

B.TECH. 5TH SEMESTER MID TERM EXAMINATION, 2018

STRUCTURAL ANALYSIS-I

UCE05B20

FULL MARKS: 50

TIME: 2 HOURS

The figures in the margin indicate full marks for the questions
 Answer question no. 1 any Two from the rest.

1. Explain the following theorems with a suitable example
 - a) Stress Equilibrium Equations;
 - b) Saint- Venant's Strains Compatibility Equations;
 - c) Principle of Superposition;
 - d) Betti's law and Maxwell Reciprocal theorem;
 - e) Castigliano's Theorems $4 \times 5 = 20$
2. A plane steel truss as shown in figure Q. 2. Cross sectional area of each member is $600 \times 10^{-6} \text{ m}^2$ and $E=201 \text{ GPa}$.
 - a) Determine whether the truss is statically determinate or indeterminate;
 - b) Determine the member forces using the method of joints OR method of Tension Coefficients;
 - c) Calculate horizontal displacement of right support.

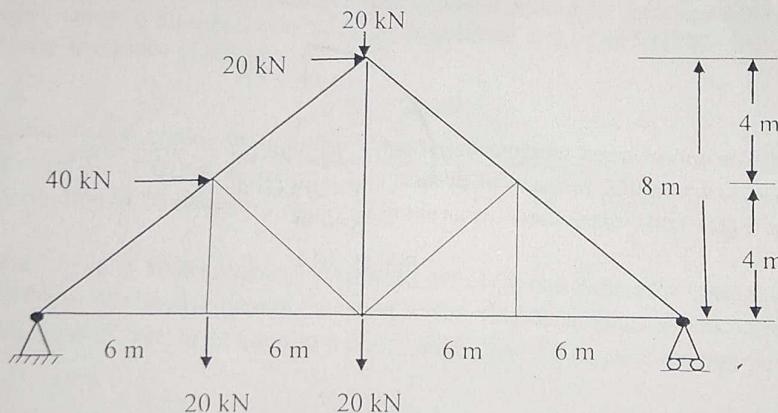


Fig. Q. 2

$$2+8+5=15$$

3. a) Derive the strain energy in a member of length 'L' under action of axial force, bending moment, shear force and torsion for a rectangular cross section.
- b) Compute the maximum deflection and rotation at the free end of the cantilever beam shown in figure Q. 3(b) by using Castigliano's theorem. Assume $E=200 \times 10^6 \text{ kN/m}^2$ and $I=100 \times 10^{-6} \text{ m}^4$.

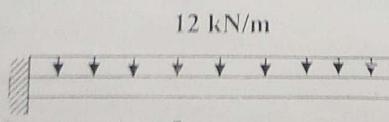


Fig. Q. 3(b)

u6-875

$$6+(5+4)=15$$

4. a). Determine the static and kinematic indeterminacy for a portal frame as shown in figure Q. 4(a)
 b) Analysis the portal frame as shown in figure Q. 4(a). The flexural rigidity EI is constant throughout

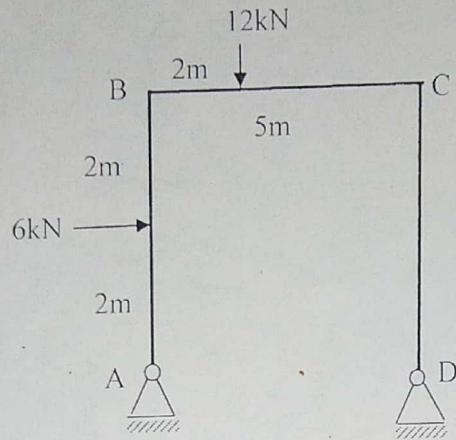


Figure Q. 4(a)

- b) Determine the vertical displacement at a free end of a quarter circle curved beam shown in fig. Q. (b)

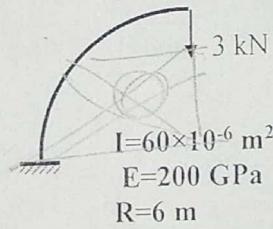
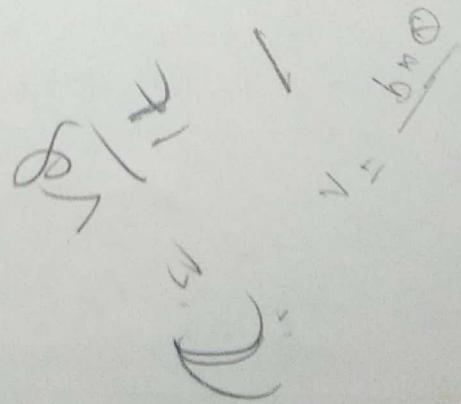


Fig. Q. 4(b)

$$(2+10)+3=15$$



Enrolment No. 1 6 7 1 2 2

S_s(UCE05B21)CE

B.TECH 5th SEMESTER MID-TERM EXAMINATION 2018

Design of RC Structures I

(UCE05B21)

Full Marks: 50

Time: 2 hours

The figures in the margin indicate full marks for the Questions

IS 456-2000 is allowed in the examination hall

Answer Question No.1 & any three (03) from rest

1. (a) Why does the code limit the compressive strength of concrete in structural design to $0.67f_{ck}$, and not f_{ck} .
(b) Why it is undesirable to design over reinforced sections in LSM?
(c) What are the advantages of doubly reinforced beams over singly reinforced beams?
(d) A depth greater than the calculated depth is normally chosen. Will it produce an under reinforced or over reinforced section? Why?
(e) Write the significance of partial safety factor and material safety factor considered in Limit State Method of Design.?

2+3+2+4+3=14

2. A reinforced concrete beam of rectangular section having a width of 400 mm and overall depth 850 mm is reinforced with 4 bars of 25mm diameter both of compression and tension sides at an effective cover of 50 mm. Using M 20 grade concrete and Fe 415 HYSD bar compute the safe moment of resistance of the section.

12

3. Design a doubly R.C section for a simply supported rectangular beam having an effective span of 6m, subjected to a UDL of 30 KN/m. Take breadth of beam as 250 mm and both effective cover as 50mm. Use M 20 concrete and Fe 415 grade steel. Assume any other data if required.

12

4. A R.C beam 25 cm \times 50 cm overall is reinforced with 4-20 mm bars at the bottom with a clear cover of 25 mm. If effective span of the beam is 4 m, find the amount of concentrated load it can support at mid span in addition to its self weight. Use M 20 concrete and Fe 415 grade steel.

12

5. Determine the ultimate moments of resistance of the isolated T beam with $D_f = 100\text{mm}$, $b_w = 300\text{mm}$, $b_f = 900\text{mm}$, $d = 600\text{mm}$, $A_{st} = 5$ nos 28mm dia bars and assuming M 20 concrete and Fe 415 grade steel.

557

12

6. Design a T beam with the following dimensions so that it can carry a factored moment of 270 KNm assuming M25 concrete and Fe 415 steel
Dimensions are: $D_f = 120\text{mm}$, $b_w = 250\text{mm}$, $b_f = 1000\text{mm}$

12

Enrolment No. 167122

S₆(UCE05B22)CE

B. Tech 5th Semesters End Term Examination, 2018

Name of subject: Concrete Technology

Paper Code: UCE05B22

Full Marks: 50

Time: 2hrs

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

Candidates are required to give their answers in their own words as far as practicable.

Answer all questions

1. Explain the following terms:

Gel-Space ratio, Retarder, Flash set, Flaky aggregate, Grading of aggregate,

Soundness of cement, Initial and final setting of cement, Normal consistency of

cement, Aggregate impact value, Apparent specific gravity.

(1×10)=10

2. (a) List out the major and minor compounds of cement and their influence on the properties of cement.

(b) Explain the function and property of any two types of admixtures.

(c) List out the various laboratory test for assessing the quality of cement and their importance.

(d) Enumerate the importance of shape and size of aggregate in concrete.

(e) What is alkali-silica reactivity (ASR) and how can it be controlled?

(5 x 5)=25

3. (a) Describe the uses of Rapid hardening cement.

(b) What is bulking of sand? How does it affect concrete mix?

(c) Discuss the various phases of heat of hydration of cement.

(d) What are the supplementary additives? Describe fly ash and silica fume.

(e) How do you determine fineness modulus of fine aggregate? What is its significance?

(3 x 5)=15

Enrolment No. []

S₅ (UCE05B24), CE

B.Tech 5th Semester Mid Term Examination 2018

Transportation Engineering I

UCE05B24

Full Marks: 50

Time: 2 Hours

The figures in the margin indicate full marks for the questions

Answer Question No.1 and any three from the rest

1) Answer all the question:

- a) What is expressway?
- b) In which year IRC came into existence?
- c) What is the value of ruling gradient in mountainous terrain as per IRC?
- d) What is obligatory point?
- e) What is the width of intermediate carriageway (except on important roads) as per IRC?

$$5 \times 1 = 5$$

2) a) What are the various methods of road classification?

b) Why Macadam's method of road construction is considered more scientific compared to the previous methods?

c) What are the various plans to be prepared after the planning surveys are carried out?

d) Four new road links P, Q, R and S are to be constructed during a five-year plan period. Suggest the order of priority the road construction programme based on maximum utility approach. Assume utility units of 0.5, 1.0, 2, and 4 for the four population ranges and 2, 2 and 5 units per 1000 t of agricultural, raw material and industrial products from the following data:

Road Link	Length km	No. of village served with population range				Productivity served, t		
		<500	501-1000	1001-2000	>2000	Agri.	Raw Material	Industrial Product
P	75	30	15	10	3	8000	3000	1000
Q	35	20	8	6	3	5000	1000	1600
R	40	15	6	5	5	6000	2000	3200
S	50	40	4	3	2	3000	7000	500

$$0+1+2+4+2+2+5 \\ 2+4+4+5=15$$

3) a) Discuss the methods of introducing extra widening on horizontal curves with neat sketch.

b) Derive an expression for finding the super elevation required on horizontal alignment of highways.

c) An ascending gradient of 1 in 50 meets a descending gradient of 1 in 80. Determine the length of summit curves to provide (a) ISD (b) OSD, for design speed of 80 kmph. Assume all other data.

$$4+5+6=15$$

256, 484
567, 1089

- 4) a) What is curve resistance?
b) Draw the typical cross section details of road in embankment.
c) A national highway passing through a flat terrain has a horizontal curve of radius equal to the ruling minimum radius. If the design speed is 100 kmph, calculate the absolute minimum sight distance, superelevation, extra widening and length of transition curve. Assume necessary data suitably.

$$1+2+12 = 15$$

- 5) a) Why set-back distance is provided on horizontal curves? Derive an expression for set-back distance on a two lane road with neat sketch.
b) A valley curve is formed by a descending grade of 1 in 25 meeting an ascending grade of 1 in 30. Design the length of valley curve to fulfill both comfort condition and head light sight distance required for a design speed of 75 kmph. Assume allowable rate of change of centrifugal acceleration $C = 0.6 \text{ m/sec}^3$.
c) Find the safe overtaking sight distance for a highway having a design speed of 115 kmph. Assume reaction time of the driver 2 sec and maximum acceleration of overtaking vehicle = 1.6 kmph/sec. Mention the minimum length of overtaking zone and draw a neat sketch of the overtaking zone and show the position of the sign posts.

$$5+5+5 = 15$$

COPT

Enrolment No. [] [] [] [] [] []

S₅(UCE05B25)CE

B.Tech 5th Semester Mid Term Examination, 2018

Environmental Engineering-I

UCE05B25

Full Marks: 50

Time: 2 Hours

The figures in the margin indicate full marks for the Questions

Answer the following Questions

1. Explain the following terms:

- (a) Coincident draft; (b) Design Period; (c) Hydrologic cycle; (d) Negative Lapse rate; and (e)
Maximum mixing depth.

2×5=10

2. (a) Distinguish between: Fog – Smog – Haze. Classify air pollutants into different categories and indicate their sources.

(b) List the oxides of nitrogen and indicate which are of primary concern in air pollution and why?

3. (c) Determine the effective height of a stack, given the following data:

- i. Physical stack is 170 m tall with a 1.25 m inside diameter.
- ii. Wind velocity is 5.17 m/s
- iii. Air temperature is 18°C.
- iv. Barometric pressure is 1000 mill bars.
- v. Stack gas velocity is 8.75 m/s.
- vi. Stack gas temperature is 128° C.

Assume any other required data.

3+3+4=10

3. (a) Explain the logistic curve method with sketch for population forecasting of a city.

(b) The following population data is available of a city. Estimate the population of the city in 2046 by (i) Arithmetic increase method; (ii) Geometric increase method; and (iii) Incremental increase method and compare their results.

Year	1941	1951	1961	1971	1981	1991	2011
Population	12000	16500	26800	41500	57500	68000	74100

4+6=10

4. (a) Derive an expression for yield of a tube well by Thiem's formula in case of a confined aquifer.

(b) A well penetrates into an unconfined aquifer having a saturated depth of 100 meters. The discharge is 250 liters per minute at 12 meters drawdown. Assuming equilibrium flow conditions and a homogenous aquifer, estimate the discharge at 18 meters drawdown. The distance from the well where the drawdown influences are not appreciable may be taken to be equal for both the cases.

$$4+6=10$$

5. (a) Differentiate between the following terms:

- (i) Permanent Hardness & Temporary Hardness
- (ii) Organic Nitrogen & Ammonia Nitrogen
- (iii) Total suspended solids & Total dissolved solids
- (iv) True and apparent color of water

(b) Mention the permissible limits of following water quality parameters as per BIS standard:

Turbidity, Total Hardness, Fluoride and Iron.

(c) What do you mean by Per Capita Demand of water? How it is estimated?

$$6+2+2=10$$

Enrolment No. [REDACTED]

S_s(UCE05B23)

B.Tech 5th Semester Mid Term Examination 2018
Geotechnical Engineering - I
UCE05B23

Full Marks: 50

Time: 2 Hours

The figures in the margin indicate full marks for the questions

Answer Q.No.1 (compulsory) and ANY THREE from the rest

1.(a) Explain the following terms (ANY FIVE):

- (i) Soil as a three phase system; (ii) Thixotropy; (iii) Relative density; (iv) Consistency index; (v) Critical hydraulic gradient; (vi) Flow net, (vii) Optimum moisture content and maximum dry density, (viii) Capillary action

(b) Write whether the following statements are **TRUE** or **FALSE**.

5, 7, 10, 11.

- ✓ 1 (i) Honeycomb structure is found in coarse sand.
2 (ii) The plasticity characteristics of clay are due to adsorbed water.
3 (ii) Dry density of soil is equal to the mass of solids to the total volume of soil.
4 (ii) The permeability of soil varies as the square of grain size.
5 (iii) The pressure on a phreatic line is more than atmospheric pressure.
6 (iv) The consistency index can be negative.
7 (v) IS classification of soil in many respects is similar to MIT classification.
8 (vi) "Zero air void line" and 100% saturation line are identical.
9 (vii) The critical gradient of a soil increases with decrease in void ratio.
10 (viii) Soil is a single phase system.
11 (ix) Porosity is the ratio of the volume of voids to the volume of solids.
12 (x) For a well graded sand, the coefficient of curvature should be within 1 and 3.

$$(2 \times 5) + 10 = 20$$

2.(a) Develop a relationship between the void ratio, water content, specific gravity and degree of saturation.

(b) A partially saturated soil sample has a density of 1950 kg/m^3 and a water content of 21%. If the specific gravity of solids is 2.65, calculate the degree of saturation and void ratio.

(c) A sample of sand above the water table was found to have a natural moisture content of 15% and unit weight of 18.84 kN/m^3 . Laboratory tests on a dried sample indicated values of $e_{min} = 0.50$ and $e_{max} = 0.85$ for the densest and loosest state respectively. Compute the degree of saturation and relative density.

$$3 + 3 + 4 = 10$$

3.(a) A 12m thick bed of sand is under-lain by a clay layer of 6m thickness. The water table which was originally at the ground surface lowered by drainage to a depth of 4m, where upon the degree of saturation above the lowered water table reduces to 20%. Determine the increase in the magnitude of the vertical effective pressure at the middle of clay layer due to lowering of water table. The saturated densities of sand and clay are respectively 2.05 gm/c.c and 1.85 gm/c.c and the dry density of sand is 1.76 gm/c.c.

5/2

(b) The specific gravity of the particles of a sand is 2.65. The porosity of the sand in loose state is 0.52, and in dense state is 0.37. Find out the values of the critical hydraulic gradient in two states.

2/2
→
L

(c) Determine the seepage discharge through the foundation of an earthen dam if the flow net has 10 equipotential drops and 3.5 flow channels. The length of the dam is 300 m and the coefficient of permeability of the soil is 2.5×10^{-4} cm/sec. The level of water above the base of dam is 12m above on upstream and 4m on downstream.

$$4 + 3 + 3 = 10$$

4.(a) Explain the factors effecting permeability of any soil.

(b) A sand sample of 35 cm^2 cross sectional area and 20 cm long was tested in a constant head permeameter. Under a head of 60 cm, the discharge was 120 ml in 6 mins. The dry weight of sand used for the test was 1120 gm., and $G_s = 2.68$. Determine (a) the hydraulic conductivity in cm/sec. (b) the discharge velocity and (c) the seepage velocity.

(c) What will be the ratio of average permeability in horizontal direction to that in the vertical direction for a soil deposit consisting of three horizontal layers, if the thickness and permeability of the second layer are twice of those of the first and those of the third layer twice those of second?

$$3 + 3 + 4 = 10$$

5.(a) 500 g of dry soil was used for a sieve analysis. The masses of soil retained on each sieve are given below:

Sieve size	Mass (gm)	Sieve size	Mass (gm)
2.00 mm	10	250 μ	145
1.40 mm	18	125 μ	56
1.00 mm	60	75 μ	45
500 μ	135	---	----

Plot a grain size distribution curve and calculate the following:

(i) Effective particle size, (ii) uniformity coefficient, (iii) coefficient of curvature. (iv) comment on the type of soil.

(b) The Atterberg limits of clay are: LL = 60%, PL = 45% and SL = 25%. The specific gravity of solids is 2.70 and natural moisture content is 50%. (i) What is state of consistency of clay in nature? (ii) Calculate the volume to be expected in the sample when moisture content reduced by evaporation to 20%. Its volume at Liquid limit is 10 cm^3 .

(c) Explain briefly the different applications of flow net.

$$5 + 3 + 2 = 10$$

6. (a) If a soil sample has a dry unit weight of 19.5 kN/m^3 , moisture content of 8% and a specific gravity of solids particles is 2.67. Calculate the following: a) The void ratio b) Moisture and saturated unit weight. c) The mass of water to be added to cubic meter of soil to reach 80% saturation. d) The volume of solids particles when the mass of water is 25 grams for saturation.

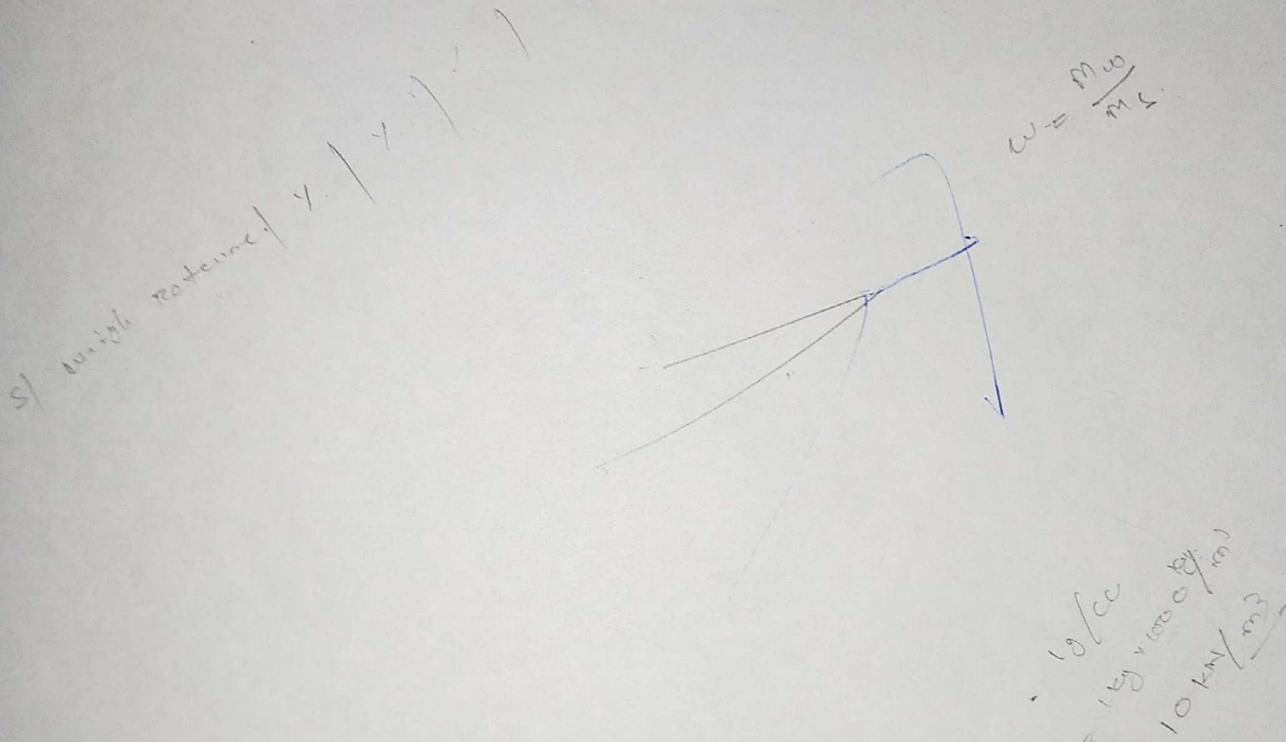
(b) Show that, $\gamma = \frac{(G + Se)\gamma_w}{1+e}$,

MO2 by

Where, γ = Dry density of soil, G = Specific gravity of soil, e = void ratio, γ_w = Unit weight of water.

$5+5=10$

$\gamma \quad w \quad G$



19 kN/m^3
 150 g/cc
 1000 g/cc
 10 kN/m^3

Enrolment No. 16015007

S, (UCE05B25) CE

B. Tech 5th Semester End Term Examination, 2018
Environmental Engineering-I
(UCE05B25)

Full Marks: 100

Time: 3 Hours

The figures in the margin indicate full marks for the question
Answer Question No. 1 and any 3 from the rest

1. (a) Write short notes on the following terms:

(i) Lime-soda process; (ii) Theory of filtration; (iii) Negative head in a filter; (iv) Jar test;
(v) Pressure filter; (Vi) Zeolite process; (Vii) Distribution reservoirs; (Viii) Fluoridation;
(ix) Break point chlorination; and (x) Clariflocculator.

(b) Discuss the design procedure of a rectangular sedimentation tank and explain why the water depth does not have any effect on the sediment removal.

$$(2 \times 10) + 5 = 25$$

2.(a) Explain the significance of the following terms from the view point of water quality criteria:

(i) Turbidity; (ii) Chlorides; (iii) Nitrates; (iv) Sulphates; and (v) Iron

(b) During a recuperation test, the water level in an open well was depressed by pumping by 2.5 meters and is recuperated by an amount of 1.6 meters in 70 minutes.

(i) Determine the yield from a well of 3 m diameter under a depression head of 3.5 meters. (ii) Also determine the diameter of the well to yield 10 litres/second under a depression head of 2.5 meters

(c) In a water treatment plant, the pH values of incoming and outgoing waters are 7.2 and 8.4 respectively. Assuming a linear variation of pH with time, determine the average pH value of water.

(d) In two periods of each of 20 years, a city has grown from 30,000 to 1,70,000 and then to 3,00,000. Determine, (i) the saturation population; (ii) the equation of the logistic curve; (iii) the expected population after the next 20 years.

$$(5 \times 1.5) + 5 + 4.5 + 8 = 25$$

3.(a) Draw typical section of a rapid gravity filter and describe how it works. What are its advantages over the slow sand filter?

(b) Design the approximate dimensions of a set of rapid gravity filters for treating water required for a population of 50,000; the rate of supply being 180 litres per day per person. The filters are rated to work 5000 litres per hour per sq m. Assume whatever data are necessary, and not given.

(c) Explain dry feeding and wet feeding devices in a coagulation sedimentation plant with sketch.

(d) What is meant by "porosity" and "permeability"? How do they affect the ground water storage?

(e) An industry utilizes 0.3 ML of oil fuel per month. It has also been estimated that for every 1 ML of fuel oil burnt in the factory, per year, the quantities of various pollutants emitted are given as:

Particular matter = 2.9 t/yr; SO₂ = 60 t/yr; NOx = 8 t/yr; HC = 0.4 t/yr; CO = 0.5 t/yr

Calculate the height of the chimney required to be provided for safe dispersion of the pollutants.

$$8+5+4+3+5=25$$

4. (a) Compare the Slow sand and Rapid gravity filter with respect to following criteria:

(i) Filter media; (ii) Rate of filtration; (iii) Bacteria removal efficiency; and (iv) Quantity of wash water required.

$$200-400 \quad 300-550 \quad 1.3-1.8 \quad 1.8-2.5$$

(b) Compare the Lime soda process and Zeolite process of softening water supply with respect to following criteria:

(i) Sludge troubles; (ii) Hardness which can be treated; (iii) Allowable turbidities in raw water; and (iv) Results obtained

(c) Design the water depth for a mixing basin having around the end baffles, in order to treat 48 million litres per day of water. The tank may be divided into two similar compartments by providing a longitudinal partition wall, and each half may have a clear width of 8 m. Assume suitable values of detention period and the flow velocity through the basin. The clear distance between the baffles may be kept as equal to minimum permissible. Mention the number of channels in the tank and also the overall inside length of the tank.

$$8+8+9=25$$

5. (a) Enumerate the chemicals which are used for coagulation. Discuss their comparative merits and demerits.

(b) What is meant by "disinfection" in treating public water supply? What is its importance? What are the chemicals which are used as disinfectants and what are their comparative merits and demerits.

(c) Explain the effect of pH on chlorination.

(d) It is required to supply water to a population of 20,000 at a per capita demand of 150 litres per day. The disinfectant used for chlorination is bleaching powder which contains 30% of available chlorine. Determine how much of bleaching powder is required annually at the waterworks, if 0.3 ppm of chlorine dose is required for disinfection.

(e) Calculate the annual cost of slaked lime and soda for treating 70,000 litres of water per day, if the water contains the following impurities:

$$\begin{array}{ll} \text{CaCO}_3 = 280 \text{ ppm} & \text{Mg(HCO}_3)_2 = 100 \text{ ppm} \\ \text{NaCl} = 35 \text{ ppm} & \text{CaSO}_4 = 110 \text{ ppm} \\ \text{MgCl}_2 = 138 \text{ ppm} & \text{MgSO}_4 = 80 \text{ ppm} \\ \text{Fe}_2\text{O}_3 = 55 \text{ ppm} & \text{SiO}_2 = 40 \text{ ppm} \end{array}$$

Purity of slaked lime is 85% and that of soda is 100%. Slaked lime costs Rs. 80 per quintal and soda for Rs. 400 per quintal.

[Atomic weights in gm: Ca = 40, Mg = 24, S = 32, Cl = 35.5, C = 12, O = 16, Na = 23, Fe = 56, Si = 28]

$$3+4+4+4+10=25$$

6. (a) Illustrate with sketches the different types of layouts of distribution networks, and compare their comparative merits and demerits.

(b) A city with a population of 2 lakhs has to be supplied with water at 180 litres per person per day. The probable hourly variation in the rate of demand is given in the table below:

Period of day in hours (1)	Percentage of average hourly flow expected (2)	Period of day in hours (1)	Percentage of average hourly flow expected (2)	Period of day in hours (1)	Percentage of average hourly flow expected (2)
0-1	15	8-9	180	16-17	150
1-2	15	9-10	220	17-18	180
2-3	15	10-11	220	18-19	180
3-4	20	11-12	150	19-20	160
4-5	25	12-13	100	20-21	140
5-6	40	13-14	80	21-22	80
6-7	80	14-15	60	22-23	45
7-8	120	15-16	110	23-24	15

Determine the capacity of the balancing reservoir to be provided for balancing the variable demand against rate of pumping (i) if the pumping is to be done only from 5 A.M. to 11 A.M. and 2 P.M. to 8 P.M. Also mention the rate of pumping required. Solve this problem by using analytical method.

5+20=25

Enrolment No. 16UC5007 -

S_s(UCE05B21)

B.TECH 5TH SEMESTER END-TERM EXAMINATION (CIVIL ENGINEERING), 2018
NAME OF SUBJECT- DESIGN OF RC STRUCTURES-I
PAPER CODE- UCE05B21

Full marks: 100

Time: 3 Hours

*Answer question no. 1 and any five from rest
IS 456-2000 is allowed in the examination*

80

1. (a) In one way slab the reinforcements are provided in the shorter direction- Explain the Statement.
(b) Why factor of safety for steel is taken less than the concrete?
(c) Define panel and drop.
(d) Why shear reinforcement is provided in RC beam?
(e) Write short note on load dispersion in two way slab.

4+4+4+4+4=20

2. Design a one way slab with a clear span of 4m simply supported on 200mm thick concrete masonry walls to support a live load of 4KN/m². Adopt M20 grade concrete and Fe 415 HYSD bar. Draw reinforcement details. 16
3. Design a two way slab for a room size 3.5 m by 4 m with discontinuous and simply supported edges on all the sides with corners prevented from lifting to support a live load of 4 KN/m². Use M-20 grade of concrete and Fe- 415 HYSD bars. Draw reinforcement details. 16
4. a) What are the different types of stair case depending upon geometrical and structural classifications?
b) Design a Dog-legged staircase for a building in which the vertical distance between floors is 3.2m. Width of landing beams are 300mm. The live load is taken as 5KN/m². Use M20 grade concrete and Fe 415 HYSD bar. Draw reinforcement details. 4+12=16

5. (a) Write short note on effect of shrinkage and creep on the behaviour of RC column.
(b) A simply supported beam of rectangular section Span over 10m and has an effective depth of 700mm. The beam is reinforced with 1% reinforced on the tension side. Check for deflection control of the beam by empirical method. 6+10=16

6. (i) Discuss briefly about the classification of column.
(ii) Design the reinforcements in a column of size 400 mm by 600 mm subjected to axial working load of 2000KN. The column has an unsupported length of 3m and is braced against side sway in both the directions. Adopt M-20 grade concrete and Fe- 415 HYSD bars. Draw reinforcement details. 4+12=16
- a) A beam having dimension 300mmx500mm is provided with top and bottom reinforcement of 2 nos 16mm bar each, side reinforcement of 2 nos 10mm bar and two legged tie reinforcement of 10 mm@150 c/c. Clear cover is 30mm on all sides. Determine the design torsional resistance of the beam under pure torsion. Assume moderate exposure condition. Adopt M20 grade concrete and Fe 415 HYSD bar.
b) Derive the expression of cracking torque using plastic theory approach. 10+6=16

8. a) A rectangular beam of 300mm width and 500mm effective depth is reinforced with 4 nos 20 mm bars, out of which 2 bars are bent at the ends of the beam at 45°. Determine additional shear reinforcement required if the factored shear force at the critical section is 400KN. Consider M20 grade concrete and Fe 415 HYSD bar.
b) What are different types and arrangements of shear reinforcement. 12+4=16

Enrolment No.

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25

S₅ (UCE05B24) CE

B.Tech. 5th Semester End Term Examination, 2018

Transportation Engineering – I

UCE05B24

Full Marks: 100

Time: 3 hours

The figures in the margin indicate full marks for the questions

Answer Q. No. 1 and any 4 (four) from the rest

1. (a) Explain briefly the Marshall method of bituminous mix design.
(b) Explain with sketches how the sub-surface drainage system is provided to lower the water table and control seepage flow.
(c) Derive an expression for finding length of valley curve on vertical alignment of highway. Draw the sketches of various cases when valley curves are formed while two different gradients meet.
(d) Find the length of transition curve and extra width of pavement required on a horizontal curve of radius 300 m of a two lane highway passing through rolling terrain for a design speed of 80 kmph. Assume all other data as per IRC recommendations.

5+5+5+5=20

2. (a) What are the various test carried out on bitumen? Briefly mention the principle and uses of viscosity test and softening point test of bitumen.
(b) Discuss the suitability of the soil as a subgrade material.
(c) A vertical summit curve is to be designed when two grades, +1/50 and -1/80 meet on a highway. The stopping sight distance and overtaking sight distance required are 180 and 640 m respectively. But due to site conditions the length of vertical curve has to be restricted to a maximum value of 500 m if possible. Calculate the length of summit curve needed to fulfill the requirements of (i) Stopping sight distance (ii) Overtaking sight distance.
(d) Write down the comparison between tar and bitumen?

(2+5)+4+6+3=20

3. (a) Write down the construction procedure of bituminous surface dressing.
(b) What are the problems in the construction of high embankment over weak foundation soils? How are various problems dealt with?
(c) Explain flexible pavement and rigid pavement and bring out the points of difference.
(d) The driver of a vehicle travelling 60 km/hr up a gradient requires 9m less to stop after he applied brakes, as compared to a driver travelling at same speed, down the same gradient. What is the gradient of the road? Assume $f = 0.40$

5+5+5+5=20

4. (a) Explain obligatory points with sketches as a factor controlling the alignment of road.
(b) Define the following terms:
 - (i) Cross slope, (ii) Intermediate sight distance, (iii) Off tracking (iv) Prime coat and
(v) Mastic asphalt
(c) The design speed of a highway is 80 kmph. There is a horizontal curve of radius 200 m on a certain locality. Calculate the superelevation needed to maintain this speed. If the maximum superelevation of 0.07 is not to be exceeded, calculate the maximum allowable speed on this

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horizontal curve as it is possible to increase the radius. Safe limit of transverse coefficient of friction is 0.15.

$$4+(5 \times 2)+6=20$$

5. (a) Enumerate the steps for practical design of superelevation.
(b) Derive an expression for finding the stopping sight distance at level and at grades.
(c) Explain compensation in gradient on horizontal curves.
(d) There is a horizontal curve of radius 60 m on a stretch of hill road with a gradient of 5.0%. Determine the grade compensation.
(e) In a district road where the rainfall is light, a major district road of WBM pavement, 3.8 m wide and a state highway of bituminous concrete pavement, 7.0 m wide are to be constructed. What should the height of crown with respect to the edges in these two cases.

$$5+5+3+3+4=20$$

6. (a) What are the various types of failures in flexible pavement? Explain the causes.
(b) Write a note on Maintenance Management System.
(c) Explain the necessity and objects of highway planning?
(d) Explain with sketches the requirements of joints filler and sealer. Discuss the desirable properties and the various materials in use.

$$5+5+5+5=20$$

Enrolment No. 160CE008
160CE008

70
S_s(UCE05B23)

B.Tech 5th Semester End Semester Examination 2018
Geotechnical Engineering - I
UCE05B23

Full Marks: 100

Time: 3 Hours

The figures in the margin indicate full marks for the questions

Answer Q. No. 1 and *ANY FOUR* from the rest

1.(a) Write whether the following statements are TRUE or FALSE.

- (i) The horizontal stress is more than vertical stress.
- (ii) The vertical stress due to point load depends upon modulus of Elasticity.
- (iii) An isobar is a curve which joins points of maximum vertical stress.
- (iv) The initial consolidation of a fully saturated soil is zero.
- (v) The compression index of normally consolidated soils is constant.
- (vi) The time taken for a half closed layer to attain a particular degree of consolidation is twice of that for an equivalent open layer.
- (vii) When consolidation of a saturated soil sample occurs, the degree of saturation remains constant.
- (viii) On the failure plane, the shear stress is maximum.
- (ix) At critical void ratio, the volume change during shear is maximum.
- (x) Vane shear test can be performed in all type of soils.
- (xi) Consolidated drained test is also known as slow test.
- (xii) The field consolidation curve is generally steeper than laboratory curve.
- (xiii) A well-graded soil contains particles of one size.
- (xiv) The plasticity characteristics of clays are due to adsorbed water.
- (xv) The permeability of soil varies as square of grain size.

(b) Explain with justifications:

- (i) The Mohr circle for unconfined compression test passes through the origin.
- (ii) The stress developed at a point in the soil exactly below a point load at the surface is inversely proportional to the depth of point.
- (iii) The zero-air void line and 100% saturation line are identical.
- (iv) The ultimate settlement of a soil deposit increases with an increase in the compression index.
- (v) The consistency index can be negative.

$$15 + 5 = 20$$

- 2.(a) What do you understand by geostatic stresses ? State the assumptions made in computing stresses below the ground surface due to a point load acting on it.
(b) How do you determine the stresses at a point due to a point load?
(c) Explain the use of Newmark's influence chart.
(d) A rectangular loaded area $2 \text{ m} \times 4 \text{ m}$ carries a load of 80 kN/m^2 . Determine the vertical stresses at point P located at the middle loaded line AB at a depth of 2.5 m in Fig.1.

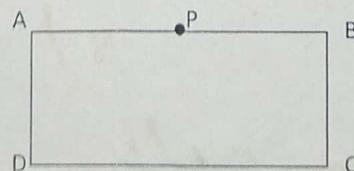


Fig.1

- (e) Explain the factors that affect the contact pressure distributions. Show the contact pressure distribution diagram for flexible and rigid footings on clayey and sandy soils.

$$(1 + 3) + 3 + 3 + 5 + (2 + 3) = 20$$

3. (a) Define the following terms: (i) Coefficient of compressibility, (ii) Coefficient of volume change; (iii) Compression index; (iv) Expansion index.
 (b) Differentiate between: (i) Immediate, Primary and Secondary consolidation, (ii) Normally consolidated and the Over-consolidated soils.
 (c) Discuss the limitations of Terzaghi's one dimensional theory.
 (d) Describe the consolidation test procedure. Present how the results are used to predict the rate of settlement and magnitude of settlement.

$$(2 \times 4=8) + (2.5 \times 2=5) + 2 + 5 = 20$$

4. (a) How would you determine the over-consolidation pressure? What are the assumptions in the theory of one dimensional consolidation?
 (b) Two points on a curve for a normally consolidated clay have the following coordinates:

Point 1: $e_1 = 0.7, p_1 = 100 \text{ kPa}$

Point 2: $e_2 = 0.6, p_2 = 300 \text{ kPa}$

If the average overburden pressure on a 6 m thick clay layer is 150 kPa, how much settlement will the clay layer experience due to an induced stress of 160 kPa at its mid depth?

- (c) A 3m thick clay layer beneath a building is overlain by a permeable stratum and is underlain by an impervious rock. The coefficient of the clay was found to be $0.025 \text{ cm}^2/\text{minute}$. The final expected settlement is 8 cm. (a) How much time will it take for 80% of the total settlement to take place. (b) Determine the time required for 2.5 cm to occur. (c) Compute the settlement that would occur in one year.

$$3 + 2 + 5 + 10 = 20$$

- 5.(a). Write revised Mohr-Coulomb equation. How does it differ from the original equation?
 (b). What is stress path? Sketch different types of stress paths that can be obtained in a tri-axial test.
 (c). A cylindrical soil specimen failed at an axial load of 140 kN/m^2 in an unconfined compression test. The failure plane makes an angle of 54° with the horizontal. Determine the soil properties.
 (d). A shear vane 7.5 cm diameter 11.25 cm long was pressed into soft clay at the bottom of a bore hole. Find the shear strength of the clay if the torque required for the failure was 40 N-m.
 (e). A sample of dry sand was subjected to tri-axial test with a confining pressure of 250 kN/m^2 . The angle of shearing resistance was found to be 36° . At what value of the major principal stress the sample is likely to fail?

$$2+3+5+5+5 = 20$$

- 6.(a). What are the factors that affect compaction? Discuss in brief.
 (b). A cylindrical specimen of a cohesive soil of 10 cm diameter and 20 cm length was prepared by compaction in a mould. If the wet mass of the specimen was 3.25 kg and its water content was 15%, determine the dry density and void ratio. If the specific gravity of the particle was 2.70, find the degree of saturation.
 (c). Determine the average co-efficient of permeability in the horizontal and vertical directions for a deposit consisting of three layers of thickness 5m, 1m and 1.5m and having the co-efficient of permeability of 0.003 mm/sec , $3 \times 10^{-5} \text{ mm/sec}$ and $4 \times 10^{-3} \text{ mm/sec}$ respectively. Assume the layers are isotropic.
 (d). The water table in a deposit of uniform sand is located at 2.0m below the ground surface. Assuming the soil above the water table is dry, determine the effective stress at a depth of 5.0m below the ground surface. The void ratio is 0.75 and the specific gravity of solid is 2.65. If the soil above the water table is saturated by capillary action, what is the effective stress at that depth?

$$4+6+5+5 = 20$$

* * * * *

Enrolment No. 16 UC5007

16 UC5007

S₅ (UCE05B22) CE

B. Tech 5th Semesters End Term Examination, 2018

Name of subject: Concrete Technology

Paper Code: UCE05B22

Full Marks: 100

Time: 3 hrs

The figures in the bracket indicate full marks for the questions.
Candidates are required to give their answers in their own words as far as practicable.

Answer any five questions

1. (a) Describe the factors affecting the workability of fresh concrete. Enumerate two methods of measurement of workability.
(b) Describe segregation, bleeding and laitance of concrete. Explain the factors affecting them. $(6+4)+(6+4)=20$
2. (a) What is gel-space ratio? How does it affect the strength of concrete? Describe the factors which influence the strength of concrete?
(b) What is non destructive testing of concrete? Discuss any method for non destructive test. $(4+6)+(5+5)=20$
3. (a) Write down short notes on:
 - (i) Sulphate attack and its prevention
 - (ii) Permeability of concrete
 - (iii) Creep of concrete and its importance
 - (iv) Shrinkage of concrete and factors affecting it
 - (v) Factors affecting modulus of elasticity of concrete
(b) List the causes of lack of durability and explain how chloride-ion penetration affects the durability. $(3 \times 5)+5=20$
4. (a) What is fiber reinforced concrete and what are its advantages? What is alkali silica reactivity and how can it be avoided?
(b) Write short notes on the following
 - (i) High density concrete
 - (ii) High performance concrete
 - (iii) Polymer concrete
 - (iv) Light weight concrete

$$(5+5)+(2.5 \times 4) = 20$$

5. (a) Discuss briefly the factors affecting by corrosion of reinforcement embedded in concrete? How to prevent the concrete deterioration against corrosion?
(b) What is grading of aggregate and it's significance? Describe the process of sieve analysis for determination of fineness modulus of an aggregate?

$$(5+5)+(5+5) = 20$$

6. Perform concrete mix design as per IS10262:2009 with following data:

Grade designation = M40, Type of cement OPC 43 grade, maximum nominal size of aggregate=20 mm, type of aggregate is crushed angular aggregate, fine aggregate conforms to Zone-I, minimum cement content=320kg/m³, maximum cement content=450 kg/m³, maximum water cement ratio is 0.45, workability=50 mm (slump), exposure condition is severe, degree of supervision is good, , chemical admixture type is super plasticizer, relative density of superplasticizer is 1.2, specific gravity of cement is 3.15, specific gravity coarse and fine aggregate is 2.74, maximum water content for 20 mm aggregate is 186 liter, volume of coarse aggregate per unit volume of total aggregate for zone 1 is 0.60.

- (a) Calculate the quantities (by mass) of cement, fine aggregate, coarse aggregate, and water for 1 m³ of concrete.
(b) Determine the actual quantities of all the ingredients and new w/c ratio after adjustments, if absorption of coarse aggregate is 0.5% and surface moisture of fine aggregate is 1%.

$$15+5=20$$

B.TECH. 5TH SEMESTER END TERM EXAMINATION, 2018
STRUCTURAL ANALYSIS-I
UCE05B20

FULL MARKS: 100

TIME: 3 HOURS

The figures in the margin indicate full marks for the questions

Answer All Questions

1. a) A two hinged parabolic arch of span 30 m and rise 6 m carries two point loads, each 60 kN at 7.5 m and 15 m from left end respectively. The moment of inertia varies as the secant of slope of arch axis;
- i) Determine the horizontal thrust;
 - ii) Calculate moment at a distance 8 m from the left end support and crown;
 - iii) Calculate normal thrust and radial shear at a section of 6 m from left support.
- b) Analyse the frame shown in figure question 1(b) and sketch bending moment diagram.

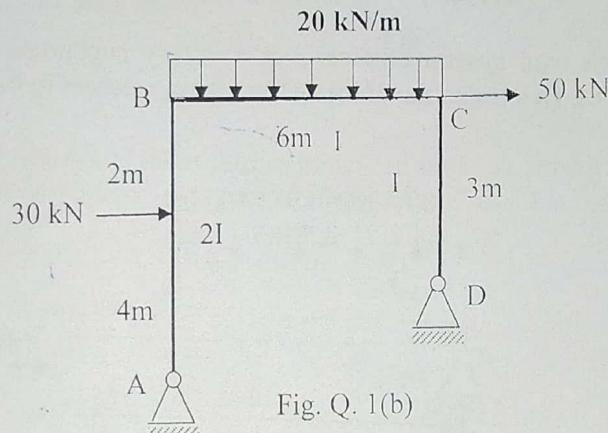


Fig. Q. 1(b)

$$5 + (2+2) + (2+2) + (5+2) = 20$$

2. a) Using Müller-Breslau principle, compute the influence line ordinates at 2 m intervals for reaction at propped end of cantilever beam of span 8 m. Also draw the corresponding influence line diagram for propped end reaction.

- b) Determine the deflection at free end of a cantilever beam of quarter circle in plan of radius R subject to a downward concentrated load P at free end. Assume uniform flexure rigidity.

$$(10+2)+8=20$$

3. a) A suspension cable 100 m span and 8 m central dip is hung from supports at the same level. Cable is loaded with a uniformly distributed load of 5kN/m. Find
- i) the length of the cable between the supports;
 - ii) the horizontal pull in the cable;
 - iii) the tension in the cable at the supports;
 - iv) the necessary sectional area required if the allowable stress is 130N/mm².

- b) A three-hinged circular arch has a span of 40 m and a rise of 5 m. Draw
- i) Influence line diagram for horizontal thrust;

ii) Influence line diagram for bending moment, normal thrust and radial shear at a section 12 m from left hand hinge;

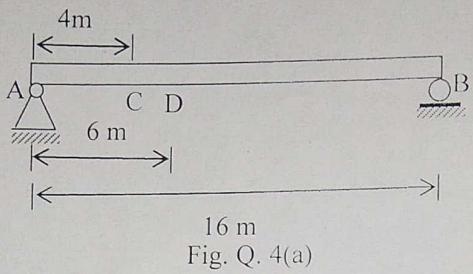
iii) A load of 200 kN crosses the arch from one end to the other. Determine the maximum horizontal thrust and maximum +ve and -ve bending moment at a section 12 m from left hand hinge.

$$[(3+2+3+2)+(3+6+6)]=25$$

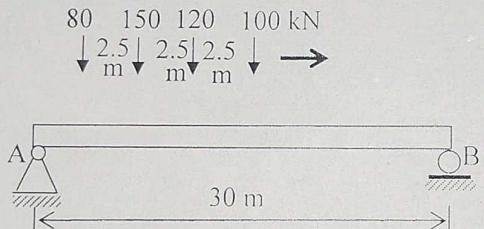
4. a) Draw influence line diagrams and calculate the maximum values for

i) reaction at A;

ii) shear at C and moment at D for the beam shown in figure question 4(a);



b) A given load system crosses over a simply supported beam shown in figure question 4(b). Determine the absolute maximum moment in the beam and where does it occurs?



5. a) Explain followings with a suitable example

$$(3+3+3)+(4+2)=15$$

i) Müller Breslau Principle;
ii) Castiglino's 2nd Theorem.

b) Draw the qualitative I.L.D for support moment at the C of a continuous beam shown in figure question 5(b)

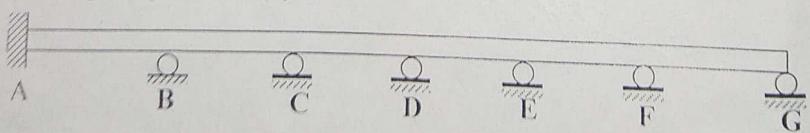


Fig. Q. 5(b)

c) Determine the statically and kinematical indeterminacy of the plane frame shown in figure question 5(c). Also determine the kinematical indeterminacy of the frame neglecting axial deformation.

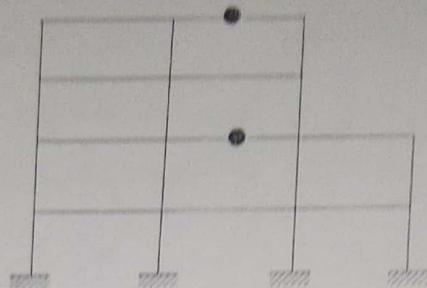


Fig. Q. 5(c)

d) Draw influence line diagram for reaction at B and moment at A for the beam shown in figure question 5(d)

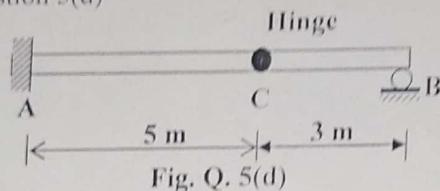


Fig. Q. 5(d)

e) Determine the horizontal deflection of joint C of the truss shown in figure question 5(e). Take $E=200 \times 10^6 \text{ kN/m}^2$ and cross sectional area of each bar $A=100 \times 10^{-6} \text{ m}^2$.

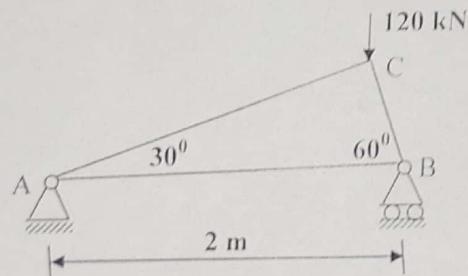


Fig. Q. 5 (e)

OR

Using Clapeyron theorem determine the support moments for the continuous beam shown in figure question 5(e1) considering support B sinks by 10 mm under the given loading. Assume $E=200 \times 10^6 \text{ kN/m}^2$ and $I=100 \times 10^{-6} \text{ m}^4$.

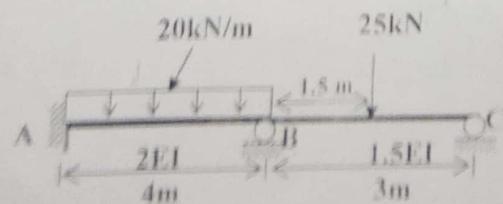


Fig. Q. 5 (e1)

$$(2+2)+2+(2+2+1)+(2+2)+5=20$$

