, investigation progress, supervision of investigating works, investigation reports, form of the report. | **5** |
| **Engineering geology, planning and development** | Introduction, geological hazards, risk assessment and planning, landslide hazard maps, derelict and contaminated land. | **5** |

Text books:

Bell, F. G. (2007): Engineering Geology, 2nd edition, Elsevier Publication, 583p.
Price, D. G. and Freitas, M., (editors) (2008:) Engineering Geology - Principles and Practice, Springer, 460p.

**Reference books:**

Dahal, R. K. (2006) Geology for Technical Students, Bhrikuti Academic Publications, 756p.

Hoek, E. (2014): Practical Rock Engineering Available in http://www.rocscience.com.

Johnson, R. B. and Degraff, J. V. (1988): Principles of Engineering Geology, 1988, John Wiley Publication, 497p.

## B. Hydrogeology

Total marks: 50 Total Period: 75

| **Main Topics** | **Contents** | **Period** |
|---|---|---|
| **Soil moisture and groundwater** | Porosity of earth materials, classification of sediments, forces acting on groundwater, vertical distribution of groundwater, water table, infiltration, soil moisture, permeability of sediments. | **5** |

| | | |
|---|---|---|
| **Geology of groundwater occurrence** | Aquifers, types of aquifers, Unconsolidated aquifers (alluvial valleys, alluvium in tectonic valleys) Rocks as aquifers. | **8** |
| **Groundwater exploration** | Surface and subsurface investigations of groundwater: Geological methods, remote sensing, test drilling, geophysical logging (resistivity logging, spontaneous potential logging and other subsurface methods. | **8** |
| **Groundwater movement** | Darcy's Law, groundwater flow rates, specific yield, hydraulic conductivity of earth materials (Darcy's experiment, hydraulic conductivity, permeability of sediments, permeability or rocks), storage coefficient, effective porosity, groundwater flow directions, general flow equations. | **10** |
| **Water wells** | well drilling methods (direct rotary, reverse rotary, percussion, down the hole, types and applications of drilling fluids, well screens and their types and method of sediment size analysis, water well designs, casing diameter, casing materials, well depth, well screen length, well screen slot openings, open area, entrance velocity, design of wells. Installation and removal of well screens, well development methods, aquifer development techniques, factors that affect development. Pumping test, conducting a pumping test, measuring drawdown in wells, well efficiency, step drawdown test, problems of pumping test analysis. multiple well systems, well losses and specific capacity, Thiem equation, Theis equation, Cooper-Jacob equations, Hantush equations and their applications. Water well pumps: | **22** |
| **Groundwater quality and pollution** | Sources of salinity, measures of water quality, chemical analysis, Graphic representations, physical analysis, biological analysis, groundwater samples, water quality criteria, changes in chemical composition, dissolved gases, temperature, water pollution due to mining, agricultural sources of pollution. Water quality protection for wells and nearby groundwater resources. | **7** |
| **Groundwater** | Dynamic equilibrium in natural aquifers, groundwater budgets, | **7** |

| | | |
|---|---|---|
| **development and management** | management of potential aquifers, water law, conjunctive use of groundwater and surface water. Groundwater monitoring technology, artificial recharge, groundwater modelling, | |
| **Groundwater resources of Nepal** | Distribution, utilization, quality, and management. Types of aquifer and springs in different geological regions of Nepal. Groundwater legislation. | **8** |

**Text book:**

Driscoll, F. G., (1989): Groundwater and wells, Johnson Filtration Systems Inc., Minnesota.

Todd, D.K., Mays, W.M. (2005): Groundwater Hydrology. John Wiley & Sons, New York, third edition

**Reference books**:

Fetter, C.W. (1994): Applied Hydrogeology. Macmillan, New York

Freeze R. A., Cherry J. A. (1979): Groundwater, Prentice Hall.

# B.Sc. IV Year
# Geology (GEO.404)

**Subject: Engineering Geology and Hydrogeology**

Nature of course: Practical
Full marks: 50
Pass marks: 20

Course No.: GEO.404
Total class period: 160

## A. Engineering Geology

**Lab 1-10**: Determination of index properties of soil and rock (Natural moisture contents, grain size distribution, hydrometer analysis, Atterberg Limits, Unit weight, Specific Gravity, Permeability test, direct shear, point load test).

**Lab 11-12**: Evaluation of mechanical properties of aggregates.

**Lab 13-16**: Selection of possible sites using topographic maps for dams, tunnels, bridges, highways and other civil engineering structures.

**Lab 17-20**: Analysis of engineering geological data for solving engineering problems.

### B. Hydrogeology

**Lab 1-2**: Determination of water content of soils.

L**ab 3-7**: Preparation of groundwater flow maps and determination of flow directions.

**Lab 8-10**: Calculation of groundwater storage potentials.

**Lab 11-15**: Analysis of pumping test data to calculate aquifer parameters.

**Lab 16-20**: Analysis and presentation of groundwater quality parameters for drinking and domestic use of groundwater resources.

# B.Sc. IV Year
# Geology (GEO.406)
## Subject: Field Work

Nature of course: Practical — Course No.: GEO.406
Full marks: 100
Pass marks: 35 — Field work duration: 28 days
**Course Load:** 7 hours per day per teacher**.**

**General Objectives**: The principal objectives of filed work are to introduce students to various geological rock successions of the Nepal Himalaya, and to familiarize them various criteria and techniques to study geological elements to produce geological maps of 1:25,000-scale.

There will be two MODULES in the field work.

| Module I | Module II |
|---|---|
| Full marks: 50 | Full marks: 50 |
| Duration: 14 days | Duration: 14 days |

**Field Report:** Each student should submit field report individually after completion of the field work

### A. Field Work Module I (14 days)

**General objectives**:

- Geological study of the Siwalik Group and the Quaternary Sediments
- Geological study of the Lesser Himalayan succession

**Specific objectives**:

To carry out the following tasks

- Field techniques of recording lithological information: composition, texture, and structure of rocks:
    - Maintaining Field Diary, Graphic logging, Sketching, etc.
    - Measuring paleocurrent data,
    - Sampling and describing rocks and fossils
    - Route mapping
- Delivering concept on order of superposition, and correlation of rock units
    - Using various sedimentary structures and cross-cutting relations of geological structures
    - Using concept of litho- and bio-stratigraphic correlations
- Identifying various geological structures in the field
    - Joints, lineation, foliation, fault, fold, unconformity, etc.
- Understanding the criteria of lithostratigraphic sub-division of geological units
    - Preparation of lithostratigraphic columns
    - Classification of successions into different units (Bed, Member, Formation, Group, Supergroup)
- Studying geological mapping techniques after following all the previous mentioned tasks
    - Producing a geological map and a geological cross-section
    - Interpreting various geological structures, and litho-stratigraphic units

**Subtitles of Module I**

| | Subtitle of Module I | Fieldwork marks |
|---|---|---|
| A | Study of geology of the Siwalik Group and Quaternary Sediments: Lithostratigraphy, sedimentology, fossil occurrence, geological structures, and geological mapping | 25 |
| B | Study of geology of Proterozoic-Early Cenozoic successions (Kaligandaki Supergroup and Tansen Group of western Nepal or similar successions of mid-western or eastern Nepal Lesser Himalaya): Lithostratigraphy, sedimentology, fossil occurrence, geological structures, and geological mapping | 25 |

**Field Work Plan**

| | Subtitle of Module I |
|---|---|
| | Day 1: Departure to Field work area and Field orientation and preparation |
| A | Study of geology of the Siwalik Group and Indo-Gangetic Plain: |
| | Day 2: Traverse within the Indo-Gangetic Plain |
| | Day 3: Traverse within the Lower-Middle Siwaliks |

| | |
|---|---|
| | Day 4: Traverse within the Middle-Upper Siwaliks<br>Day 5:Geological Route Mapping in an appropriate scale |
| B | Study of geology of Proterozoic-Early Cenozoic successions (Kaligandaki Supergroup and Tansen Group of western Nepal or similar successions of mid-western or eastern Nepal Lesser Himalaya): |
| | Day 6: Traverse within the Proterozoic-Early Cenozoic successions (mainly Kaligandaki SG or equiv.) |
| | Day 7: Traverse within the Proterozoic-Early Cenozoic successions (mainly Kaligandaki SG or equiv.) |
| | Day 8: Traverse within the Proterozoic-Early Cenozoic successions (mainly Tansen Group or equivalent) |
| | Day 9: Traverse within the Proterozoic-Early Cenozoic successions (mainly Tansen Group or equivalent) |
| | Day 10: Geological Route Mapping in an appropriate scale |
| | Day 11: Individual Group Field work: Geological Mapping in 1:25,000 scale |
| | Day 12: Individual Group Field work: Geological Mapping in 1:25,000 scale |
| | Day 13: Field Report writing |
| | Day 14: Field Report submission and Field viva. Retreat from the field to College |

**B. Field Work Module II (14 days)**

**General objectives**:

- to familiarize students with
  - methods of mineral Exploration and mining (EXPLORATION AND MINING GEOLOGY)
  - various techniques of characterizing properties of soil and rock, and to prepare engineering geological maps (ENGINEERING GEOLOGY)
  - groundwater exploration technique such as bore hole drilling, and estimating discharge and recharge (HYDROGEOLOGY)

**Specific objectives**:

- To familiarize students with various techniques of characterizing properties of soil and rock, and to prepare engineering geological maps (ENGINEERING GEOLOGY)
  - To classify soils using USCS
  - To classify rocks using RMR, Q-system, GSI, Rmi
  - Technique of preparing Engn Geol. map for road or tunnel or canal alignment
  - Technique of preparing Engn. Geol. maps and profiles of landslides; Factor of Safety Analysis
- to familiarize students with groundwater exploration technique such as bore hole drilling, and estimating discharge and recharge (HYDROGEOLOGY)
  - Technique of bore hole drilling: equipments and method
  - Logging bore hole: Litho logging, geophysical well logging
  - Techniques of estimating discharge: wells and springs
  - Techniques of estimating recharge: wells and ponds

- To familiarize students with exploration methods, evaluation of deposits, mining and processing methods (EXPLORATION AND MINING GEOLOGY)
    - Introducing mineral exploration and Sampling techniques of ore minerals, minerals, rocks and rock materials.
    - Mapping of a reserve in an appropriate scale, Estimation of reserve
    - Introducing a quarry site, equipments, and quarry methods
    - Introducing mineral or rock processing (e.g., limestone processing)

**Field work subtitles based on course load**

| | Subtitle of Field Work Phase II | Subject | Field work marks |
|---|---|---|---|
| A | (a) To familiarize students with various techniques of characterizing properties of soil and rock, and to prepare engineering geological maps | ENGINEERING GEOLOGY | 12.5 |
| | (b) To familiarize students with groundwater exploration technique such as bore hole drilling | HYDROGEOLOGY | 12.5 |
| B | To familiarize students with exploration methods, evaluation of deposits, mining and processing methods | EXPLORATION AND MINING GEOLOGY | 25 |

| | | Days |
|---|---|---|
| | Day 1: Departure to Field work area and Field orientation and preparation | 1 |
| A | **(a) Techniques of characterizing properties of soil and rock, and to prepare engn. geol. maps** | |
| | Day 2: Characterization of soil and rock mass including Technique of preparing Engn Geol. maps | |
| | Day 3: Technique of preparing Engn. Geol. maps for road or tunnel or canal alignment<br>including characterization of soil and rock mass | |
| | Day 4: Technique of preparing Engn. Geol. maps and profiles of landslides; Factor of Safety Analysis | 3 |
| A | **(b) To familiarize students with groundwater exploration technique such as bore hole drilling** | |
| | Day 5: Technique of bore hole drilling: equipments and method; Logging bore hole | |
| | Day 6: Hydrogeological investigation | |
| | Day 7: Estimation of discharge and recharge | 3 |

| | | |
|---|---|---|
| B | **To familiarize students with exploration methods, evaluation of deposits and mining methods** | |
| | Day 8: Introducing mineral exploration and Sampling techniques | |
| | Day 9: Mapping of ore bodies and host rocks in an appropriate scale | |
| | Day 10: Mapping of ore bodies and host rocks in an appropriate scale and reserve estimation | |
| | Day 11: Study of mining sites and observation of mining equipment and mining methods | |
| | Day 12: Study of ore processing and dressing in industrial plants | 5 |
| | Day 13: Field Report writing | 1 |
| | Day 14: Field Report submission and Field viva. Retreat from the field to College | 1 |
| | | Days |
| | Day 1: Departure to Field work area and Field orientation and preparation | 1 |
| A | **(a) Techniques of characterizing properties of soil and rock, and to prepare engn. geol. maps** | |
| | Day 2: Characterization of soil and rock mass including Technique of preparing Engn Geol. maps | |
| | Day 3: Technique of preparing Engn. Geol. maps for road or tunnel or canal alignment<br>including characterization of soil and rock mass | |
| | Day 4: Technique of preparing Engn. Geol. maps and profiles of landslides; Factor of Safety Analysis | 3 |
| A | **(b) To familiarize students with groundwater exploration technique such as bore hole drilling** | |
| | Day 5: Technique of bore hole drilling: equipments and method; Logging bore hole | |
| | Day 6: Hydrogeological investigation | |
| | Day 7: Estimation of discharge and recharge | 3 |
| B | **To familiarize students with exploration methods, evaluation of deposits and mining methods** | |
| | Day 8: Introducing mineral exploration and Sampling techniques | |
| | Day 9: Mapping of ore bodies and host rocks in an appropriate scale | |
| | Day 10: Mapping of ore bodies and host rocks in an appropriate scale and reserve estimation | |

# B.Sc. IV Year
# Geology (GEO.407)

Subject: Fundamentals of Economics and Management

Nature of course: Theory (Interdisciplinary) Course No.: GEO.407
Full marks: 50 Total class period: 75
Pass marks: 17.5

**A: Economics**

Total period: 40

| Main Topics | Contents | Period |
|---|---|---|
| **Introduction** | Origin of Engineering Economy, Principles of Engineering Economy, Role of Geologists in Decision Making, Cash Flow Diagram. | **2** |
| **Interest and Time Value of Money** | Introduction to Time Value of Money, Simple Interest, Compound Interest, Nominal Interest rate, Effective Interest rate, Continuous Compounding, Economic Equivalence, Development of Interest Formulas, The Five Types of Cash flows, Single Cash flow Formulas, Uneven Payment Series, Equal Payment Series, Linear Gradient Series, Geometric Gradient Series. | **4** |
| **Basic Methodologies of Engineering Economic Analysis** | Determining Minimum Attractive (Acceptable) Rate of Return (MARR), Payback Period Method, Equivalent Worth Methods, Present Worth Method, Future Worth Method, Annual Worth Method, Rate of Return Methods, Internal Rate of Return Method, External/Modified Rate of Return Method, Public Sector Economic Analysis (Benefit Cost Ratio Method). Introduction to Lifecycle Costing, Introduction to Financial and Economic Analysis. | **6** |

| | | |
|---|---|---|
| **Comparative Analysis of Alternatives** | Comparing Mutually Exclusive Alternatives having Same useful life by Payback Period Method and Equivalent Worth Method, Rate of Return Methods and Benefit Cost Ratio Method, Comparing Mutually Exclusive Alternatives having different useful lives by Repeatability Assumption, Co-terminated Assumption, Capitalized Worth Method, Comparing Mutually Exclusive, Contingent and Independent Projects in Combination. | **6** |
| **Replacement Analysis** | Fundamentals of Replacement Analysis, Basic Concepts and Terminology, Approaches for Comparing Defender and Challenger, Economic Service Life of Challenger and Defender, Replacement Analysis When Required Service Life is Long, Required Assumptions and Decision Framework, Replacement Analysis under the Infinite Planning Horizon, Replacement Analysis under the Finite Planning Horizon. | **6** |
| **Risk Analysis** | Origin/Sources of Project Risks, Methods of Describing Project Risks, Sensitivity Analysis, Breakeven Analysis, Scenario Analysis, Probability Concept of Economic Analysis, Decision Tree and Sequential Investment Decisions. | **6** |
| **Depreciation and Corporate Income Taxes** | Concept and Terminology of Depreciation, Basic Methods of Depreciation, Straight line method, Declining Balance Method, Sinking Fund Method, Sum of the Year Digit Method, Modified Accelerated Cost Recovery System (MACRS), Introduction to Corporate Income Tax, After Tax Cash flow Estimate. General Procedure for Making After Tax Economic Analysis. | **6** |
| **Inflation and Its Impact on Project Cash flows** | Concept of Inflation. Measuring Inflation, Equivalence Calculation Under Inflation, Impact of Inflation on Economic Evaluation. | **4** |

**B: Management**

Total period:35

| Main Topics | Contents | Period |
|---|---|---|
| **Introduction to management:** | Concept, meaning and essence of management, Functions of Management, Types of Managers, Managerial Roles and Skills, Becoming a Manager: Role of Education, Experience and Situation, Business and Society, Corporate Social Responsibility, Ethics and Ethical Standards, Corporate Governance. | **3** |
| **Perspectives in Management** | Early Developments, The Classical perspective, The Behavioral Perspective, Quantitative Perspective, Integrating Perspective, Contingency Perspective, Contemporary Perspective on Management, Emerging Management Issues and Challenges. | **4** |
| **Planning and Decision Making:** | Planning: Meaning of Planning, The Planning System, Levels of Planning, Hierarchy of Plans, Steps in Planning, Tools for Planning, Planning Premises, Pitfalls of Planning, Improving Planning. Decision Making: Meaning and Concept, Types of Decisions, Decision Making Process, Decision Making Conditions. | **8** |
| **Organizing and Staffing:** | Organizing: Meaning of Organizing, Principles of Organizing, Process of Organizing, Organizational Architecture, Vertical Differentiation, Horizontal Differentiation, Responsibility, Authority, Delegation of Authority, Centralization, Decentralization and Devolution. Staffing: Concept of Staffing, Stafffing and Human Resource Management, Objectives of Staffing, Importance of Staffing, Components of Staffing Function. | **10** |
| **Leadership, Motivation and Communication**: | Meaning of Leadership, Qualities of Leadership, Understanding Individual Differences and Psychological Contacts, Leadership Styles. Concepts of Work Groups. Managerial Ethics. Concept of Motivation, Importance of Motivation, Techniques of Motivation. Meaning of Communication, Importance of Communication in Organizations, | **10** |

| | | |
|---|---|---|
| | Purpose of Organizational Communication, The Communication Process, Communication Networks, Concept of Active Listening, Communication Flows in Organizations, Types of Communications, Barriers of Effective Communications, Enhancing Organizational Communication. | |

**Text and Reference Books**:


Chan S. Park, Contemporary Engineering Economics, Prentice Hall, Inc.

GS Gupta (2011), Managerial economics, Tata McGraw Hill Education Pvt. Ltd. New Delhi. 432p.

James L. Riggs, David D. Bedworth and Sabah U. Randhawa, Engineering Economics, Tata MCGraw Hill Education Private Limited.

MS Bhat and AV Rau (2008), Managerial Economics and Financial Analysis, BS Publications, Hyderabad, 364p.

Paul De Garmo, William G. Sullivan and James A. Bonta delli, Engineering Economy, MC Milan Publishing Company.

PR Pant, 2014. Principles of management. Buddha Academic Publishers and Distributors Pvt. Ltd.