(3 Hours) [Total Marks: 100

NB:

i. All the sections are compulsory.
ii. Assume suitable data wherever necessary and in case if not given. However, the same may be indicated and justified.
iii. Illustrate your answers with neat sketches wherever necessary although not sought specifically.

SECTION-I

(40 Marks)

This section comprises 40 objective questions. All the questions are compulsory. Each question carries 01 mark.

1. Pre stressed concrete means
   a) Compressive stress induced in concrete before loading
   b) Compressive stress induced in steel before loading
   c) Tensile stress induced in steel before loading
   d) Tensile stress induced in concrete before loading

2. The neutral axis of the reinforced beam passes through
   a) C.G of concrete section
   b) Meta Centre of the concrete section
   c) Centroid of the transformed concrete section
   d) Centroid of the concrete section

3. Design of foundation for a large generator is guided primarily, by
   a) Frequency
   b) Deformation
   c) Strength
   d) stiffness

4. The shape of influence line diagram for the maximum bending moment in simply supported beam is
   a) Rectangular
   b) Triangular
   c) Parabolic

d) circular

5. Which of the following are statically indeterminate beams ,
   a) Fixed beam
   b) Continuous beam
   c) Both a and b
   d) None of the above

6. The failure of struts may occur
   a) By pure compression
   b) By buckling
   c) By combination of pure compression and buckling, depending upon a slenderness ratio
   d) Any of the above

7. A Flow net is drawn to obtain
   a) Seepage coefficient of permeability and uplift pressure
   b) Coefficient of permeability, uplift pressure and exit gradient
   c) Exit gradient, uplift pressure, seepage quality
   d) Exit gradient, seepage and coefficient of permeability

8. The expansion of soil due to the shear at a constant value of pressure is called
   a) Apparent cohesion
   b) True cohesion
   c) Dialatancy
   d) consistency

9. For stability analysis of an earth dam for steady seepage case , the most appropriate test would be the
   a) Unconsolidated undrained test
   b) consolidated undrained test
   c) Unconsolidated drained test
   d) consolidated drained test

10. The shape of log-log plot of load settlement curve is a
   a) Straight curve
   b) Parabolic curve
   c) Spiral curve
   d) Cubic curve

11. Boussinesq assumptions for soil , in his analysis of intensity of stress in foundation material is that soil mass in
   a) Finite
   b) Infinite
   c) Semifinite
   d) None of above

12. Liquefaction of foundation soil during an earthquake shall not be the reason for cracking of
   a) Only floors on the building

b) Wall and roofs in the building
c) Beams and columns in the building
d) Only balcony in the building

13. In earthen roads, the common stabilizer used are
a) Cement
b) Bitumen
c) Lime
d) All the above

14. Compaction of concrete slab is done with the help of
a) Light roller
b) Heavy roller
c) Vibrator
d) Mixer

15. An enclosed area for birthing ships, to keep them a float at a uniform level, to facilitate loading and unloading cargo is known as
a) Harbour
b) Port
c) Dock
d) Lock

16. The taxiway is the strip of pavement which connects
a) The city to the airport
b) The runway to the apron
c) The terminal building to taxi stand
d) None of the above

17. The 'break-water' is provided
a) In artificial harbour
b) With arm
c) Both of the above
d) None of the above

18. Sub-surface drainage of a road means removal of rain water from
a) Surface of the road
b) Sub grade of sub-surface of the road
c) Surface and sub-surface of the road
d) Soil of permanent land of road

19. Base flow is,
a) The annual minimum flow in a stream
b) The flow not obstructed by manmade structures
c) Delayed ground water flow reaching a stream
d) None of the above

20. Centre of pressure of a plane surface immersed in a liquid is
a) Above the centre of gravity of the plane surface

b) At the centre of gravity of the plane surface
c) Below the centre of gravity of the plane surface
d) None of the above

21. The value of the kinetic energy correction factor of the viscous flow through a circular pipe is
a) 1.33
b) 1.50
c) 2.0
d) 1.25

22. The boundary layer separation takes place if

a) Pressure gradient is zero
b) Pressure gradient is positive
c) Pressure gradient is negative
d) None of the above

23. A body is called a bluff body if the surface of the body
a) Coincides with the streamlines
b) Does not coincide with the streamlines
c) Is very smooth
d) None of the above

24. Which of the following compass can be used without a tripod for observing bearings
a) Trough compass
b) Prismatic compass
c) Surveyor compass
d) All of the above

25. The bubble tube parallel to the telescope of a theodolite should be more sensitive, since it controls
a) Vertical axis
b) Horizontal axis
c) Axis of bubble tube
d) None of the above

26. Latitude of a line is defined as
a) Orthographic projection of a survey line on the E-W Line
b) Orthographic projection of a survey line on the reference meridian
c) Length of a survey line corrected for various chain/ tape corrections
d) None of the above

27. The closing error can be eliminated by
a) Bowditch rule
b) Transit rule
c) Working accurately latitudes
d) Either a or b is applicable

28. Overturning of vehicles on a curve can be avoided by using a
a) Compound curve
b) Vertical curve
c) Reverse curve

d) Transition curve

29. In a broad gauge, the clear horizontal distance between the inner faces of two parallel rails forming the track is
    a) 1 m
    b) 0.792 m
    c) 0.6096 m
    d) 1.676 m

30. When two different rail sections are joined by means of fish plates, the joint is known as
    a) Supported joint
    b) Suspended joint
    c) Compromise joint
    d) Staggered joint

31. The best suited material for the ballast is
    a) Broken stone
    b) Gravel or river pebbles
    c) Ashes or cinders
    d) Brick ballast

32. The railway track from which a train is to be diverted is called
    a) Branch track
    b) Main or through track
    c) Points and crossings
    d) All of the above are correct

33. The accurate method for predicting population for a sound and rapidly increasing city is
    a) Arithmetical increase method
    b) Geometrical increase method
    c) Incremental increase method
    d) Graphical method

34. A moderately soft or slightly hard water will have hardness in the range
    a) 100-150 mg/litre of $CaCO_3$
    b) 150-250 mg/litre of $CaCO_3$
    c) 250-400 mg/litre of $CaCO_3$
    d) 400-1000 mg/litre of $CaCO_3$

35. Rate of filtration of a slow sand filter ranges from
    a) 10 to 100 litres/hr/m^2
    b) 100 to 200 litres/hr/m^2
    c) 200 to 400 litres/hr/m^2
    d) 400 to 1000 litres/hr/m^2

36. Sludge bulking can be controlled by
    a) Chlorination
    b) Coagulation
    c) Aeration
    d) Denitrification

37. Bar charts are considered suitable for
    a) Major projects
    b) Minor projects
    c) Large projects
    d) All of the above

38. CPM network is
    a) Event oriented
    b) Activity oriented
    c) Slack oriented
    d) Float oriented

39. When the times of earliest finish and latest finish are equal in an operation, the operation is called
    a) Critical
    b) Float
    c) Free float
    d) All of the above

40. Total project cost
    a) Increased with time
    b) Reduced with increase in time
    c) Initially reduces with time and then increases with further increase
    d) Initially increases with time and then reduced with further increase

SECTION-II

(30 Marks)

NB: Attempt any three questions. Each question carries 10 marks.

1. **(a)** Design a septic tank for a hostel having 50 students with probable peak discharge of 63 litres/ minute. Assume detention period of 24 hours. Further, assume the rate of sludge deposition at 30 litres/capita/ year and cleaning period of one year. The free board of 30 cms may be provided. (06)

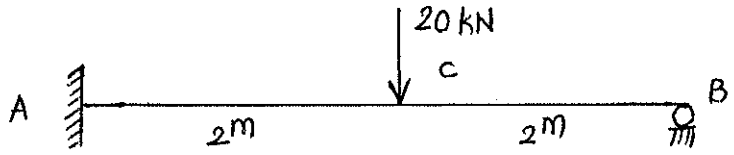
   (b) A flow net is plotted for a homogeneous earthen dam of height 22 m and free board, 2 m. The results obtained are:
   - No. of potential drops = 10
   - No. of flow channels = 4

   The dam has a horizontal filter of 30 metres length at the downstream end and the coefficient of permeability of the dam material is 5×10^{-4} cm/sec. Calculate the discharge per metre run of the dam. (04)

2. **(a)** A 4 m long circular bar was found to deflect 20 mm at mid span under the point load of 100 N. If this bar is used as a column with both the ends hinged, calculate the buckling load. (06)

   (b) Differentiate between the static indeterminacy and kinematic indeterminacy. (04)

3. (a) Analyze the propped cantilever loaded as shown in Figure using Flexibility method/ Theorem of Least Work. Assume EI to be constant. Draw BMD and hence, SFD. (07)



(b) Write a short note on : Negative skin friction. (03)

4. (a) Calculate the safe stopping sight distance on a level road stretch for a design speed of 60 km/hr for :
- Two way traffic on two lane road
- Two way traffic on single lane road

Assume coefficient of friction as 0.35 and the total reaction time of the driver as 2.5 seconds. (06)

(b) Give the classification of the Rural Roads in accordance with the **first** as well as **third twenty year road development plan**. Also state the urban roads in a classified manner. (04)

5. A building project consists of 10 activities A,B, C.... as listed in the following table. Normal duration of each activity along with the preceding and succeeding activities is also given. (10)

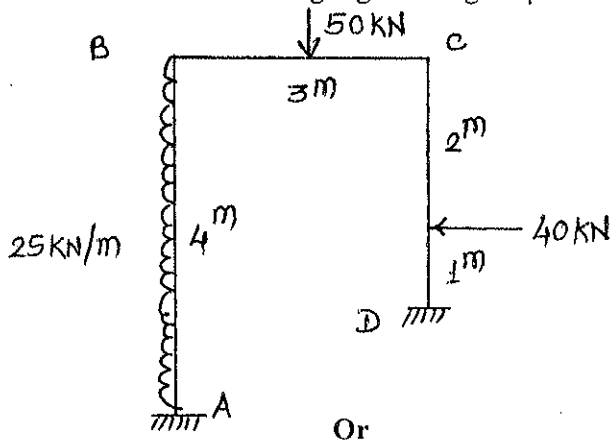
Activity	Preceding Activity	Succeeding Activity	Estimated Duration
A	-	B,C	5
B	A	D,E	2
C	A	F,G	6
D	B	H	4
E	B	I	4
F	C	I	2
G	C	J	3
H	D	-	8
I	E,F	-	7
J	G	-	2

Section-III

(30 Marks)

NB.: Attempt any two questions. Each question carries 15 marks.

1. Analyze the frame as shown in the following Figure using Displacement Method. (15)



Or

1. (a) A rectangular flume 2.5 m wide carrieds discharge at the rate of 3 cu.m./sec. The bed slope of the flume is 0.0005. At a certain section, the depth of flow is 1.2 m. Calculate the distance of the section downstream where the depth of the flow is 0.8 m. Assume coefficient of rugosity as 0.013. (10)

   (b) A circular plate 2.5 m diameter is immersed in water, its greatest and least depth below free surface being 2 m and 1 m, respectively. Find (a) total pressure on one face of the plate, and (b) the position of the centre of the pressure. (05)

2. (a) A RCC beam of rectangular section 230 mm wide and 550 mm deep is reinforced on the tension side by 4 bars of 20 mm diameter with a clear cover of 30 mm. The concrete of grade M-25 and HYSD Steel of grade Fe 415 are the materials used. Calculate the ultimate moment of resistance of the section. Also, find out the maximum uniformely distributed load a simply supported beam of this section can carry. (10)

Or

(a) i. Bring out the difference between the Network and Bar chart in a tabular and classified manner. (04)

ii. Explain the terms: Administrative Approval, Readministrative Approval and Technical Sanction, Current Schedule Rates, Sinking Fund (06)

(b) Differentiate between statically determinate and indeterminate structure. (05)

3. (a) Draw a complete flow diagram of waste water treatment plant and describe the function of each unit. (07)

Or

(a) A pipe 50 mm diameter is 6 m long and the velocity of flow in the pipe is 2.4 m/s. What loss of head and the corresponding power would be saved if the central 2 m length of pipe was replaced by 75 mm diameter pipe, the change of the section being sudden? (07)

Take f = 0.04 for pipes of both the diameters.

(b) Find the intensity of vertical pressure and horizontal shear stress at a point 5 m directly below 25 kN point load acting at a horizontal group surface. What will be the vertical pressure and shear stress at a point 3 m horizontally away from the axis of loading but at the same depth of 5 m. (08)

Or

(b) What do you mean by creep? How do one notice that the creep has occurred on a particular railway track ? State various theories propounded for explaining the probable causes of creep in rails. Point out various effects of creep. How creep is measured? What are the remedial measures to be taken for preventing the creep or eliminating the creep? (08)

4. (a) Draw the schematic of the layout (plan) of a concrete pavement. Show different joints, reinforcement and positions of the wheel loads considered in the analysis and design of concrete pavements. What are the additional loads considered in the design of concrete pavaments? What are the combinations of loads considered in the analysis? (04)

(b) Determine the cumulative standard axles for the flexible pavement using the following data: (05)

- No. of commercial vehicles as per last count 1500 CVPD
- Period of construction: 4 years
- Two lane single carriageway
- Growth rate of traffic: 6.5%
- Design life: 10 years

(c) What are the different types of traffic surveys required to be conducted with reference to traffic engineering? Explain any one of it in terms of its utility (purpose), methods of conducting such study and interpretation of the results. One of the methods needs to be explained in brief. (06)
