ABP/CCM–11/XIV

2015

CIVIL ENGINEERING

FIRST PAPER

Full Marks : 200

Time : 3 Hours

*The figures in the margin indicate full marks for the questions*

Group–A

*Answer **any five** questions.*

1. (a) What do you mean by statically determinate and indeterminate structure?

   (b) Find the vertical deflection of point *C* of the loaded truss shown in *fig.1*. The cross-sectional area of the members *CD* and *DE* are each $2500mm^2$ and those of other members are each $1200mm^2$.

Take $E = 200 kN/mm^2$ and $AE = 4m$ and $BD = 2m$.

5+15

fig. 1
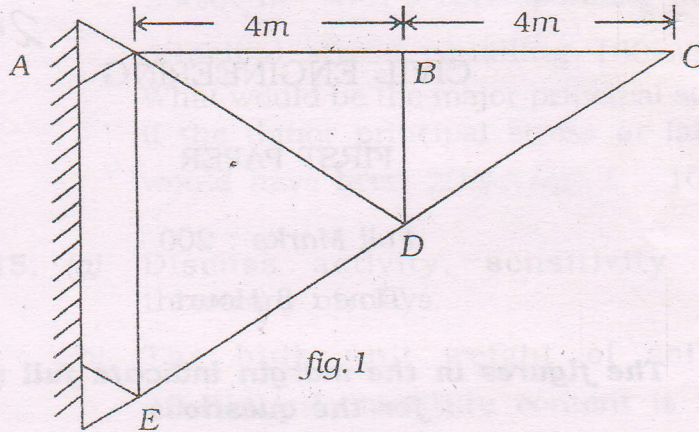
2. Analyse the rigid frame shown in *fig. 2*. Plot bending moment and deflected shape of the structure using slope deflection method.

15+3+2

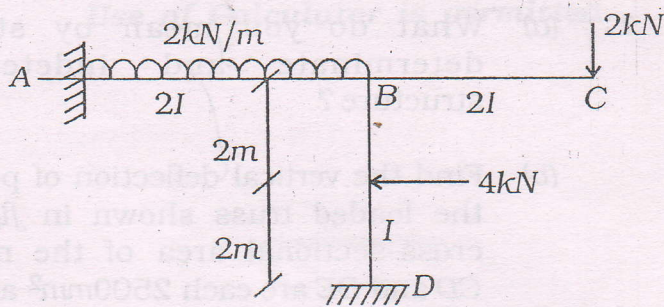
fig. 2

3. (a) Define influence line. Why influence line diagrams are required ?

(b) Draw the influence line diagram for the girder shown in *fig.3* below and find the maximum shear force and bending moment at section ©-© for vehicle load, which may approach, the girder from both sides. 5+15
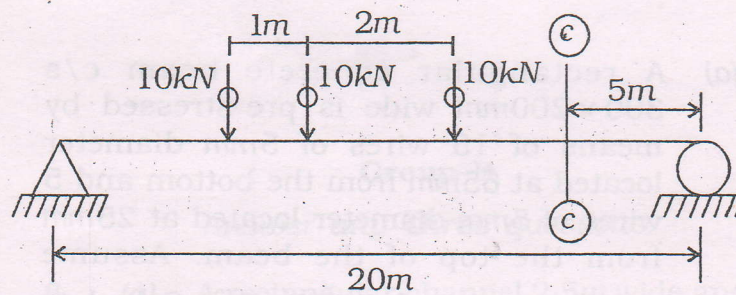

fig.3

4. A parabolic three pined arch has a span of 20*m* and central rise 4*m*. It is loaded with a uniformly distributed load of 2*kN/m* for a length of 8*m* from the left end support. Find the position and magnitude of maximum bending moment. 15+5

5. Analyse the continuous beam shown in *fig.4* when the support B settles by $5mm$.

$F = 2 \times 10^5 \, N/mm^2$, $I = 36 \times 10^6 \, mm^4$ 20

A |————————————| B ——————— C ———————| D
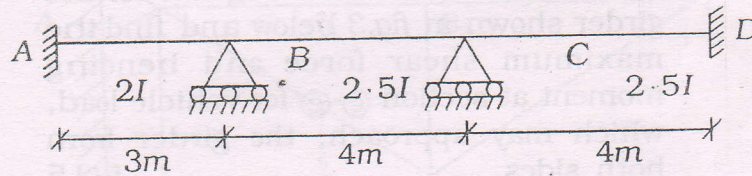
A　2I　　　　B　　2.5I　　　C　　2.5I　　D

3m　　　　　4m　　　　　4m

fig.4

6. (a) A rectangular concrete beam c/s $300 \times 200mm$ wide is pre-stressed by means of 15 wires of $5mm$ diameter located at $65mm$ from the bottom and 5 wires of $5mm$ diameter located at $25mm$ from the top of the beam. Assume prestress in steel $840N/mm^2$. Calculate the stresses in extreme fibres of the mid-span section when the beam is supporting its own weight over a span of $6m$. If uniformly distributed live load of $6kN/m$ is imposed, evaluate maximum working stress in the concrete. The density of concrete is $24kN/m^3$.

(b) What are various types of losses in prestressing ?

(c) What is load balancing ?   12+5+3

7. Determine the value of *P* at collapse of a three span continuous beam shown below in *fig.5*. The plastic moment capacity 'M_P' is constant for all spans. 20
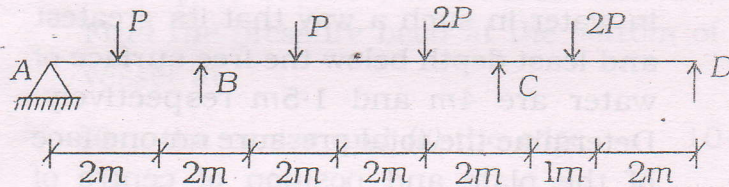

fig.5

Group–B

*Answer **any three** questions.*

8. (a) A rectangular channel $2.5m$ wide and has uniform bed slope 1 in 500. If depth of flow is constant at $1.7m$, calculate the hydraulic radius and the flow velocity. Assume Chezy's constant $C = 50$ in *SI* units.

(b) A jet of water having an initial diameter of $12.0cm$ reaches a maximum height of $20m$ when directed vertically upwards. Assuming that jet remains circular, determine the rate of jet water flow. 10+10

9. (a) Define continuity equation. Obtain an expression for continuity for a three dimensional flow.

   (b) A circular plate 3m diameter is immersed in water in such a way that its greatest and least depth below the free surface of water are 4m and 1·5m respectively. Determine the total pressure on one face of the plate and position of centre of pressure. 10+10

10. Differentiate between the following :

   (i) ϕ Line and ψ Line

   (ii) Mouthpiece running free and running full

   (iii) pitot tube and pitot static tube

   (iv) free vortex and forced vortex

   (v) H-G Line and Every line. 5×4=20

11. (a) Draw the layout of diversion type canal headworks with all major component parts. Explain briefly silt excluder and fish ladder with figure.

   (b) Define canal fall. How do you select its location ? Distinguish between vertical drop fall and glacis fall. 10+10

12. A closed cylindrical vessel of diameter $30cm$ and height $100cm$ contains water upto a depth of $80cm$. The air above the surface is at a pressure of $5 \cdot 886N/cm^2$. The vessel is rotated at a speed of 250 *rpm* about its vertical axis. Find the pressure head at the bottom of the vessel at

    (i)   the centre and *(ii)* the edge   10+10

Group–C

*Answer **any two** questions.*

13. *(a)* Define plasticity index. consistency index, liquidity index of soil.

    (b) Sketch the plasticity chart for classifying fine grained soil in the *IS* soil classification system.   6+14

14. *(a)* In a consolidated strained triaxial test, a specimen of clay fails at cell pressure $60kN/m^2$. The effective shear strength parameters are given as : $C = 15kN/m^2$, $\phi = 20°$. Determine compressive strength of the soil sample.

(b) A cohesive soil specimen ($\phi = 0°$) failed under major principal stress of $300 kN/m^2$ with a corresponding minor principal stress equalling $100 kN/m^2$. What would be the major principal stress if the minor principal stress at failure would have been $200 kN/m^2$?   10+10

15. (a) Discuss activity, sensitivity and thixotropy of clays.

(b) The bulk unit weight of soil is $19·6 kN/m^3$, moisture content is 20% and degree of saturation is 80%. What will be moisture content and unit weight on full saturation ?   10+10

Use of Calculator is permitted.

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