Total No. of Printed Pages-6 Roll No. _____

1(CCE-M)6

CIVIL ENGINEERING - I

[06]

Time Allowed -3 Hours *Maximum Marks-300*

INSTRUCTIONS

i) Answers must be written in English.

ii) The number of marks carried by each question is indicated at the end of the question.

iii) The answer to each question or part there of should begin on a fresh page.

iv) Your answer should be precise and coherent.

v) The part/parts of the same question must be answered together and should not be interposed between answers to other questions.

*vi) Candidates should attempt question **no. 1** which is compulsory and any **three** more questions selecting at least **one** Question from each Section.*

vii) If you encounter any typographical error, please read it as it appears in the text book.

viii) Candidates are in their own interest advised to go through the General instructions on the back side of the title page of the answer script for strict adherence

ix) No continuation sheets shall be provided to any candidate under any circumstances.

x) Candidates shall put a cross (X) on blank pages of answer script

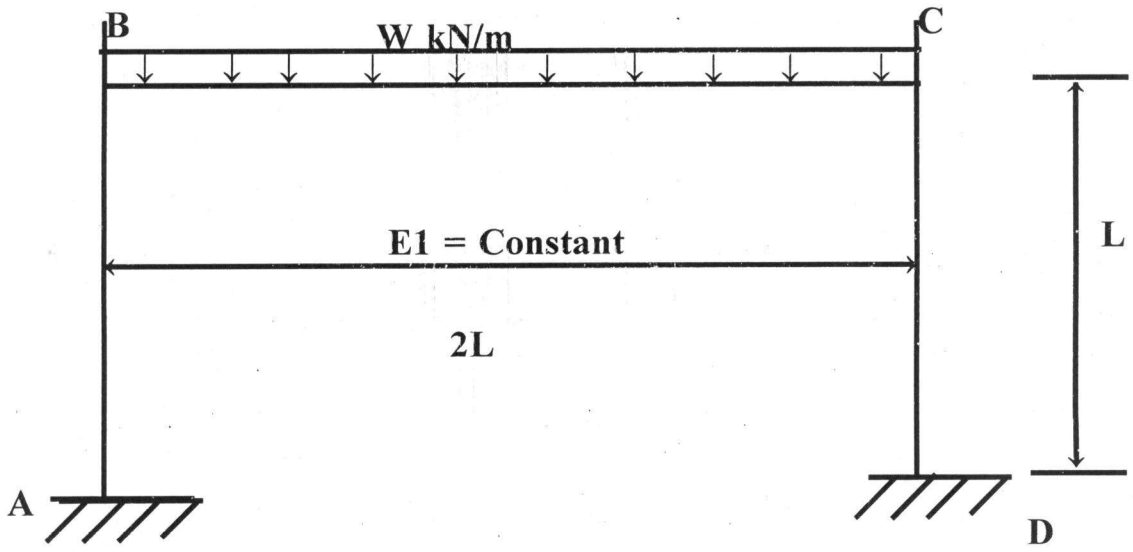
xi) No blank page be left in between answer to various questions.

xii) No programmable Calculator is allowed.

xiii) No stencil (with different markings) is allowed.

xiv) In no circumstances help of scribe will be allowed.

1. a) A portal frame ABCD is fixed at A and D, and is loaded as shown in figure. Treating joints B and C as rigid, calculate the moments at A, B, C and D. Draw the bending moment diagram using slope defection method and sketch the deflected shape of the frame. **(25)**



b) Four wheel loads of 6,4,8 and 5 kN cross a girder of 20 m span, from left to right followed by UDL of 4 kN/m and 4 m long with the 6 kN load leading. The spacing between the loads in the same order are 3 m, 2 m and 2 m. The head of the UDL is at 2 m from the last 5 kN. Using the Influence lines,

calculate the S.F and B.M at a section 8 m from the left support when the 4 kN load is at centre of the span. **(25)**

c) i) Discuss the computed 'DO' statement in computer program with suitable example. **(10)**

ii) Explain the history and development of different languages for the Computers. **(15)**

SECTION - A

2. a) i) Determine the area of tensile reinforcement for a singly reinforcement beam section of size 300×550 mm effective to carry a factored moment of 175 kN-m. The concrete mix used is M20 and tensile steel is of grade Fe415. **(10)**

ii) A rectangle reinforced concrete column of cross-sectional dimensions 300x 600 mm is to be designed to support an ultimate axial load of 2000 kN. Design suitable reinforcement in the column using M20 grade con crete and Fe415 HYSD bars. **(15)**

b) A Pretensioned beam 250 mm wide and 360 mm deep is prestreesed by 10 wires of 8 mm diameter initially stressed to 1000 N/mm^2. The centriod of the steel wires is located at 105 mm from the soffit. Determine the maximum stress in concrete immediately after transfer allowable elastic shortening of concrete only at the level of the centriod steel. If, however, the concrete is subjected to additional shortening due to creep and shrinkage and the steel is

subjected to a relaxation of stresses of 5 %. Find the final percentage loss of the stresses in the steel wires. Take Es=210 kN/mm^2. Ec=36.85 kN/mm^2, Creep coefficient ϕ=1.60, Total residual shrinkage=3×10^{-4} **(25)**

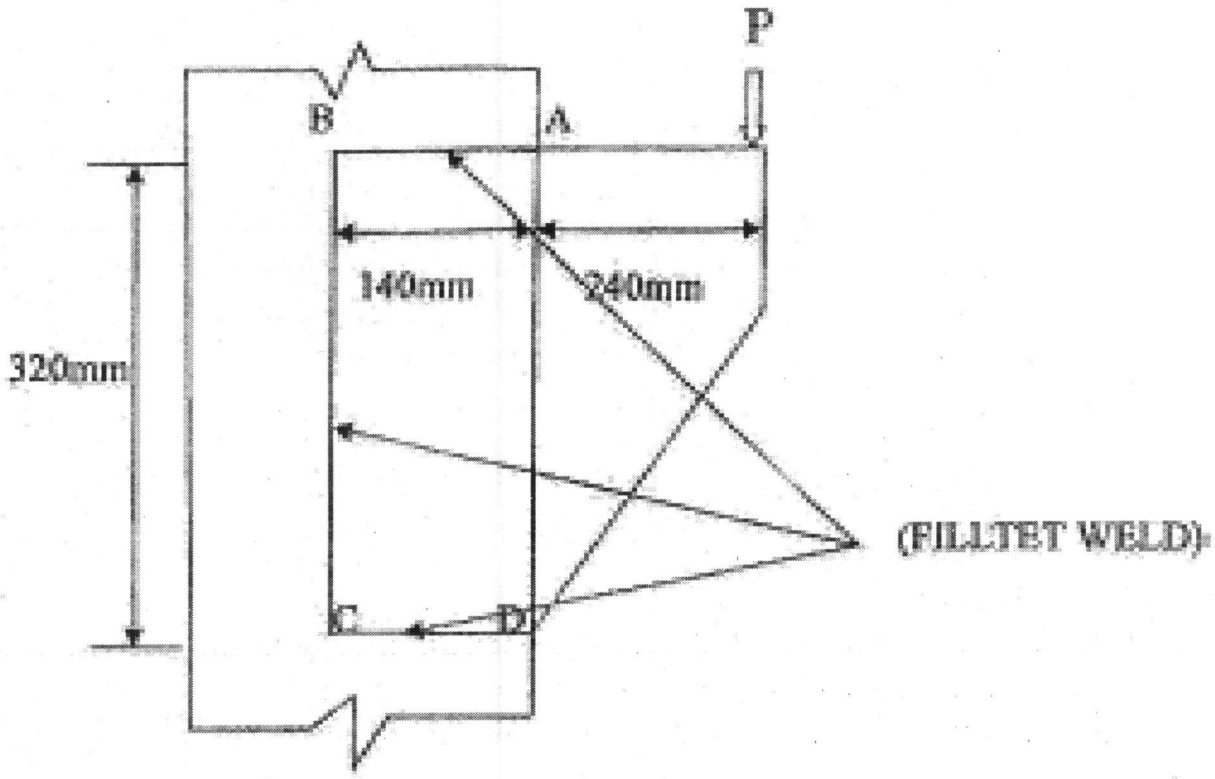
c) A symmetrical three hinged parabolic arch of span 40 m and rise 8 m carries an u.d.l of 30 kN/m over the left half of the span. The hinges are provided at the supports and at the centre of the arch. Calculate the reactions at the supports. Also calculate the bending moment, radial shear and normal thrust at a distance of 10 m from left support. **(25)**

3. a) Design a one way slab with clear span of 3.5 m, simply supported on 200 mm thick concrete masonry walls to support a live load of 4 kN/m^2. Use M20 grade concrete and Fe415 HYSD steel. **(25)**

b) i) What is a retaining wall? How many types of retaining wall are there **(10)**

ii) Explain the behavior of various parts of a counterfort retaining wall with neat sketches. **(15)**

c) Determine the maximum load that can be resisted by the bracket shown below, by filltet weld of size 6 mm, if it is shop welding. The fillet welding is done on AB, BC and CD sides. **(25)**



SECTION - B

4. a) i) A plate 0.0254 mm distant from a fixed plate, moves at 61 cm/sec and requires a force of 0.2 kg(f)/m^2 to maintain this speed. Determine the dynamic viscosity of the fluid between the plates. **(10)**

ii) A triangular gate which has a base of 1.5 m and an altitude of 2 m lies in vertical plane. The vertex of the gate is 1 m below the surface of water in a tank which contains oil of specific gravity 0.8. Find the force by the oil on the gate and the position of the centre. **(15)**

b) i) Prove that the discharge through a triangular notch or weir is given by

$$Q=\frac{8}{15} C_d \tan\frac{\theta}{2}\sqrt{2g}\ H^{5/2}$$

where H= head of water over the notch

θ=angle of notch. **(15)**

ii) For laminar flow of an oil having dynamic viscosity μ=1.766 N sec/m^2 in a 0.3 m diameter pipe, the velocity distribution is parabolic with maximum point velocity of 3 m/s at the centre of the pipe. Calculate the shear stresses at the pipe wall and at the 50 mm from pipe wall. **(10)**

c) i) Find the power required to tow lengthwise a plate 1.2 m wide and 3 m long at a velocity of 2.4 m/s in water. Make allowance for the fact that the boundary layer will change from laminar to turbulent over the plate. Take kinematic viscosity v as 0.9×10^{-6} m^2/s and mass density of water ρ as 1000 kg/m^3. **(15)**

ii) Define and explain the terms, Hydraulic gradient line and total energy line with neat diagrams. **(10)**

5. a) i) The discharge through weir is 1.5 m^3/s. Find the discharge through model of the weir if the horizontal dimension of the model=1/50 the horizontal dimension of prototype and vertical dimension of the model=1/10 the vertical dimension of the prototype. **(15)**

ii) What is meant by distorted models and undistorted models? What are the use of distorted models? **(10)**

b) i) An Irrigation channel of trapezoidal section, having side slopes 3 H:2V, is to carry a flow of 10 m^3/s on a longitudinal slope of 1 in 5000. The channel is to be lined for which the values of Manning's friction coefficient is 0.012. Find the most economical section of the channel. **(15)**

ii) What is specific energy curve? Draw specific energy curve, and then derive expressions for critical depth and critical velocity. **(10)**

c) i) The water is flowing with a velocity of 1.5 m/s in a pipe 2500 m and of diameter 500 mm. At the end of pipe, a valve is provided to create water hammer action. Find the rise in pressure if the valve is closed in 25 seconds. Take the value of wave speed C=1460 m/s. **(15)**

ii) What is the essential defference between gradually varied flow and rapidly varied flow? Illustrate with neatly drawn sketches. **(10)**

SECTION - C

6. a) i) A sample of saturated soil has a water content pf 35 %. The specific gravity of solids is 2.65. Determine its void ratio, porosity saturated unit weight and dry unit weight. **(10)**

ii) A soil sample with a grain specific gravity of 2.67 was filled in a 1000 ml container in the loosest possible state and the dry weight of the sample was found to be 14.75 N. It was then filled at the densest state obtainable and the weight was found to be 17.70 N. The void ratio of the soil in the natural state was 0.63. Determine the density index in the natural state. **(15)**

b) i) Define and explain: Liquid Limit, plastic limit, Shrinkage Limit and Plas ticity Index with neat diagrams. **(10)**

ii) Calculate the coefficient of permeability of a soil sample, 6 cm in height and 50 cm^2 in cross-sectional area, if a quantity of water equal to 430 ml passed down in 10 minutes, under an effective constant head of 40 cm. On oven -drying, the test specimen has mass of 498 gm. Taking the specific gravity of soil solids as 2.65. Calculate the seepage veliocity of

water during test. **(15)**

c) i) What are the advantages and disadvantages of a triaxial compression test? Briefly explain how you conduct the test and compute the shear parameters of the soil sample from the test data. **(15)**

ii) A cylinder of soil fails under an axial vertical stress of 160 kN/m^2, when it is laterally unconfined. The failure plane makes an angel of 50^0 with the horizontal. Calculate the value of cohesion and the angle of internal fric tional of the soil. **(10)**

7. a) i) An embankment is inclined at an angle of 35^0 and its height is 15 m. The angle of shearing resistance is 15^0 and the cohesion intercept is 200 kN/ m^2. The unit weight of soil is 18.0 kN/m^3. If Taylor's stability number is 0.06, find the factor of safety with respect to cohesion. **(15)**

ii) Compute the intensities of active and passive earth pressure at a depth of 8 m in dry cohesionless sand with an angle of internal friction of 30^0 and unit weight of 18 kN/m^3. What will be the intensities of active and passive earth pressure if the water level rises to the ground level? Take saturated unit weight of sand as 22 kN/m^3. **(10)**

b) i) Calculate the safe bearing capacity of a continuous footing 1.8 m wide, and located at a depth of 1.2 m below ground level in a soil with unit weight $\gamma = 20 kN / m^3$, cohesion c= 20 kN/m^2, and angle of internal friction $\phi = 20^0$. Assume a factor of safety of 2.5. Terzaghis bearing capacity factor for $\phi = 20^0$, are Nc=17.7, Nq=7.4, and $N\gamma = 5.0$. What is the permissible load per meter run of the footing? **(15)**

ii) A soft, normally consolidated clay layer is 6 m thick with a natural water content of 30 %. The clay has a saturated unit weight of 17.4 kN/m^3, a specific gravity of 2.67 and liquid limit of 40 %. The ground water level is at the surface of the clay. Determine the settlement of the foundation if the foundation load will subject the centre of the clay layer to a vertical stress increase of 8 kN/m^2. **(10)**

c) i) A group of 16 piles of 50 cm diameter is arranged with centre to centre spacing of 1.0 m. The piles are 9 m long and are embedded in soft clay with cohesion 30 kN/m^2. Bearing resistance may be neglected for the piles and adhesion factor is 0.6. Determine the ultimate load carrying capacity of the pile group. **(15)**

ii) Explain briefly the salient components of 'mass-spring- dashpot model' for the analysis of machine foundation. **(10)**
