

Ph.D. Entrance Test Examination April 12 Faculty: Technology
Civil Engineering

23/04/12

Con. 3206-12.

(3 Hours)

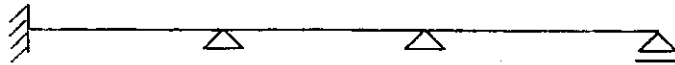
KK-2621

[Total Marks : 100

- N.B. :**
1. Attempt all questions.
 2. Answers to all sub questions should be grouped together.
 3. Figures to the right indicate full marks.
 4. Assume suitable data if necessary and state the same clearly.

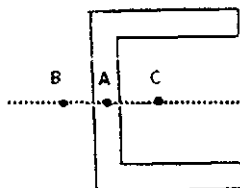
Q.1 Solve **all** questions. (2 marks each) (40)

- (i) Determine the static and kinematic indeterminacy (neglecting axial deformations) of the structures shown in fig below.



- (ii) In three dimensional problems of elasticity, the total no of independent stress components are equal to
- (a) 9
 - (b) 6
 - (c) 3
 - (d) 12
- (iii) For plain strain problem in elasticity, the unknowns are
- (a) ϵ_x , ϵ_y and γ_{xy}
 - (b) σ_x , σ_y and τ
 - (c) a & b
 - (d) None of these
- (iv) As per Theory of elasticity the 36 elastic constants can be reduced to
- (a) 3
 - (b) 4
 - (c) 5
 - (d) 2
- (v) As per Theory of elasticity, the maximum value of Poisson's ratio is
- (a) 0.25
 - (b) 0.5
 - (c) 1.0
 - (d) 2.0

- (vi) As per Theory of elasticity Membrane Analogy is used to determine stresses in case of
 - (a) Flexural problems
 - (b) Torsional problems
 - (c) Both flexural and torsional problems
 - (d) None of these
- (vii) As per IS 456-2000,
 Modulus of elasticity of concrete is
 Modulus of rupture of concrete is
- (viii) The shape factor of a rectangular section of width 'b' and depth 'd' is
- (ix) State true or false.
 The buckling load obtained by Energy Method is greater than or equal to exact buckling load.
- (x) What are isoparametric shape functions in FEM.
- (xi) What is the percentage of distribution steel provided in slab using
 1. Fe 250
 2. Fe 415
- (xii) Enlist losses in prestress.
- (xiii) Draw the stress block as given in IS 456-2000 for a beam in LSM showing resultant forces.
- (xiv) The basic perfect pin jointed frame is
 - (a) Triangle
 - (b) Rectangle
 - (c) Square
 - (d) Hexagon
- (xv) Define
 1. Load factor
 2. Characteristic load
- (xvi) The shear centre of the channel section shown in fig. below lies at
 - (a) A
 - (b) B
 - (c) C
 - (d) None of the above



- (xvii) For a structure having static indeterminacy of 3, the number of plastic hinges required to be formed for the structure to become a mechanism are.....
- (xviii) Determine the period of vibration for a SDOF system with a mass of 100kg and stiffness of 10000 N/m
- (xix) Define principal planes.
- (xx) Differentiate between the structural behavior of long column and short column.

Q.2 Solve any three questions

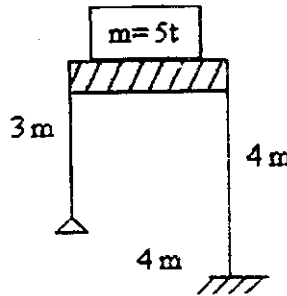
- (a) A state of stress at a point is given by 10

$$\sigma_{xyz} = \begin{pmatrix} 50 & 20 & 10 \\ 20 & 100 & 60 \\ 10 & 60 & 50 \end{pmatrix} \text{ Mpa}$$

Find at a point normal stress, resultant stress and shear stress on a plane passing through a point having unit normal given by

$$\bar{n} = 0.866\bar{i} - 0.3\bar{j} + 0.4\bar{k}$$

- (b) (i) For the structures shown in figure calculate the natural frequency of vibration. 05

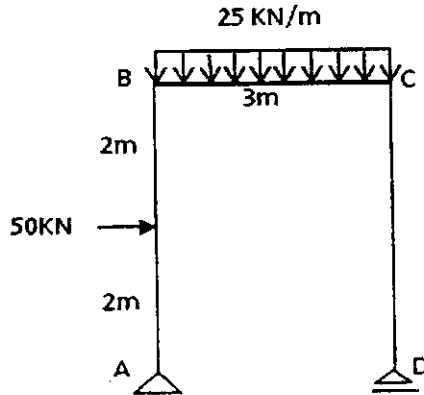


- (ii) A vibrating system consists of a mass 4.5 kg and spring with $K = 3.5 \text{ N/mm}$ is viscously damped. The system is set into free vibration by releasing it at $t = 0$ sec. from a displacement of 10 mm. If the amplitude of displacement on the return swing is 6 mm, determine:

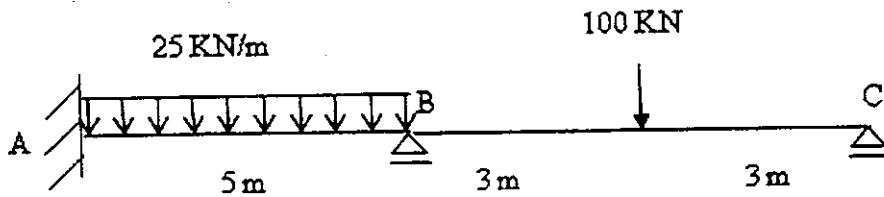
- (i) Natural frequency of undamped system
- (ii) Logarithmic decrement
- (iii) Damping ratio
- (iv) Damping coefficient
- (v) Damped natural frequency

- (c) A three span continuous beam ABCD where $AB = 7\text{m}$, $BC = 6\text{m}$, $CD = 6\text{m}$ carries a central point load of 100 kN on span AB, a point load of 50 kN at 3m to the right of support B on span BC and a udl of 15 kN/m on span CD. If the beam is to have uniform section throughout, find the plastic moment capacity of the section required if the load factor is 1.5. 10

- (d) Design a one way slab by Limit State Method, with a clear span of 4.0m, simply supported on 230mm brick wall and subjected to a live load of 4 KN/m^2 and surface finish of 1 KN/m^2 . Use M20 grade of concrete and Fe 415 grade of steel. 10
- (e) Determine the horizontal deflection at D of the rigid jointed frame loaded as shown in figure below. 10

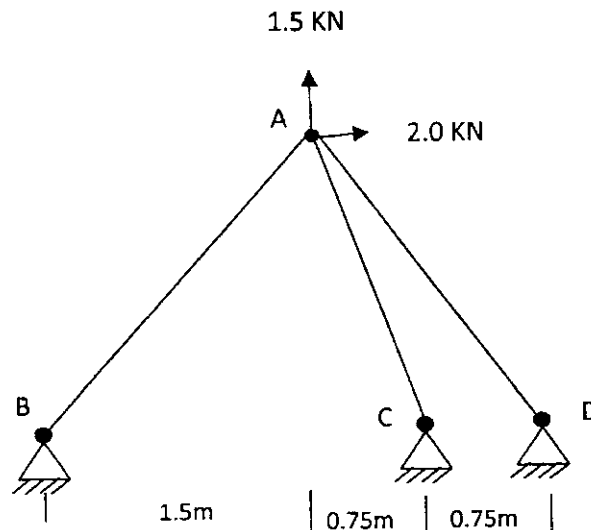


- (f) Analyse the beam shown in figure. Draw SFD, BMD and deflected shape. 10



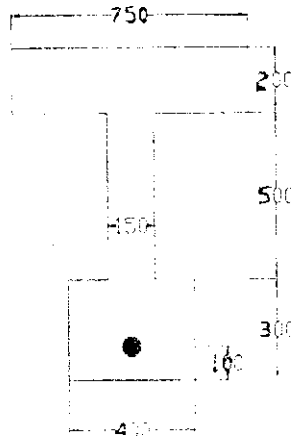
Q.3 Solve any two questions

- (a) Determine the unknown nodal displacements, support reactions and member forces for the pin jointed frame as shown in figure below by employing Finite Element Method. The cross sectional area of all members is same at 1000 mm^2 15



$E = 210 \text{ GPa}$.

- (b) (i) Design a reinforced concrete beam by LSM of overall size 250 mm by 500 mm to carry an ultimate moment of 400 KN-m. Assume that the depth to centre of steel from free end is 50 mm. Use M 25 grade concrete and Fe 415 steel. 08
- (ii) Find the limiting moment of resistance of a reinforced concrete beam of rectangular section 230 mm x 600 mm reinforced with 3 numbers of 25 mm diameter bars. Use M20 concrete and Fe415 steel. 07
- (c) A rectangular single bay, single story frame ABCD, the columns AB and CD are of 4m height and beam BC is 6 m long. Both column supports are fixed. The frame carries udl of 10KN/m on column member AB. Analyze the frame using stiffness approach and draw SFD and BMD. EI is constant for all members. 15
- (d) A prestressed concrete I-beam has its upper flange 750mm wide and 250mm deep, lower flange 400mm wide and 300mm deep and a web of depth 500mm and width 150mm. it is supported over a span of 30 metres and carries a uniformly distributed load of 4000N/m, exclusive of self weight. It is prestressed with 120 wires of 5mm diameter, with their centroid 100mm above the bottom edge and initially tensioned to 1000N/mm^2 . Assuming 15 percent loss in prestress, determine the extreme fibre stresses at mid span at various stages. 15



Q. No.1. Objectives Type Questions (Solve all) (20 * 2 marks each = 40 Marks)

- (1) Reynold's number is defined as
 - (a) ratio of inertia force to gravity force
 - (b) ratio of viscous force to gravity force
 - (c) ratio of viscous force to elastic force
 - (d) ratio of inertia force to viscous force.

- (2) An ideal fluid is defined as the fluid which
 - (a) is compressible
 - (b) is incompressible
 - (c) is incompressible and non-viscous
 - (d) has negligible surface tension.

- (3) Continuity equation deals with the law of conservation of
 - (a) mass
 - (b) momentum
 - (c) energy
 - (d) none of the above.

- (4) Pitot tube is used for measurement of
 - (a) Pressure
 - (b) flow
 - (c) velocity at a point
 - (d) discharge.

- (5) When the fluid is at rest, the shear stress is
 - (a) maximum
 - (b) zero
 - (c) unpredictable
 - (d) none of the above.

- (6) Study of fluid motion without considering the forces, causing the flow, is known as
 - (a) Kinematics of fluid flow
 - (b) Dynamics of fluid flow
 - (c) Statics of fluid flow
 - (d) None of the above.

- (7) Rotameter is used for measuring
 - (a) density of fluids
 - (b) velocity of fluid in pipes
 - (c) discharge of fluids
 - (d) viscosity of fluids.

- (8) Pressure intensity (p) has a dimension of
 - (a) MLT
 - (b) $ML^{-1}T^{-2}$
 - (c) MLT^{-2}
 - (d) $ML^{-2}T$

- (9) Infiltration process is
 - (a) movement of water through soil
 - (b) absorption of water by surface of the soil
 - (c) saturation of the soil
 - (d) capillary rise of water in the soil.

- (10) The upstream face of the earth dam is considered as
 - (a) equipotential line
 - (b) streamline
 - (c) neither streamline nor equipotential line
 - (d) sometimes equipotential line sometimes streamlines.

- (11) Hygroscopic water is defined as
- the readily available water for the use of plants
 - the water which is adsorbed by the particles of the dry soil from the atmosphere
 - the total water content of the soil when all the pores are filled with water
 - the water held by the soil under capillary action.
- (12) Uplift pressure is considered in the analysis of gravity dam
- only when there is drainage gallery in the dam
 - only when there is tail water
 - only when the reservoir is empty
 - in all situations having water in the reservoir.
- (13) A body is called bluff body if the surface of the body
- coincides with the streamlines
 - does not coincides with the streamlines
 - is very smooth
 - none of the above.
- (14) Model analysis of free surface flows are based on
- Reynolds number
 - Froude number
 - Mach number
 - Euler number
- (15) Specific energy of a flowing fluid per unit weight is equal to
- p/w
 - $p/w + h$
 - $(V^2/2g) + h$
 - $(p/w) + h + (V^2/2g)$
- (16) The critical depth (h_c) for rate of flow per unit width of channel (q) is given by
- $(q^2/g)^{1/2}$
 - $(q/g)^{2/3}$
 - $(q^2/g)^{1/3}$
 - $(q^2/g)^{2/3}$
- (17) A turbine is called reaction turbine if at the inlet of the turbine the total energy is;
- kinematic energy only
 - kinetic energy and pressure energy
 - pressure energy only,
 - none of the above
- (18) Chezy's formula is given as
- $V = i (m.C)^{1/2}$
 - $V = C (m.i)^{1/2}$
 - $V = m (C.i)^{1/2}$
 - none of the above
- where; V = velocity of flow in channel, C = Chezy's constant, m = hydraulic mean radius and i = longitudinal slope of channel
- (19) If the R.L. of canal bed level and high flood level of drainage are 212.00 meter and 210.00 meter respectively, then cross drainage work will be
- aqueduct
 - super passage
 - siphon
 - siphon aqueduct

- (20) Hydrograph is a plot of
- (a) rainfall intensity against time
 - (b) discharge against time
 - (c) cumulative rainfall against time
 - (d) cumulative runoff against time.

Q.No.2. Solve any three out of six questions (3*10 marks each = 30 Marks)

- (1) Discuss the various methods of assessment of irrigation water charges.
- (2) Discuss the effect of environmental disturbances on hydrology.
- (3) What are the various objectives of watershed management? Explain its benefits.
- (4) Define boundary layer thickness. Explain the fundamental causes of its existence. Also discuss the various methods of controlling the boundary layer.
- (5) Write a brief note on compatibility of multipurpose uses in a water resources project.
- (6) Discuss the design criteria of filters for earth dams.

Q.No.3. Solve any two questions out of four questions (2*15 Marks each = 30 Marks)

- (1) What is Unit Hydrograph? Explain clearly the basic assumptions of Unit Hydrograph theory. Describe how you can obtain the Unit Hydrograph from a flood hydrograph resulting from a storm of certain duration.
- (2) What do understand by well development? Describe briefly the various methods of well development.
- (3) What do you understand by life of a reservoir? What measures may be taken to prolong the life of a reservoir?
- (4) What do you understand by Mass-Inflow curve? How would you find 'safe yield' if the mass inflow curve and the reservoir capacity are given.

*****:

Section – I Objective type Questions (each carries two marks)

1. Abrasion test results used to determine the properties of aggregate
(a) Hardness (b) toughness (c) soundness (d) none of the above
2. During impact test the height from which hammer falling on the mould filled with sample is
(a) 27 mm (b) 45 mm (c) 38 cm (d) 40 cm
3. 15. During crushing strength test the load apply up to
(a) 40 t (b) 50 t (c) 40 to 50 t (d) 25 t
4. If the impact value of aggregate is lie between 10 – 20 % Such aggregate can be called as
(a) Strong (b) Exceptionally strong (c) satisfactory (d) all the above
5. The Total annual cost of the highway transportation (A) may be expressed as
(a) $A = B - CN$ (b) $A = B + CN$ (c) $A = B/CN$ (d) CN/B
6. The Unit Cost of the transportation (A_u) on a section of highway may be roughly calculated by
(a) $A_u = AL/N$ (b) $A_u = AN/L$ (c) $A_u = A/LN$ (d) $A_u = ALN$
7. The life of the cement concrete road is taken as
(a) Five years (b) 10 years (c) 10 to 15 years (d) 25 to 30 years
8. For the concrete roads, the expansion joints are provided at interval of
(a) Five Meter (b) 10 Meter (c) 12 to 15 Meter (d) 18 to 21 Meter
9. An Ideal Pavement is constructed of
(a) Cement concrete (b) Bricks (c) Stones (d) Bitumen
10. A road suitable for very heavy traffic is
(a) Surface dressed macadam (b) Cement concrete
(c) Reinforced cement concrete (d) all the above
11. arrange the order of following layers of the flexible pavement from bottom to top
(1) Subbase (2) Base (3) Subgrade (4) Dense Bituminous Macadam (5) Bitumenous concrete
(a) 1, 2, 3, 4, 5 (b) 3, 2, 1, 4, 5 (c) 3, 1, 2, 4, 5 (d) 3, 1, 2, 5, 4
12. the transverse joint in the concrete pavement may be
(a) an expansion joint (b) a contraction joint (c) a warping joint
(d) construction joint (e) all the above
13. As per IRC recommendation the traffic volume study is carried out for rural roads for
Days continuously during harvesting and lean season.
(a) 7 (b) 14 (c) 21 (d) 28

14. The practical capacity of highway is that of a possible capacity
 (a) Same as (b) Less than (c) more than (d) none of the above
15. Traffic engineering deals with the
 (a) traffic operation (b) design and application of the control devices
 (c) Analysis of traffic characteristics (d) all the above
16. The general unit used for measuring the traffic on highway is the
 (a) Annual average daily traffic volume (b) Monthly average daily traffic volume
 (c) Daily average daily traffic volume (d) half yearly daily traffic volume
17. According to K. B. Wood if the dry density of the subgrade soil is greater than 2.1 gm/cm^3 , such types of subgrade soil classified as
 (a) Excellent (b) very good (c) poor (d) very poor
18. As per IRC recommendation CBR test can be conducted on
 (a) subgrade material only (b) subbase material only (c) base material only (d) all the above
19. Geotextile can be use in the Pavement as a
 (a) Reinforcement (b) Drainage (c) separator (d) all the above
20. The central portion of road used for movement of traffic known as
 (a) Expressway (b) shoulder (c) carriageway (d) all the above

Section – II (Short Type Questions)
Solve any Three each carries 10 Marks

- (a) Different type of joints of cement concrete pavement.
 (b) Steps for construction of WBM road.
 (c) Surface and subsurface Drainage System
 (d) Traffic signs
 (e) Discuss types of failure in flexible pavements with neat sketch.
 (f) Mud Pumping in Rigid Pavement.

Section – III (Long Type Questions)
Solve any Two each carries 15 Marks

- (a) What are the objectives of soil stabilization? List different methods of stabilization. Discuss in brief lime Stabilization.
- (b) Enlist the different methods of classification of subgrade soil. Discuss revised PRA system for classification of subgrade soil. State the equation and importance of GI value in revised PRA system for classification of subgrade soil.
- (c) A traffic survey revealed the present ADT of commercial vehicle as 800 commercial vehicle per day and the rate of growth of traffic is 5 % per annum. The pavement construction is to be completed in three years after last count. If the design life is 20 years, the vehicle damage factor is 2.5. Calculate the cumulative number of standard axles to be catered in the design.
- (d) At an uncontrolled T junction, past experience indicates that the probability of vehicle arriving on the side road during 10 second interval and turning right into the main road is $1/5$. Find the probability that in a period of one minute, there will be 1,2,3 and 4 vehicles arriving and turning right.

- N.B. :**
1. The paper consists of sections I, II and III.
 2. Section I consists of fill in the blank type questions which are compulsory
 3. Section II consists of six questions out of which 3 are compulsory
 4. Section III consist of four questions out of which 2 are compulsory
 5. Draw figures wherever required
 6. Assume whatever required and state the assumptions

Section I

Q1) Fill in the blanks

(40)

- 1) _____ is the basic formula used to design sewerage system
- 2) _____ and _____ are used to remove oil and grease in wastewater treatment
- 3) The commonly used formula used for rooftop harvesting is _____.
- 4) _____ is a connection fixture used in service connection to apartment to reduce pressure from water mains
- 5) _____ and _____ are plant injuries caused due to air pollution
- 6) _____ for a sedimentation tank passing discharge of Q and having length L , width B and height H is given by Q/BL .
- 7) _____ can remove 90-92% pathogens in water treatment process flowsheet.
- 8) Two devices used to control particulates are _____ and _____
- 9) The length at the end of vertical stack of drainage system is known as _____.
- 10) A standard normal distribution has mean equal to _____ and variance equal to _____
- 11) An ecosystem consists of _____ and _____ factors.
- 12) Two disposal methods for solid waste are _____ and _____.
- 13) Two pollutants emitted from industries are _____ and _____.
- 14) _____ type of soil is found in Maharashtra region.
- 15) _____ is a temperature change in natural water bodies caused by human influence, such as use of water as coolant in a power plant.
- 16) _____ is the global effect caused majorly by chloro fluoro carbon.
- 17) The per capita per day demand of water is an average value over a period of _____.
- 18) The total water consumption including domestic, commercial and industrial and public use for an Indian town with full flushing system as per IS code is taken as _____.
- 19) _____ and _____ are responsible for air pollution disasters
- 20) Minimum dissolved oxygen required by fish to survive is _____ mg/L.

Section II

Solve any 3 questions

(30)

Q1) Draw the plan and hydraulic diagram of domestic wastewater treatment flowsheet. Explain in detail the function of each unit with its efficiency.

Q2) Explain citric acid cycle (TCA) with equations and diagram. What is the significance of this cycle

Q3) Draw and explain material recovery flowsheet consisting of front end system and rear end system Compost and for boiler recovery. Explain the pre and post treatment required for the same

Q4) What is the history of environmental acts? Which are the various environmental acts or laws passed after Indian independence? Write in short about these laws.

Q5) Derive Stoke's law. Explain the concept of ideal settling tanks.

Q6) What is Bayes theorem? Consider a group of 10 water samples. Exactly 3 are contaminated. Define following events:

c- sample contaminated

c'- sample not contaminated

d- contamination detected

d'- contamination not detected

$P(C) = 0.3$ (based on 3 out of 10 samples contaminated)

Suppose sample analysis technique is imperfect. Based on calibration tests:

$P(D|C) = 0.9$ Successful detection

$P(D|C') = 0.4$ False alarm

What is the probability of actual contaminated sample if the detection is contaminated ?

Section III
Solve any two questions

(30)

- Q1) Write a note on physical, chemical and bacteriological characteristics of water and wastewater. Explain in short techniques used to determine these characteristics.
- Q2) Three laboratories, A, B, and C, are used by mineral water manufacturing companies for carrying out hardness tests of their products. The following data are the hardness (in mg/l) of three similar types of mineral water.

Mineral Water	Laboratory			
	A	B	C	D
Brand 1	16.6	17.7	16	16.3
Brand 2	16	15.5	15.6	15.9
Brand 3	16.4	16.3	15.9	16.2

Analyse the data at 5% significance by (a) carrying out a one-way ANOVA to see if there is a difference between the hardness of the three brands

- Q3) Forecast the population for the following data for 2060 using incremental increase method

Census	Population
1960-70	30,600
1970-80	44,000
1980-90	55,000
1990-2000	62,000
2000-2010	65,000

The daily per capita demand is 120 litres for the population, of which 80% finds its way into the sewer. Slope available for sewer to be laid is 1 in 600 and sewer should be designed to carry 3.5 times the DWF when running full. What would be the velocity of flow in sewer when running full? Assume $n=0.012$ in Manning's formula

- Q4) Explain ISO 14000 in detail (Procedure followed and certification along with implication).

SECTION-I Objective Type Questions

- For major construction project the best suited organization is
(a) Line and staff organization (b) Functional organization
(c) Line organization (d) None of these
- Following is the starting point of all management functions.
(a) Organizing (b) Planning (c) Controlling (d) Scheduling
- The estimated time required to perform an activity is known as
(a) Duration (b) dummy (c) event (d) Float

[TURN OVER

- 4) The time which results in least possible construction cost of an activity is known as
(a) Slow (b) normal (c) crash (d) standard time
- 5) The direct cost of a project with respect to normal time is
(a) Maximum (b) Minimum (c) Zero (d) infinite
- 6) The time by which the particular time of activity can be delayed without affecting preceding and succeeding activity is known as
(a) Interfering float (b) free float (c) total float (d) independent float
- 7) In case of resource leveling operation for rescheduling of activities the constraint is on
(a) Resources (b) Project duration (c) Both a and b (d) None of these
- 8) The process of incorporating change in a network by preplanning and rescheduling is called
(a) Updating (b) Resource Leveling (c) Resource smoothening (d) Scheduling
- 9) In CPM governing factor is
(a) Cost (b) time (c) both a and b (d) none of these
- 10) The network in which the analysis is wider and less rigidly structured is
(a) PERT network (b) desion network (c) CPM network (d) None of these
- 11) The factor affecting cost of owning and operating construction equipment is
(a) Depreciation and investment cost (b) maintenance and repair cost
(c) Operation cost (d) All of these
- 12) Which of the following lifting equipment has a large service area and three way mobility?
(a) Traveller crane (b) Tower crane (c) Derrick crane (d) Gantry crane
- 13) The most suitable equipment for close range of work is
(a) Back Hoe (b) Clam shell (c) Power shovel (d) Drag line
- 14) Preventive maintenance means
(a) Taking action before break down (b) taking action before break down
(c) Break down maintenance (d) All of these
- 15) Safety in construction site is to be strictly enforced
(a) It is beneficial to employers (b) all of these
(c) It is beneficial to customers (d) it is beneficial to employees

- 16) The viability of any project depends on
 (a) Technical analysis (b) Ecological analysis
 (c) Financial and economic analysis (d) All of these
- 17) The stage of work at which cost control is not affected is at
 (a) Planning stage (b) Designing stage (c) Construction stage (d) None of these
- 18) The area in which cost control can be best achieved
 (a) Labour (b) Plants and equipment (c) Materials (d) both (a) and (b)
- 19) Identify which of the following is not a PERT event
 (a) Assembly of units started (b) Assemble units (c) Income tax form completed
 (d) List of necessary equipment completed.
- 20) In CPM activity times are
 (a) Probabilistic (b) Deterministic (c) Non-deterministic (d) None of these

SECTION-II Short Type Questions

Attempt any three of the followings: (10 marks each)

1. Prepare PERT network for following works. Workout,
 a. Project completion time.
 b. Period of completion of work with 90 % probability.
 c. Period of completion of work with 50 % probability.

Activity	t_o	t_m	t_p
P(10-20)	3	4	5
Q(10-30)	6	8	10
R(10-40)	2	5	8
S(20-40)	9	10	11
T(40-70)	4	8	12
U(30-70)	7	9	11
V(30-50)	12	14	16
W(60-80)	3	6	9
X(70-80)	6	7	8
Y(50-60)	3	6	9

2. Describe in detail ready-mix concrete.
3. Explain the term (a) Mean b) Median c) Mode d) Skewness
4. How major and minor equipment are selected? Explain in detail.
5. Explain contribution of Fredric Taylor and Henry Fayol
6. Formulation of Linear Programing Problem

SECTION-III Long Type Questions

Attempt any Two of the followings: (15 marks each)

Q.1 (a) What is updating? When updating is to be done? Explain by quoting an example in brief the procedure of updating.

Q.2. (a) Explain in detail soil improvement techniques.
(b) Write note on ABC analysis.

Q.3. Maximise, $Z_{\text{Max}} = 45 X_1 + 80 X_2$

Subjected to,

$$5 X_1 + 20 X_2 \leq 400$$

$$10 X_1 + 15 X_2 \leq 450$$

For all X_1 and $X_2 \geq 0$

Q.4 Table shows the network for the project, the data for the duration and cost of each activity. The indirect cost of the project is 2000 Rs per week. Determine the optimum duration of the project and corresponding minimum cost.

Also, draw a time scale version of the network at each stage of the crashing.

activity	Normal duration (weeks)			Normal cost (Rs)	Crash duration (weeks)	Crash cost (Rs)
	t_o	t_l	t_p			
1-2	2	5	14	7,000	3	14,500
1-3	1	9	11	4,000	5	8,500
2-3	3	4	5	6,000	1	9,000
2-4	3	4.5	9	8,000	3	15,000
3-4	3	4.5	9	5,000	3	11,000