विद्युत नियमन आयोग
इन्जिनिरिङ सेवा, हाइड्रोपावर समूह, तह ७, इन्जिनियर पदको
खुला/आन्तरिक प्रतियोगितात्मक परीक्षाको पाठ्यक्रम

यस पाठ्यक्रमलाई दुई चरणमा विभाजन गरिएको छः

प्रथम चरण :- लिखित परीक्षा (Written Examination) पूर्णाङ्क :- २००

द्वितीय चरण :- अन्तर्वार्ता (Interview) पूर्णाङ्क :- ३०

परीक्षा योजना (Examination Scheme)

१. प्रथम चरणः लिखित परीक्षा (Written Examination) **पूर्णाङ्क :- २००**

पत्र	विषय	पूर्णाङ्क	उत्तीर्णाङ्क	खण्ड	परीक्षा प्रणाली	प्रश्न संख्या	अङ्क भार	समय
प्रथम	सामान्य ज्ञान, बौद्धिक परीक्षण तथा विद्युत नियमन सम्बन्धी	१००	४०	(क)	वस्तुगत बहुवैकल्पिक प्रश्न (MCQs)	५०	१	१ घण्टा ३० मिनेट
	General Technical Subject			(ख)	वस्तुगत बहुवैकल्पिक प्रश्न (MCQs)	५०	१	
द्वितीय	Technical Subject	१००	४०	(क)	छोटो उत्तर आउने प्रश्न	२	५	३ घण्टा
					लामो उत्तर आउने प्रश्न	४	१०	
				(ख)	छोटो उत्तर आउने प्रश्न	२	५	
					लामो उत्तर आउने प्रश्न	४	१०	

२. द्वितीय चरणः अन्तर्वार्ता (Interview) **पूर्णाङ्क :- ३०**

विषय	पूर्णाङ्क	परीक्षा प्रणाली
अन्तर्वार्ता	३०	मौखिक

द्रष्टव्यः

१. लिखित परीक्षाको माध्यम भाषा नेपाली अथवा अंग्रेजी वा नेपाली र अंग्रेजी दुवै हुन सक्नेछ।

२. प्रथम र द्वितीय पत्रको लिखित परीक्षा छुट्टाछुट्टै हुनेछ।

३. लिखित परीक्षामा सोधिने प्रश्न संख्या र अङ्कभार यथासम्भव सम्बन्धित पत्र / विषयमा दिइए अनुसार हुनेछ।

४. वस्तुगत बहुवैकल्पिक (Multiple Choice) प्रश्नहरूको गलत उत्तर दिएमा प्रत्येक गलत उत्तर बापत २० प्रतिशत अङ्क कट्टा गरिनेछ । तर उत्तर नदिएमा त्यस बापत अङ्क दिइने छैन र अङ्क कट्टा पनि गरिने छैन।

५. वस्तुगत बहुवैकल्पिक प्रश्नहरू हुने परीक्षामा परीक्षार्थीले उत्तर लेख्दा अंग्रेजी ठूलो अक्षर (Capital Letter) A, B, C, D मा लेख्नुपर्नेछ। सानो अक्षर (Small Letter) a, b, c, d लेखेको वा अन्य कुनै सङ्केत गरेको भए सबै उत्तरपुस्तिका रद्ध हुनेछ।

६. बहुवैकल्पिक प्रश्नहरू हुने परीक्षामा कुनै प्रकारको क्यालकुलेटर (Calculator) प्रयोग गर्न पाइने छैन।

७. विषयगत प्रश्नहरूको हकमा एउटा लामो प्रश्न वा एउटै प्रश्नका दुई वा दुई भन्दा बढी भाग (Two or more parts of a single question) वा एउटा प्रश्न अन्तर्गत दुई वा बढी टिप्पणीहरू (Short notes) सोध्न सकिनेछ।

८. विषयगत प्रश्न हुने पत्र/ विषयको प्रत्येक खण्डका प्रश्नका लागि छुट्टाछुट्टै उत्तरपुस्तिकाहरू हुनेछन्। परीक्षार्थीले प्रत्येक खण्डका प्रश्नको उत्तर सोही खण्डको उत्तरपुस्तिकामा लेख्नुपर्नेछ।

९. यस पाठ्यक्रम योजना अन्तर्गतका प्रश्न/ विषय विषयवस्तुमा जुनसुकै कुरा लेखिएको भए तापनि पाठ्यक्रममा परेको कानुन, ऐन, नियम, विनियम तथा नीतिहरू परीक्षाको मिति भन्दा ३ महिना अगाडि (संशोधन भएका वा संशोधन भई हटाइएका वा थप गरी संशोधन भई) कायम रहेकालाई यस पाठ्यक्रममा परेको सम्झनु पर्दछ।

१०.प्रथम चरणको परीक्षाबाट छनौट भएका उमेदवारहरूलाई मात्र द्वितीय चरणको परीक्षामा सम्मिलित गराइनेछ।

११.पाठ्यक्रम स्वीकृत मिति : २०८२/०१/०८

विद्युत नियमन आयोग

इन्जिनिरिङ सेवा, हाइड्रोपावर समूह, तह ७, इन्जिनियर पदको

खुला/आन्तरिक प्रतियोगितात्मक परीक्षाको पाठ्यक्रम

प्रथम पत्र :

खण्ड (क) सामान्य ज्ञान, बौद्धिक परीक्षण तथा विद्युत नियमन सम्बन्धी : ५० अङ्क

1. सामान्य ज्ञान (१५ × १ = १५ अङ्क)

1.1 नेपालको भूगोल र आर्थिक तथा सामाजिक क्रियाकलापः धरातलीय स्वरुपको किसिम र विशेषता, नेपालमा पाइने हावापानीको किसिम र विशेषता, नदीनाला, तालतलैया, खनिज पदार्थ, प्राकृतिक श्रोत साधन, विद्युत, शिक्षा, स्वास्थ्य र सन्चार सम्बन्धी जानकारी

1.2 नेपालको सामाजिक एवं सांस्कृतिक अवस्थाः परम्परा, धर्म, जाति, भाषाभाषी, कला, संस्कृति र साहित्य

1.3 नेपालमा विद्युत विकास, उर्जाका श्रोत र सम्भावना

1.4 नेपालको संघीय, प्रादेशिक र स्थानीय संरचना तथा शासन प्रणाली सम्बन्धी जानकारी

1.5 विश्वको भूगोलः महादेश, महासागर, अक्षांश, देशान्तर, अन्तर्राष्ट्रिय तिथि रेखा, समय, पर्वतशृंखला, नदी, हिमनदी. ताल, हिमताल

1.6 संयुक्त राष्ट्र संघ र यसका एजेन्सीहरू सम्बन्धी जानकारी

1.7 दक्षिण एशियाली क्षेत्रीय सहयोग संगठन (SAARC), SAARC- Energy Center, बिमस्टेक (BIMSTEC) सम्बन्धी जानकारी

1.8 राष्ट्रिय र अन्तर्राष्ट्रिय महत्त्वका समसामयिक घटना तथा नवीनतम गतिविधिहरू

2. संविधान, विद्युत क्षेत्रको नियमन र सम्बन्धित कानुनी व्यवस्था (१५ × १ = १५ अङ्क)

2.1 नेपालको संविधानः मौलिक हक र कर्तव्य, राज्यका निर्देशक सिद्धान्त, नीति तथा दायित्व, अनुसूचीहरू

2.2 विद्युत ऐन, २०४९ र विद्युत नियमावली, २०५०

2.3 विद्युत नियमन आयोग ऐन, २०७४ तथा विद्युत नियमन आयोग नियमावली, २०७५

2.4 विद्युत नियमन आयोग कर्मचारी प्रशासन विनियमावली, २०८१

2.5 सार्वजनिक खरिद ऐन, २०६३

2.6 विद्युत क्षेत्रमा नियमनको अवधारणा

2.7 विद्युत नियमन आयोगको काम, कर्तव्य तथा अधिकार

2.8 उपभोक्ता महशुल निर्धारणको सिद्धान्त तथा प्रक्रिया

2.9 विद्युत खरिद बिक्री दर निर्धारणका सिद्धान्त तथा प्रक्रिया

2.10 विद्युत नियमन आयोगको पाँच वर्षे मार्गचित्र २०८१-८६

3. Aptitude Test (20 ×1 = 20 Marks)

3.1 Verbal reasoning :

Series, analogy, classification, coding-decoding, insert the missing character, direction and distance sense test, ranking order, assertion and reason, statement and conclusion

3.2 Non-verbal reasoning:

Series, analogy, classification, matrices, figure formation and analysis, dot situation, water images, mirror images, embedded figures.

3.3 Quantitative aptitude:

Arithmetical reasoning/operation, percentage, fraction, ratio, average, profit & loss, time and work

3.4 General mental ability, logical reasoning and analytical ability, data interpretation

खण्ड (ख)
General Technical Subject तथा विद्युत नियमन सम्बन्धी : ५० अङ्क

(A). General Technical Subject (40 ×1 = 40 Marks)

1. **Structural Engineering**
   - 1.1 Center of gravity, moment of inertia , radius of gyration
   - 1.2 Stresses and strains, theory of torsion and flexure
   - 1.3 Analysis of beams and frames: bending moment, shear force and deflection of beams and frames
   - 1.4 Determinate structures (energy methods), three hinged systems, suspension cable system
   - 1.5 Indeterminate structures: slope deflection method and moment distribution method, use of influence line diagrams for simple beams, unit load method, two hinged arch
   - 1.6 Plastic analysis of beam and frame

2. **Fundamentals of Surveying**
   - 2.1 Introduction and basic principles, classification of surveys
   - 2.2 Linear measurement techniques:- chain and tape method, measurement and common scales, sources of errors, effect of slope and slope correction, correction for chain and tape measurements, Abney level and clinometers
   - 2.3 Plane table surveying: principles and methods of plane tabling
   - 2.4 Leveling: principle of leveling, temporary and permanent adjustment of level, bench marks, booking methods and their recording, longitudinal and cross sectioning, reciprocal leveling, trigonometric leveling
   - 2.5 Contouring: contour interval and characteristics of contours, methods of contouring, interpolation, use of contour map
   - 2.6 Theodolite traversing: principle of traverse, computation of coordinates; adjustment of closed traverse and linked traverse, closing errors
   - 2.7 Tacheometry: principle, tacheometric formula, relation of distance and elevation
   - 2.8 Uses of total station and electronic distance measuring instruments

3. **Construction Materials and Concrete Technology**
   - 3.1 Properties of building materials: physical, chemical and thermal
   - 3.2 Stones: characteristics and requirements of stones as a building materials
   - 3.3 Ceramic materials: ceramic tiles, mosaic tile, brick types and testing
   - 3.4 Cementing materials: types and properties of lime and cement; cement mortar tests
   - 3.5 Metals: types and properties of steel, alloys
   - 3.6 Timber and wood: timber trees in Nepal, types and properties of wood
   - 3.7 Miscellaneous materials: asphaltic materials (asphalt, bitumen and tar), paints and varnishes, polymers

3.8 Concrete Technology : Constituents and properties of concrete (physical and chemical); Water cement ratio; Grade and strength of concrete, concrete mix design, testing of concrete; Mixing, transportation pouring and curing of concrete; Admixtures; High strength concrete; Pre-stressed concrete

4. **Geotechnical Engineering**

4.1 Formation of soil, general classification of soil depending on transporting agent and deposit media

4.2 Three phases of soil: basic terms, relation between basic terms, volumetric relationship: mass and volume, weight and volume, specific gravity of soil and lab test, field density and determination methods

4.3 Types of water in soil, moisture content and relationship, organic content in soil

4.4 Index properties of soil: grain size distribution and types of soil depending on grain size distribution, consistency limit, relative density, lab test of index properties

4.5 Types of rock, dip, strike, fold, fault, cleavage, geographical divisions of Nepal, earthquake: causes of earthquake, types of wave, grading of earthquake, seismic fault line in Nepal

4.6 Tunneling: types of tunnels, component parts of a tunnel and tunnel cross section, survey for tunnel alignment, drainage, lighting and ventilation requirements for tunnels, method of tunneling in soft soils and rock

5. **Construction Management**

5.1 Construction scheduling and planning: network techniques (CPM, PERT) and bar charts

5.2 Contractual procedure and management: types of contract, preparation of bidding document, contractors pre-qualification, evaluation of tenders and selection of contractor, bid acceptance, condition of contract, quotation and direct purchase, classifications of contractors, dispute resolution

5.3 Project management

5.4 Project monitoring and evaluation

5.5 Material management: procurement procedures and materials handling

5.6 Cost, quality and time control

5.7 Quality assurance plan

5.8 Variation, alteration and omissions

5.9 Occupational health and safety

6. **Estimating, Costing, Specification and Valuation**

6.1 Types of estimates and their specific uses

6.2 Methods of calculating quantities

6.3 Key components of estimating norms and rate analysis

6.4 Preparation of bill of quantities

6.5 Purpose, types and importance of specification

6.6 Purpose, principles and methods of valuation

(B). सेवा तथा विद्युत नियमन सम्बन्धी (10 ×1 = 10 Marks)

7. **Hydropower Policy and Planning**
   - 7.1 History of power development in Nepal; efforts towards power sector reform, concept of deregulation and unbundling of NEA
   - 7.2 Current demand and supply scenario of electricity in the power system; status and prospects renewable energy
   - 7.3 Electricity Demand Forecast Report (2025-2040), WECS, GON
   - 7.4 Transmission System Development Plan of Nepal, RPGCL, GON

8. **Concept of Regulation, Regulatory Bodies and Relevant Legal Instruments**
   - 8.1 Concept of the independent regulator; global and regional trends in regulation of electricity business
   - 8.2 History of regulation of electricity sector in Nepal
   - 8.3 Stakeholder relations, protection of their right and public hearing
   - 8.4 Corporate Governance of Electricity Generation Company, Transmission Company, Electricity Trading Company, the Independent System Operator and Distribution Utilities
   - 8.5 Concept of sub-legislation (directives, by-laws and circulars) issued by regulatory bodies and their significance
   - 8.6 Principles of the consumer tariff fixation procedures in Nepal – past and present
   - 8.7 Power Purchase (Generation Tariff Fixation) Procedure in Nepal
   - 8.8 Types of Electricity Tariffs
   - 8.9 Concept of wheeling charges, methods of determination of wheeling charges

9. **Electricity Market**
   - 9.1 Concept of: power pool, electricity market (types of electricity market), open access, net metering, energy banking
   - 9.2 Elements of Power Purchase Agreement (PPA)
   - 9.3 Elements of Project Development Agreement (PDA)
   - 9.4 Cross border grid connectivity and Cross Border Energy Trade in Bangladesh, Bhutan, India and Nepal (BBIN) region and SAARC member states

10. **Reliability and Quality Concerns**
   - 10.1 Concept and metrics of reliability [System Average Interruption Duration Index (SAIDI), Customer Average Interruption Duration Index (CAIDI), System Average Interruption Frequency Index (SAIFI)] and impact of lower reliability
   - 10.2 Quality of electricity supply
   - 10.3 Customer Service Standards

विद्युत नियमन आयोग

इन्जिनिरिङ सेवा, हाइड्रोपावर समूह, तह ७, इन्जिनियर पदको

खुला/आन्तरिक प्रतियोगितात्मक परीक्षाको पाठ्यक्रम

द्वितीय पत्र :

Technical Subject

खण्ड (क) : ५० अङ्क

1. **Structural Engineering**

1.1 Reinforced concrete structures: difference between working stress and limit state philosophy, design of beam and slab, analysis of RC beams and slabs in bending, shear, deflection, bond and end anchorage, design of axially loaded columns; isolated and combined footings, introduction to pre-stressed concrete

1.2 Steel and timber structures: standard and built-up sections: design of riveted, bolted and welded connections, design of simple elements such as ties, struts, axially loaded and eccentric columns, column bases, design principles of timber beams and columns

1.3 Seismic design of buildings

1.4 Structural design of bridge: various types of bridges, selection and type of bridges and economic span length, types of loads, forces and stresses, live load, impact load, wind load, longitudinal forces, lateral loads, centrifugal force, width of roadway and footway, general design requirements, solid slab bridges, deck girder bridges, distribution of live loads on longitudinal beams, method of distribution coefficients, Courbon's method, design of a T- beam bridge, balanced cantilever bridge, design of box culvert

1.5 Structural standards for hydropower structure - dams, spillways, powerhouses, penstocks etc.

2. **Geotechnical Engineering**

2.1 **Soil Mechanics**

2.1.1 Identification and classification of soils Field identification of soils and soil classification: descriptive, textural, ISI, MIT and USCS

2.1.2 Permeability of soils, Factors affecting permeability of soil, determination of coefficient of permeability: laboratory and field methods

2.1.3 Effective stress: Factors affecting effective stress, capillary rise, quicksand condition

2.1.4 Seepage analysis: Flow net, application of flow net, seepage below concrete dam, sheet pile and safety check, seepage analysis through earthen dam and filter layer design, techniques to reduce discharge and to increase safety of dam

2.1.5 Compaction of soil: Concept of compaction, lab test, factors affecting compaction, specification of compaction, field control of compaction, methods of compaction in field and their suitability, special parameters to be considered for compaction in road, earthen dam

2.1.6 Shear strength of soils: Concept of shear strength, principal planes and principal stresses, Mohr-Coulomb theory of shear strength, calculation of normal stress and shear, Stress at different plane, relation of principle

stress at failure condition, types of shear tests: direct shear test, unconfined compression test, triaxial test, vane shear test

2.1.7 Consolidation and settlements: Concept of consolidation, types of consolidation, test of consolidation, NC, OC, OCR, pre-consolidation pressure, calculation of settlement, settlement of structures resting on soil: its nature, causes and remedial measures

2.1.8 Stability of slopes: Causes of slope failures, types of slope and slope failures, critical surfaces and factor of safety, method of stability analysis and stability number, bioengineering: advantages, principles, concept, components and uses in stabilization of slope

2.2 **Foundation Engineering**

2.2.1 Introduction: Types of foundation, factors affecting on selection of foundation, requirement and criteria of ideal foundation, types of loads for design of foundation, criteria for selection of depth of foundation

2.2.2 Earth pressure and retaining structures: Rankine's earth pressure theory, Coulomb's earth pressure theory, trial wedge theory, types of earth pressure, types of retaining wall, stability analysis of earth retaining structures, techniques to increase stability of retaining wall

2.2.3 Bearing capacity and settlements: Types of bearing capacity and factors influencing bearing capacity, effects of various factors on bearing capacity, modes of foundation failure, Terzaghi's general bearing capacity theory, ultimate bearing capacity of cohesionless and cohesive soils, settlement: types, nature and effects

2.2.4 Types of foundation and their suitability in context of Nepal: Condition to use spread or strap or combined footing; mat: types, bearing capacity, construction approach, floating mat, compensating mat; pile: types, load carrying capacity, negative skin friction (NSF) and calculation; comparison between pile, pier, and caisson; caisson: types, bearing capacity, construction of well, tilt and shift of well and its retrofication and prevention

2.2.5 Design of foundation: Design of spread foundation, combined footing, strap footing, mat foundation, pile foundation, well foundation

2.2.6 Foundation stabilization, underpinning and geotechnical process: Soil stabilization, stone column, sand pile, dynamic deep compaction, grouting and its methods, methods of underpinning, methods of dewatering, Rock anchoring and Grouting Standards

2.3 **Site Investigation and Soil Exploration**

2.3.1 Purpose of site investigation, planning of investigation, stages of investigation, methods of boring, types of soil samples

2.3.2 In-situ test: standard penetration test, dynamic cone penetration test, correction of N value, calculation of bearing capacity using N value for isolated footing, mat, pile and well, plate load test, pile load test

2.3.3 Preparation of site investigation report

3. **Hydrology and Hydraulics**

3.1 **Hydrology and Sediment**

- 3.1.1 Rainfall measurements and related analysis
- 3.1.2 Flow measurements, rating curve and generation of flow data
- 3.1.3 Estimation of long term daily and monthly flows, low flows
- 3.1.4 Hydrograph analysis, synthetic unit hydrographs
- 3.1.5 Flood frequency analysis, estimation of design flood
- 3.1.6 Collection of sediment data, sediment rating curve, estimation of sediment yield and concentration, reservoir sedimentation
- 3.1.7 Ground water hydrology
- 3.1.8 Glacier and snowmelt hydrology for high altitude projects
- 3.1.9 Sediment management techniques for hydropower projects

3.2 **Hydraulics**

- 3.2.1 Fluid pressure, fluid kinematics, dynamics of flows
- 3.2.2 Boundary layers, uniform flow, steady flow, laminar and turbulent flow
- 3.2.3 Bernoulli's equation and its applications
- 3.2.4 Laminar and turbulent flow in pipes
- 3.2.5 Concept of specific energy and gradually varied flows in open channel
- 3.2.6 Hydraulic jump and its types, flow profiles

4. **Irrigation Engineering**

- 4.1 Function, advantages and disadvantages of irrigation; status and need of irrigation in Nepal
- 4.2 Crops and soils, crop water and irrigation water requirements, water availability for irrigation
- 4.3 Irrigation methods (surface, sub-surface, sprinkler and drip), their suitability, advantages and disadvantages
- 4.4 Canal types, network and alignment, canal losses, command area, duty and delta
- 4.5 Silt theories, design of earthen and lined canals, canal standards, specific considerations for hill irrigation
- 4.6 Design of irrigation structures on permeable foundation (seepage theories, piping & uplift)
- 4.7 Design of weir and barrage (crest, length and thickness of impervious floor)
- 4.8 Design of silt control structures (excluder, ejector and settling basin)
- 4.9 Design of energy dissipaters (hydraulic jump and stilling basins)
- 4.10 Design of river training works (guide bund, levees and spurs), water shed management
- 4.11 Design of regulators, drops, cross-drainage and outlets
- 4.12 Waterlogging (causes, effects and measures), design of surface and subsurface drainage
- 4.13 Planning and Management of Irrigation System

5. **Hydropower Engineering**

5.1 Hydropower development in Nepal, policy, acts and regulations

5.2 Types of hydropower projects (run-off river, peaking ROR, Storage, and pump storage)

5.3 Flow duration curve, determination of reservoir capacity, reservoir sedimentation, useful life of reservoir

5.4 Power demand analysis and forecast

5.5 Potential and firm power, maximum power output, firm energy, surplus energy, seasonal energy, and average annual energy

5.6 Concept of load, load curve, capacity factor, load factor, and utilization factor

5.7 Hydropower system optimization: optimization of dam height, water conveyance system and installed capacity

5.8 Power demand variation (daily, weekly, monthly, seasonal, and annual)

5.9 Layout of reservoir, diversion structures, de-sanding basin, water conveyance system, fore-bay, surge tank, penstock, powerhouse, draft tube, tailrace, switch yard, and auxiliary structures

5.10 Dam classification and their usage based on functionality, acting forces, and construction material; selection of dam based on construction material, topography, economy and purpose

5.11 Concrete gravity dams: forces on gravity dams, their line of actions, stability against sliding, overturning, and floating

5.12 Embankment dams: earth and rock-fill dams; basic design principles, concept of seepage through embankments, considerations in foundation and slope stability

5.13 Concept of cofferdam and their usage

5.14 Design of spillways, types of spillway gates, location, and their functions

5.15 Energy dissipation methods, types of energy dissipaters, design of stilling basin and aprons

5.16 Design of intake, trash rack, gravel trap and approach canal

5.17 Types, location, and usage of de-sanding basin, suspended sediment characteristics, sediment velocities to be considered in de-sanding basin design, design of de-sanding basin, flushing of sediments from de-sanding basin

5.18 Hydraulic tunnels: pressure and non-pressure tunnels, tunnel cross-section and size, head loss in tunnels, concept of tunnel stability and protection measures, tunnel linings

5.19 Water hammer, hydrodynamic pressure calculations, design of fore-bay basin

5.20 Importance, location and application of penstock, anchor blocks and saddle support, surge tank and types design

5.21 Underground and surface power houses, powerhouse dimensions and design, tailrace

5.22 Types and selection of turbines, concept of specific speed, gates and valves, draft tube, need and working principle of governors

6. **Project Investigation**
   - 6.1 Concept of multipurpose water resources system and its development, modern tools for water resources analysis (ANN, GA, PSO)
   - 6.2 Concept of river basin development and integrated water resource management
   - 6.3 Guidelines for the study of hydropower projects in Nepal
   - 6.4 Stages of project studies and field investigation
   - 6.5 Basic idea of: Topographical survey, Geological and geotechnical investigation, Seismological study, Hydro-meteorological investigation and sedimentological investigation
   - 6.6 Construction materials and its investigation
   - 6.7 Concepts of Initial environmental examination (IEE) and environmental impact assessment (EIA) Studies and their importance in Project development

7. **Construction Management**
   - 7.1 Construction scheduling and planning: techniques (bar charts, CPM, PERT)
   - 7.2 Contract management and administration: types of contracts, preparation of bidding (tender) document, contractors' pre-qualification, evaluation of tenders and selection of contractor, bid acceptance, condition of contract
   - 7.3 Material management and handling
   - 7.4 Cost control, quality assurance and quality control mechanism
   - 7.5 Safety, occupational health and safety guidelines.
   - 7.6 Variation, time extension, alteration, omissions
   - 7.7 Claims and disputes, dispute resolution
   - 7.8 Project closure and evaluation
   - 7.9 Post –construction and commissioning

8. **Specification, Estimation, Costing and valuation**
   - 8.1 Purpose, types and importance of specification
   - 8.2 Types of estimates and their specific uses
   - 8.3 Methods of calculating quantities
   - 8.4 Key components of estimating: norms and rate analysis
   - 8.5 Preparation of price schedule
   - 8.6 Purpose, principles and methods of valuation

9. **Environment Engineering**
   - 9.1 General introduction of air pollutants, its causes, impacts and remedial measures
   - 9.2 Human excreta and its characteristics, pollution caused by excreta
   - 9.3 Health aspects of water supply and sanitation
   - 9.4 Green house effects, its impacts and remedial measures
   - 9.5 Green hydrogen, carbon trading and climate change: concept
   - 9.6 Solid waste management, types and characteristics of solid waste
   - 9.7 Role of EIA, types of environmental impacts, and EIA principles
   - 9.8 Government rules and regulations and procedures for EIA