

Proposed Format for the Written Examination

The maximum marks will be 100 and all the questions will be objective type in nature (i.e., the candidates will be choosing one correct answer from the given choices.

There will be no negative marking.

Sr No.	Section	1 mark Questions (memory, field experience based and simple thinking based)	2 mark Questions (logical, linked and analysis type)	Total
I.	TECHNICAL SECTION			
i.	Transportation Engineering	10	$5 \times 2 = 10$	20
ii.	Geotechnical Engineering	7	$4 \times 2 = 8$	15
iii.	Structural Engineering and Construction Management	9	$3 \times 2 = 6$	15
iv.	Water resources	5	0	5
v.	Environmental Engg	5	0	5
vi.	Surveying	5	0	5
vii.	Project Planning and Management	7	$4 \times 2 = 8$	15
II.	Verbal Ability	10	0	10
III.	Numerical Ability	10	0	10
		Total		100

Course Content

Technical Section (70)

Transportation Engineering

Highway Planning: Geometric design of highways, testing and specifications of paving materials, design of flexible and rigid pavements.

Traffic Engineering: Traffic characteristics, theory of traffic flow, intersection design, traffic signs and signal design, highway capacity.

Traffic and Transportation Planning: Principles of traffic engineering and transportation planning; traffic survey methods; design of roads, intersections, grade separators and parking areas; hierarchy of roads and levels of services; traffic and transport management in urban areas, intelligent transportation system; mass transportation planning; para-transits and other modes of transportation, pedestrian & slow moving traffic planning.

Geotechnical Engineering

Soil Mechanics: Origin of soils, soil classification, three-phase system, fundamental definitions, relationship and interrelationships, permeability & seepage, effective stress principle, consolidation, compaction, shear strength.

Foundation Engineering: Sub-surface investigations- scope, drilling bore holes, sampling, penetration tests, plate load test. Earth pressure theories, effect of water table, layered soils. Stability of slopes-infinite slopes, finite slopes. Foundation types-foundation design requirements. Shallow foundations-bearing capacity, effect of shape, water table and other factors, stress distribution, settlement analysis in sands & clays. Deep foundations-pile types, dynamic & static formulae, load capacity of piles in sands & clays, negative skin friction.

Structural Engineering and Construction Management

Concrete Technology- properties of concrete, basics of mix design. Concrete design- basic working stress and limit state design concepts, analysis of ultimate load capacity and design of members subjected to flexure, shear, compression and torsion by limit state methods. Basic elements of pre-stressed concrete, analysis of beam sections at transfer and service loads.

Building Services: Water supply, sewerage and drainage systems; sanitary fittings and fixtures; plumbing systems, principles of internal & external drainage systems, principles of electrification of buildings, intelligent buildings; elevators & escalators, their standards and uses; air-conditioning systems; fire fighting systems, building safety and security systems.

Building Construction and Management: Building construction techniques, methods and details; building systems and prefabrication of building elements.

Materials and Structural Systems: Behavioral characteristics of all types of building materials e.g. mud, timber, bamboo, brick, concrete, steel, glass, FRP, different polymers, composites; principles of strength of materials; design of structural elements in wood, steel

and RCC; elastic and limit state design; complex structural systems; principles of pre-stressing; tall buildings; principles of disaster resistant structures.

Water resources

Hydrology: Hydrologic cycle, rainfall, evaporation, infiltration, stage discharge relationships, unit hydrographs, flood estimation, reservoir capacity, reservoir and channel routing. Well hydraulics.

Environmental Engineering

Air Pollution: Types of pollutants, their sources and impacts, air pollution meteorology, air pollution control, air quality standards and limits.

Noise Pollution: Impacts of noise, permissible limits of noise pollution, measurement of noise and control of noise pollution.

Principles of water supply and sanitation systems; water treatment; solid waste disposal systems; waste treatment, recycle & reuse; urban rainwater harvesting; power supply and communication systems — network, design & guidelines; demography related standards at various levels of the settlements for health, education, recreation, religious & public-semi public facilities.

Surveying

Importance of surveying, principles and classifications, mapping concepts, coordinate system, map projections, measurements of distance and directions, leveling, theodolite traversing, plane table surveying, errors and adjustments, curves.

Project Planning and Management

Planning Theory: Regional planning; settlement system planning; history of human settlements; growth of cities & metropolises; principles of Ekistics; rural-urban migration; urban conservation; urban renewal; Five-year plan; structural and sectoral plan.

Techniques of Planning: Planning survey techniques; preparation of urban and regional structure plans, development plans, action plans; site planning principles and design; statistical methods of data analysis; application of G.I.S and remote sensing techniques in urban and regional planning; decision making models.

Principles of modular coordination; estimation, specification, valuation, professional practice; project management techniques e.g., PERT, CPM etc;

Logic and Aptitude; General Awareness and Language Proficiency

1 Verbal Ability: English grammar, sentence completion, verbal analogies, word groups, instructions, critical reasoning and verbal deduction.

2 Numerical Ability: Numerical computation, numerical estimation, numerical reasoning and data interpretation.

SAMPLE QUESTIONS

TECHNICAL SECTION

Q.1 Select the strength parameter of concrete used in design of plain jointed cement concrete pavements from the following choices:

- | | |
|-----------------------|--------------------------|
| (A) Tensile strength | (B) Compressive strength |
| (C) Flexural strength | (D) Shear strength |

Q.2 For a portion of national highway where a descending gradient of 1 in 25 meets with an ascending gradient of 1 in 20, a valley curve needs to be designed for a vehicle travelling at 90 kmph based on the following conditions.

- (i) headlight sight distance equal to the stopping sight distance (SSD) of a level terrain considering length of valley curve $>$ SSD.
- (ii) comfort condition with allowable rate of change of centrifugal acceleration = 0.5 m/sec^3 . Assume total reaction time = 2.5 seconds; coefficient of longitudinal friction of the pavement = 0.35; height of head light of the vehicle = 0.75 m; and beam angle = 1° .

Q.3 What is the length of valley curve (in m) based on the head light sight distance condition? _____

Q.4 What is the length of valley curve (in m) based on the comfort condition? _____

Q.5 Following statements are made on compacted soils, wherein DS stands for the soils compacted on dry side of optimum moisture content and WS stands for the soils compacted on wet side of optimum moisture content. Identify the incorrect statement.

- (A) Soil structure is flocculated on DS and dispersed on WS.
 (B) Construction pore water pressure is low on DS and high on WS.
 (C) On drying, shrinkage is high on DS and low on WS.
 (D) On access to water, swelling is high on DS and low on WS.

Q.6 Four columns of a building are to be located within a plot size of 10 m x 10 m. The expected load on each column is 4000 kN. Allowable bearing capacity of the soil deposit is 100 kN/m^2 . The type of foundation best suited is

- (A) isolated footing (B) raft foundation
 (C) pile foundation (D) combined footing

Q.7 It was observed that 150 vehicles crossed a particular location of a highway in a duration of 30 minutes. Assuming that vehicle arrival follows a negative exponential distribution, find out the number of time headways greater than 5 seconds in the above observation? _____

VERBAL ABILITY

Q.1. Choose the appropriate answer to complete the following sentence:

To those of us who had always thought him timid, his ----- came as a surprise.

(A) intrepidity (B) inevitability (C) inability (D) inertness

Ans. (A)

Q.2. Choose the appropriate answer to complete the following sentence:

Medicine is to illness as law is to _____

(A) discipline (B) anarchy (C) treason (D) etiquette

Ans. (B)

Q.3. Read the following paragraph:

"The ordinary form of mercury thermometer is used for temperature ranging from -40°F to 500°F . For measuring temperature below -40°F , thermometers filled with alcohol are used. These are, however, not satisfactory for use in high temperatures. When a mercury thermometer is used for temperature above 500°F , the space above the mercury is filled with some inert gas, usually nitrogen or carbon dioxide, placed in the thermometer under pressure. As the mercury rises, the gas pressures is increased, so that it is possible to use these thermometers for temperatures as high as 1000°F ."

With what, besides mercury, would a thermometer be filled if it was designed to be used for measuring temperature of about 500°F ?

(A) Pyrometer (B) Inert gas (C) Iron and brass (D) Gas

Ans. (B)

Q.4. The cost of manufacturing tractors in Korea is twenty percent less than the cost of manufacturing tractors in Germany. Even after transportation fees and import taxes are added, it is still cheaper to import tractors from Korea to Germany than to produce tractors in Germany.

Which of the following assertions is best supported by the above information?

(A) Labour costs in Korea are twenty percent below those in Germany.

(B) Importing tractors into Germany will eliminate twenty percent of the manufacturing jobs in Germany.

(C) The costs of transporting a tractor from Korea to Germany are more than twenty percent of the cost of manufacturing the tractor in Korea.

(D) The import taxes on a tractor imported from Korea to Germany is less than twenty percent of the cost of manufacturing the tractor in Germany.

Ans. (D)

NUMERICAL ABILITY

Q.1. In a survey, $\frac{3}{16}$ of the people surveyed told that they preferred to use public transport while commuting daily to office. $\frac{5}{8}$ of the people surveyed told that they preferred to use their own vehicles. The remaining 75 respondents said that they had no clear preference. How many people preferred to use public transport?

(A) 75 (B) 100 (C) 125 (D) 133

Ans. (A)