CBCS Scheme

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15CV/CT51

Fifth Semester B.E. Degree Examination, June/Jul 2018
Design of RC Structural Elements

Time: 3 hrs. Max. Marks: 80

Note: 1. Answer FIVE full questions, choosing one full question from each module.
2. Use of IS456-2000, SP16 permitted.

Module-1

1 a. Differentiate between working stress method and limit state method of RCC design. **(05 Marks)**

b. Define:
i) Partial safety factor for load and materials.
ii) Characteristic load.
iii) Characteristic strength. **(03 Marks)**

c. A simply supported beam of rectangular section spanning over 6m has a width of 300mm and overall depth 600mm. The beam is reinforced with 4-25mm bars on tension side. The beam is subjected to moment of 160kNm. Check the beam for serviceability limit state of cracking. Assume M25 and Fe415. **(08 Marks)**

OR

2 a. Derive the expression for stress block parameter for compresive force C_u. tensile force T_u and locate the depth of neutral axis $y = 0.42\ x_u$ from top of the beam. **(05 Marks)**

b. Explain briefly under reinforced, over reinforced and balanced sections with sketch. **(03 Marks)**

c. A simply supported beam of rectangular section 250mm wide by 450mm overall depth is used over an effective span of 4m. the beam is reinforced with 3 bars of 20mm. Two hanger bars of 10mm diameter are provided. The self weight of the beam is 4kN/m and service load is 10kN/m. Assume M20, Fe415.
Compute: i) Short term deflection; ii) Long term deflection. **(08 Marks)**

Module-2

3 a. Define simply and doubly reinforced beams list the situations when they are adopted. **(05 Marks)**

b. Determine moment of resistance of T-beam for the following data:
Width of the flange = 2500mm, effective depth = 800mm, width of the web = 300mm, number of bars = 8 of 25mm diameter, depth of flange = 150mm. Assume M20 and Fe415 steel. **(11 Marks)**

OR

4 a. A simply reinforced concrete beam 250 × 450mm deep upto the centre of reinforcement is reinforced with 3-16mm bars with an effective cover of 50mm. The effective span of the beam is 6m. Determine the central point load that the beam can carry excluding self weight. Assume M20 and Fe415. **(08 Marks)**

b. A doubly reinforced beam is 250mm wide and 450mm deep to the centre of tensile reinforcement. It is reinforced with 2-16 compression reinforcement and 4-25 as tensile reinforcement. Calculate the ultimate moment of resistance of the beam. Assume M15 and Fe250 steel. **(08 Marks)**

Module-3

5 a. Design a reinforced concrete beam of rectangular section using the following data: Effective span = 5m, width of the beam = 250mm, overall depth = 500mm, D.L + L.L. = 40 kN/m, effective cover = 50mm. **(07 Marks)**

b. A T beam slab floor of an office comprises of a slab 150mm thick resting on beams 3m c/c. The effective span of beam is 8m. Assume live load on the floor as $4kN/m^2$. Use M20 and Fe415. Design one of the intermediate T beams. **(09 Marks)**

OR

6 a. A reinforced concrete beam over an effective span 5m carries a load of 8kN/m inclusive of self weight. Assume M20 and Fe415. Design the beam to satisfy the collapse and serviceability limit states. **(08 Marks)**

b. A cantilever beam of 4m span carries a load of 40kN/m. The width of the beam is 230mm. Design the beam for flexure and shear. Sketch the details of reinforcement. Assume M20 and Fe415. **(08 Marks)**

Module-4

7 a. Distinguish between one way slab and two way slab. **(04 Marks)**

b. Explain the importance of bond, anchorage length. **(04 Marks)**

c. Design a two way slab for an office floor of 3.5 × 4.5m simply supported on all sides with corners prevented from lifting. Take live load of $4kN/m^2$. Assume M20 and Fe415. **(08 Marks)**

OR

8 a. What is development length? Write the expression for development length. **(04 Marks)**

b. Design one of the flights of dog logged stair case spanning between landing beams using the following data:

Number of steps in the flight	= 10
Tread	= 300mm
Rise	= 150mm
Width of landing beams	= 300mm

Assume M20 and Fe415. **(12 Marks)**

Module-5

9 a. What is the role of transverse reinforcement in columns? What are the codal provisions to design the transverse reinforcement? **(05 Marks)**

b. Design the reinforcement for a column of size 300 × 500mm to support a factored load of 500kN and a factored moment of 200 kNm. Assume M20 and Fe415. Sketch the reinforcement details. **(11 Marks)**

OR

10 a. Explain the different between short columns and long columns. Why is reduction coefficient applied to long column? **(04 Marks)**

b. Design a isolated forting for a rectangular column of 300mm × 500mm supporting an axial load of 1500kN factored. Assume SBC of soil as $185\ kN/m^2$. Use M20 and Fe415. Sketch the reinforcement and perform the necessary checks. **(12 Marks)**

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15CV53

Fifth Semester B.E. Degree Examination, June/July 2018
Applied Geotechnical Engineering

Time: 3 hrs. Max. Marks: 80

Note: Answer any FIVE full questions, choosing one full question from each module.

Module-1

1 a. What is subsurface exploration? What are objectives of soil exploration? **(08 Marks)**

b. What are Geophysical methods? Explain seismic refraction method with neat sketch. **(08 Marks)**

OR

2 a. List and explain different types of samplers used in soil sampling. **(08 Marks)**

b. What are the methods available for dewatering? Explain dewatering by well point system. **(08 Marks)**

Module-2

3 a. Derive the expressions for vertical stress and shear by using Boussinesq's theory. Also write expression for Westerguard's theory. **(08 Marks)**

b. What is Newmark's influence chart and also describe construction procedure for Newmarks's influence chart. **(08 Marks)**

OR

4 a. What are the types of settlement? Explain them with equations. **(08 Marks)**

b. A soft, normally consolidated clay layer 18 m thick. The natural water content, saturated unit weights specific gravity and liquid limit are 45%, 18 kN/m^3, 2.70 and 63% respectively. The vertical stress increment at centre of the layer due to the foundation load is 9 kN/m^2. The ground water level is at the surface of the clay layer. Determine the settlement of the foundation. **(08 Marks)**

Module-3

5 a. Define with neat sketch At rest, Active and Passive earth pressure. **(06 Marks)**

b. A retaining wall, 8 m high with a smooth vertical back, retains a clay backfill with $C' = 15$ kN/m^2, $\phi' = 15°$ and $\gamma = 18$ kN/m^3. Calculate the total active thrust on the wall assuming that tension cracks may develop to the full theoretical depth. **(10 Marks)**

OR

6 a. Explain the causes for slope failure and also list the type of slope failures. **(08 Marks)**

b. A 7m deep canal has side slope of 1:1. The properties of soil are $C_u = 20$ kN/m^2, $\phi_u = 15°$, $e = 0.9$ and $G = 2.75$. If Taylor's stability number is 0.108, determine the factor of safety with respect to cohesion when canal runs full. Also find the factor of safety in case of sudden draw down, if the Taylor's stability number for this condition is 0.137. **(08 Marks)**

Module-4

7 a. Write a note on standard penetration test and its corrections. **(08 Marks)**

b. Define safe bearing capacity, safe bearing pressure and allowable bearing pressure and also write expressions for the same. **(08 Marks)**

OR

8 a. Discuss the effect of ground water table on bearing capacity of soil. **(08 Marks)**

b. A square footing 2.5m × 2.5m is built on homogenous bed of sand of density 19 kN/m^3 and having an angle of shearing resistance of 36°. The depth of foundation is 1.5m below ground surface. Calculate safe load that can be applied on the footing with factor of safety 3. Take bearing capacity factors as $N_c = 27$, $N_q = 30$ and $N\gamma = 35$. **(08 Marks)**

Module-5

9 a. Explain the types of piles and also mention their uses. **(08 Marks)**

b. 200 mm diameter, 8 m long piles are used as foundation for column in a uniform deposit of medium clay (q_u = 100 kN/m^2). The spacing between the piles is 500mm. There are 9 piles in the ground arranged in a square pattern. Calculate the ultimate pile load capacity of the group. Assume adhesion factor = 0.9. **(08 Marks)**

OR

10 Write short notes on :

a. Piles in granular soils **(04 Marks)**

b. Settlement of pile group **(04 Marks)**

c. Negative skin friction **(04 Marks)**

d. Pile load tests. **(04 Marks)**

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17CV/CT51

Fifth Semester B.E. Degree Examination, Aug./Sept.2020
Design of RC Structural Elements

Time: 3 hrs. Max. Marks: 100

Note: 1.Answer any FIVE full questions, choosing ONE full question from each module.
2. Use of IS456:2000 and SP-16 is permitted.
3. Assume missing data if any suitably.

Module-1

1 a. Explain the philosophy and principles of limit state design method. **(08 Marks)**

b. What is stress block? Derive from fundamentals the expression for area of stress block 0.36fck and depth of center of compressive force from the extreme fiber in compression $0.42x_u$. **(12 Marks)**

OR

2 a. Explain the following:
i) Characteristic load
ii) Characteristic strength
iii) Partial safety factor. **(06 Marks)**

b. A rectangular section 200 × 450mm is reinforced with 3 number 16mm diameter bars at an effective depth 420mm. The beam has 2 hanger bars of 12mm diameter. With effective span 5m. The beam support a load of 10kN/m. Calculate short term deflection and long term deflection using M_{20} grade concrete and Fe415 grade steel. **(14 Marks)**

Module-2

3 a. Define singly and doubly reinforced beams. List the situations when they are adopted. **(06 Marks)**

b. A rectangular section of effective size 230mm × 500mm is used as simply supported beam for an effective span of 6.3m. What is the maximum total udl allowed on the beam if maximum percentage of steel is provided on tension side. Use M_{25} grade concrete and Fe415 steel. Take effective cover = 50mm. **(14 Marks)**

OR

4 a. A rectangular section of size 250mm × 500mm is reinforced with 4 number 16mm diameter bars. With an effective cover 50mm and effective span 6m. Using M20 grade concrete and Fe415 steel calculate moment of resistance and central concentrated load that can be carried by beam in addition to its self weight. **(12 Marks)**

b. An isolated T-beam, simply supported over a span of 6m has following dimensions: Width of flange 750mm, thickness of flange 125mm, overall depth 400mm, width of web 260mm, effective cover to tensile reinforcement 40mm. The beam is reinforced with 4 bars of 20mm diameter. Determine the moment of resistance if Fe415 bars are used. Take $\sigma_{cbc} = 5N/mm^2$ and m = 19. **(08 Marks)**

Module-3

5 A simply supported RC beam supports a service load of 8kN/m over an clear span 3m. Support width is 200mm. Using M20 grade concrete and Fe415 steel. Design the beam for flexure and shear. Sketch the reinforcement details. **(20 Marks)**

OR

6 A cantilever beam of span 4m carries a factored load 40kN/m. Take width of beam as 230mm. Design the beam for flexure and shear. Sketch the reinforcement details. Use M_{20} grade concrete and Fe415 steel. **(20 Marks)**

Module-4

7 Design a cantilever Portico slab projecting 1.5m from the beam supporting a live load of $3kN/m^2$. Adopt M_{20} grade concrete and Fe415 steel. Sketch the reinforcement details. **(20 Marks)**

OR

8 Design a dog legged stair case of a private building hall measuring 2.2m × 4.7m. Width of landing is 1.1m. The distance between floor to floor is 3.3m. Take rise = 150mm and thread = 270mm, weight of floor finish = $1kN/m^2$. Adopt M_{20} grade concrete and Fe415 steel take live load = $3kN/m^2$. Assume wall thickness of 230mm which supports the stairs at the end of outer edges of landing slabs. Sketch the reinforcement details. **(20 Marks)**

Module-5

9 Design an RCC column 400mm × 400mm to carry on ultimate load of 1000kN at an eccentricity of 160mm. Using M_{25} grade concrete and Fe415 steel. Sketch the reinforcement details. **(20 Marks)**

OR

10 A square column of 400mm sides carries a load of 900kN. Design the footing for an SBC of soil $100kN/m^2$. Show the check for one way shear, two way shear and bond strength. Adopt M_{20} grade concrete and Fe415 grade steel. Sketch the reinforcement details. **(20 Marks)**

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17CV52

Fifth Semester B.E. Degree Examination, Aug./Sept.2020
Analysis of Indeterminate Structures

Time: 3 hrs. Max. Marks: 100

Note: 1. Answer any FIVE full questions, choosing ONE full question from each module.
2. Assume missing data suitably.

Module-1

1 Analyze the continuous beam shown in Fig.Q.1 by slope deflection method BMD, SFD and elastic curve. **(20 Marks)**

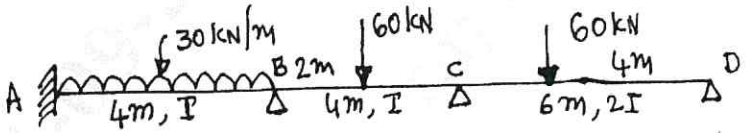

Fig.Q.1

OR

2 Analyze the Frame shown in Fig.Q.2 by slope deflection method. Draw BMD and elastic curve. **(20 Marks)**

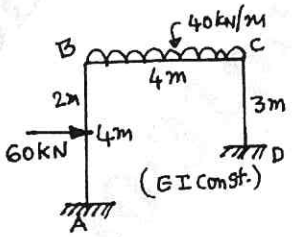

Fig.Q.2

Module-2

3 Analyze the continuous beam shown in Fig.Q.3. Using moment distribution method. Draw BMD, SFD and EC if support A yields by 0.002 radians in clockwise direction, support B sinks by 30mm and support 'C' sink by 20mm. Take EI = 480kN-m^2. **(20 Marks)**

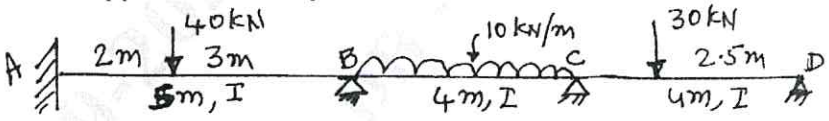

Fig.Q.3

OR

4 Analyze the frame shown in Fig.Q.4 by MD method and draw BMD and EC. **(20 Marks)**

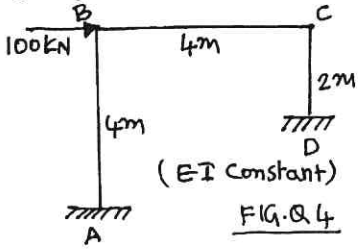

Fig.Q.4

Module-3

5 Analyze the frame shown in Fig.Q.5 using Kani's method. Draw BMD and EC. **(20 Marks)**

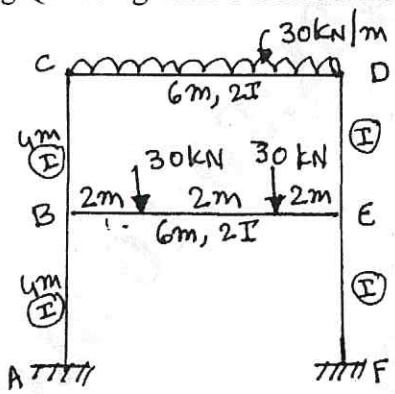

Fig.Q.5

OR

6 Analyze the frame shown in Fig.Q.6 by using Kani's method. Draw BMD. **(20 Marks)**

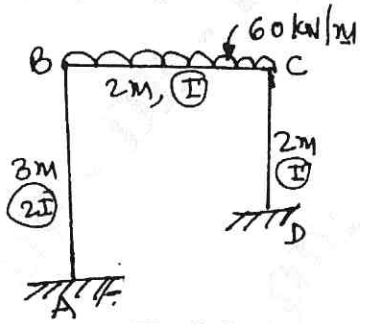

Fig.Q.6

Module-4

7 Analyze the continuous beam shown in Fig.Q.7 using flexibility matrix method. Draw BMD and SFD. **(20 Marks)**

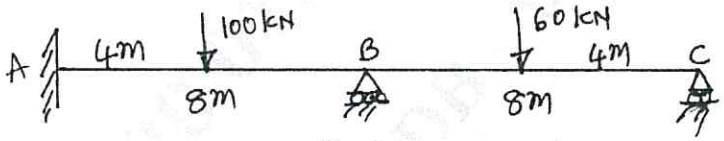

Fig.Q.7

OR

8 Analyze the frame shown in Fig.Q.8 by using flexibility matrix method. Draw BMD. **(20 Marks)**

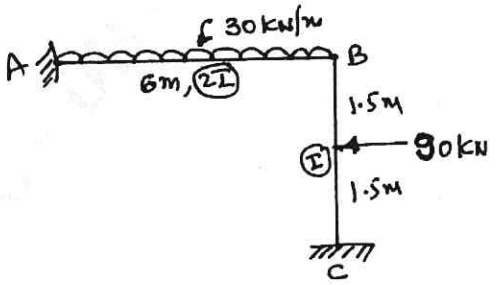

Fig.Q.8

Module-5

9 Analyze the truss shown in Fig.Q.9 using stiffness matrix method. It cross sectional areas of vertical member 300mm^2 and inclined members area 200mm^2. Take E = 2 × 10^{5}N/mm^2. **(20 Marks)**

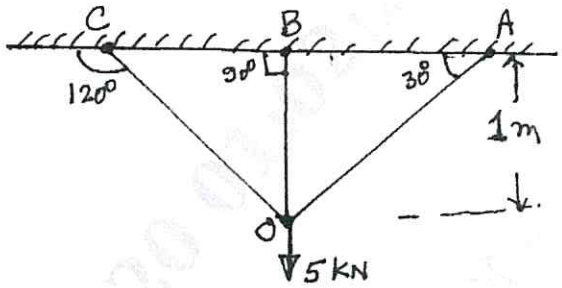

Fig.Q.9

OR

10 Analyze the Portal frame shown in Fig.Q.10 by using stiffness method. Draw BMD and EC. **(20 Marks)**

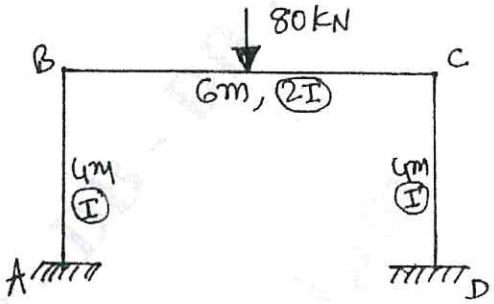

Fig.Q.10

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17CV53

Fifth Semester B.E. Degree Examination, Aug./Sept.2020
Applied Geotechnical Engineering

Time: 3 hrs. Max. Marks: 100

Note : 1. ***Answer any FIVE full questions, choosing ONE full question from each module.***
2. ***Use of IS 6403 is permitted.***

Module-1

1 a. Discuss the necessity of sub soil exploration. Mention the stages involved in it. **(06 Marks)**

b. Explain the method of Seismic Refraction method. **(08 Marks)**

c. The field N value in a deposit of fully submerged fine sand was 40 at a depth of 6m. The average saturated unit weight of the soil is 19kN/m^3. Calculate the corrected N value by applying corrections. **(06 Marks)**

OR

2 a. With the help of a neat sketch of soil sampler, define Area ratio , Inside clearance and outside clearance. State its permissible values for undisturbed sample. **(08 Marks)**

b. What are the methods available for dewatering? Explain anyone method. **(07 Marks)**

c. A soil sample was pushed into the soil for a depth of 600mm and length of the sample obtained was 590m. What is Recovery ratio? What is the state of the sample? How can this be avoided? **(05 Marks)**

Module-2

3 a. Distinguish between Boussinesq's and Westergaard's theory of stress distribution. **(06 Marks)**

b. Explain the construction and use of Newmark's chart for determining stress distribution. **(08 Marks)**

c. A water tank is supported by a ring foundation having outer diameter of 10m and inner diameter of 7.5m. The ring foundation transmits uniform load intensity of 160 kN/m^2. Compute the vertical stress induced at a depth of 4m, below the centre of ring foundation. Using i) Boussinesq's analysis ii) Westergaard's analysis. Take $\mu = 0$. **(06 Marks)**

OR

4 a. What are settlements? Explain the components of settlement and their determination. **(08 Marks)**

b. Write a note on Pressure bulb. **(04 Marks)**

c. A soft normally consolidated clay layer is 20m thick. The natural water content is 45%. The saturated unit weight is 20kN/m^3. The grain specific gravity is 2.70 and liquid limit is 60%. The vertical stress increment at the centre of clay layer due to foundation load is 10kpa. The ground water level is at the surface of clay layer. Determine the settlement of foundation if the initial effective stress at the centre of the soil is 100kPa. Assume unit weight of water is 10kN/m^3. **(08 Marks)**

Module-3

5 a. Differentiate between Rankine's and Coulomb's earth pressure theory. **(06 Marks)**

b. Describe Rebhan's graphical method for active earth pressure calculation. **(06 Marks)**

c. A retaining wall of 5.4m high, retains sand. In the loose state the sand has void ratio of 0.63 and $\phi = 27^0$, while in the dense state, the corresponding values of void ratio and ϕ are 0.36 and 45^0 respectively. Compare the values of active and passive earth pressure in both the states of soil. Assume G = 2.64 , γ_w = 10kN/m^3. **(08 Marks)**

OR

6 a. Explain the causes for a slope failure and list the modes of finite slope failure. **(06 Marks)**

b. With the help of sketch, explain Swedish slip circle method of stability analysis for cohesive soil. **(06 Marks)**

c. A new canal is excavated to a depth of 5m below ground level, through a soil having the characteristics $C = 14kN/m^2$; $\phi = 15^0$; $e = 0.8$ and $G = 2.70$. The slope of banks is 1:1. Calculate the factor of safety with respect to cohesion when canal runs full. If the canal suddenly emptied completely what will be the factor of safety. Take $S_n = 0.083$ for submerged case ; $S_n = 0.122$ for Drawdown case. **(08 Marks)**

Module-4

7 a. Define the terms : i) Ultimate bearing capacity ii) Safe bearing capacity iii) Net ultimate bearing capacity iv) Allowable bearing capacity. **(08 Marks)**

b. A footing 3m square carries a gross pressure of $350kN/m^2$ at a depth of 1.2m in sand, saturated unit weight of sand is $20kN/m^2$ and unit weight above the water table is$17kN/m^2$. The effective angle of friction is 30^0 and the bearing capacity factors for $\phi' = 30^0$ are $N_q = 22m$, $N_\gamma = 20$. Determine the factor of safety with respect to shear failure for the following cases i) Water table is 5m below the ground level.
ii) Water table is 1.2m below the ground level. **(12 Marks)**

OR

8 a. With the help of neat sketch, differentiate General shear failure and Local shear failure , Punching shear failure. **(08 Marks)**

b. A strip footing 2m wide carries a load intensity of $400kN/m^2$ at a depth of 1.2m in sand. The saturated unit weight of sand is $19.5kN/m^3$ and unit weight above water table is $16.8kN/m^3$. The share strength parameters are $C = 0$; $\phi = 35^0$. Determine the factors of safety with respect to shear failure for the following cases of location of Ground water table.
i) Water table is 4m below ground level ii) Water table is 1.2m below ground level
iii) Water table is 2.5m below ground level. For $\phi = 35^0$ consider $N_q = 41.4$; $N_\gamma = 42.4$. **(12 Marks)**

Module-5

9 a. What is Pile foundation? Explain the types of Pile foundation. **(10 Marks)**

b. A square group of 9 piles was driven into soft clay extending to a large depth. The diameter and length of piles were 30cm and 9m respectively. If the unconfined compression strength of the clay is $90kN/m^2$ and the pile spacing is 90cm centre to centre, what is the capacity of the group? Assume a factor of safety of 2.5 and adhesion factor of 0.75. **(10 Marks)**

OR

10 a. Which are the methods of finding load carrying capacity of pile? Explain any one method. **(08 Marks)**

b. Write a note on Negative skin friction of Pile. **(06 Marks)**

c. Define Under reamed piles : Under what circumstances it is employed and hence explain how the estimation of its design capacity is done. **(06 Marks)**

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17CV552

Fifth Semester B.E. Degree Examination, Aug./Sept.2020
Railways, Harbours, Tunneling and Airports

Time: 3 hrs. Max. Marks: 100

Note: Answer any FIVE full questions, choosing ONE full question from each module.

Module-1

1 a. Discuss the significance of the FOUR major modes of transportation. **(06 Marks)**

b. Describe the requirements of an ideal permanent way. **(07 Marks)**

c. An 8° branch curve diverges in an opposite direction from a 5° main curve in a BG yard. Determine the permissible speed on the branch line if the speed on the main line is restricted to 45 kmph. **(07 Marks)**

OR

2 a. Describe the indications of creep and effects of creep. **(06 Marks)**

b. Describe the requirements of sleepers. **(07 Marks)**

c. Describe the various types of gradients indicating the recommended values and conditions with examples. **(07 Marks)**

Module-2

3 a. Define plate laying, base and nail-head. Explain the operations in American method of plate laying. **(06 Marks)**

b. List the various classes of stations. Describe block stations and draw a neat sketch of a class B station with 3 lines. **(07 Marks)**

c. Describe a sump yard with a neat sketch. List the methods of stopping the rolling down wagons. **(07 Marks)**

OR

4 a. Estimate the quantities of materials required to construct 2 km length of BG railway track with a sleeper density of M+6. **(06 Marks)**

b. Discuss the factors to be considered for selecting the site for a railway station. **(07 Marks)**

c. Describe a marshalling yard with a neat sketch. **(07 Marks)**

Module-3

5 a. List the classification of harbours and draw a neat sketch of the layout of an artificial harbor with components. **(10 Marks)**

b. Discuss the advantages and disadvantages of tunnels. **(10 Marks)**

OR

6 a. List the types of breakwaters and discuss the characteristics of mound breakwaters. **(10 Marks)**

b. Explain the three systems of mechanical ventilation of Tunnels. **(10 Marks)**

Module-4

7 a. Discuss the advantages and limitations of air transport. **(06 Marks)**

b. Draw a neat sketch of an airport with open parallel concept of runways and explain the functions of the components. **(10 Marks)**

c. Describe the data to be collected for preparing a sand and scientific regional plan. **(04 Marks)**

OR

8 a. Discuss the importance of vehicular circulation and parking area at airports and list the points to be considered for an efficient system. **(06 Marks)**

b. List the factors to be considered while selecting a suitable site for a major airport and explain the features of a preferential runway with sketches. **(10 Marks)**

c. Draw a neat sketch of an airport with offset parallel concept of runway showing the components. **(04 Marks)**

Module-5

9 a. Explain (i) Cross wind component (ii) Wind coverage (iii) Calm period. **(06 Marks)**

b. Determine the turning radius of the taxiway for operating a subsonic jet aircraft of wheat base 17.70m and tread of main gear 6.62m. Turning speed is 40 kmph. Airport is of type A. **(06 Marks)**

c. Tabulate the summary of runway geometrics as per ICAO. **(08 Marks)**

OR

10 a. Explain the procedure of determining the best direction of orienting the runway as per Type-I wind rose diagram with assumed data. **(06 Marks)**

b. List the assumed conditions under which basic runway length is determined. Explain the normal landing case. **(06 Marks)**

c. The basic runway length required for a proposed airport is 1800 m. The airport site is at an elevation of 450 m above MSL. The monthly mean of average and maximum daily temperature for the hottest month of the year are 26°C and 38°C respectively. Determine the corrected length of runway required if the effective gradient is 0.22 percent. **(08 Marks)**

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15CV/CT51

Fifth Semester B.E. Degree Examination, Aug./Sept.2020
Design of RC Structural Elements

Time: 3 hrs. Max. Marks: 80

Note: 1. Answer any FIVE full questions, choosing ONE full question from each module.
2. Use of IS456-2000 and SP16 is permitted.

Module-1

1 a. Explain balanced section, under reinforced section, and over reinforced section. **(04 Marks)**

b. Obtain an expression for stress block parameter compressive force Cu and its position $\bar{y} = 0.42\ x_u$ from top. **(08 Marks)**

c. Obtain an expression for limiting percentage of steel and find limiting steel for M20 concrete and Fe415 steel. **(04 Marks)**

OR

2 a. Explain limit state of deflection and limit state of cracking. **(04 Marks)**

b. What are the factors and which influence deflection? **(04 Marks)**

c. Check the deflection requirement for the T beam continuous over 10m span having flange width 1200 mm web width 250mm and effective depth 400mm. Area of tension reinforcement 1500mm^2 area of compression reinforcement 960 mm^2. Adopt Fe415 steel. **(08 Marks)**

Module-2

3 a. A singly reinforced concrete beam 250 mm and 450mm deep up to centre of reinforcement is reinforced with 3-16mm dia effective cover 50mm, Effective span 6m. Determine central point load that can be applied in addition to self weight. Adopt M20 concrete and Fe500 steel. **(08 Marks)**

b. Find the steel for a rectangular beam 300×700mm E.span 6m supporting a load of 80 kN/m. Adopt M20 concrete and Fe415 steel. **(08 Marks)**

OR

4 a. A doubly reinforced concrete beam having rectangular section 250mm × 500mm is reinforced with 2-12 mm dia in compression 4-20 mm dia in tension. Effective cover 40 mm, Effective span 5 m. Find M_u. Adopt M20 concrete and Fe415 steel. **(08 Marks)**

b. A T beam having flange 1200 mm × 100mm web width 300 mm E.depth 550 mm, Area of tension steel 2280 mm^2. Find M_u. Adopt M20 concrete and Fe 500 steel. **(08 Marks)**

Module-3

5 Design a singly reinforced beam having effective span 7m to carry a live load of 20 kN/m for flexure and shear. Adopt M20 concrete and Fe415 steel. Also check the design for deflection and bond. **(16 Marks)**

OR

6 A hall 6m × 16m supported by beam spaced 4m c/c slab thickness 120mm. Supporting a live load 4 kN/m^2 and finishing 1 kN/m^2. Design interior T beam. Adopt M20 concrete and Fe415 steel. Assume bearing 500 mm. Overall depth limited to 450 mm. Take Effective cover 40mm. **(16 Marks)**

Module-4

7 Design a slab over a room 5.5m × 4m. Supporting a live load 4 kN/m^2. Floor finishing 1.0 kN/m^2. Design the slab if edges are restrained. Adopted M15 concrete and Fe415 steel. **(16 Marks)**

OR

8 The main stair of an office building has to be located in a stair case measuring 3.5m × 5.5m. Distance between the floor 3.75m. Design the stair. Live load 3 kN/m^2. Adopt M20 concrete and Fe415 steel. **(16 Marks)**

Module-5

9 a. Design a column to support an ultimate load 1800 kN. Effective length of column 1.85m adopt M20 concrete Fe415 steel. **(08 Marks)**

b. A column 300 × 500 mm supporting an ultimate load 1000 kN. M_u = 25 kNm. Find steel Adopt M20 concrete, Fe415 steel. Take cover 50mm. **(08 Marks)**

OR

10 Design a flat square footing to carry a column load 1000 kN column size 400 × 400mm SBC of soil 100 kN/m^2. Adopt M20 concrete, Fe415 steel. Show by calculation one way shear check, two way shear bond check and transfer of load at column base. **(16 Marks)**

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CBCS SCHEME

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15CV52

Fifth Semester B.E. Degree Examination, Aug./Sept.2020

Analysis of Indeterminate Structures

Time: 3 hrs. Max. Marks: 80

Note: Answer any FIVE full questions, choosing ONE full question from each module.

Module-1

1 Analyze the continuous beam shown in Fig.Q1 by slope deflection method and sketch BMD.

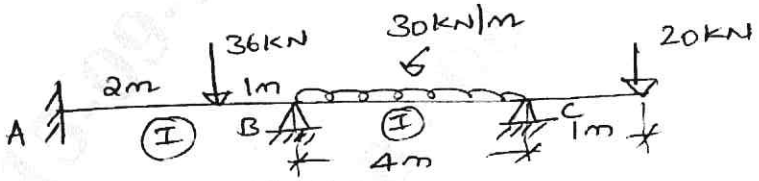

Fig.Q1 **(16 Marks)**

OR

2 Analyze the rigid plane frame shown in Fig.Q2 by slope deflection method and draw BMD.

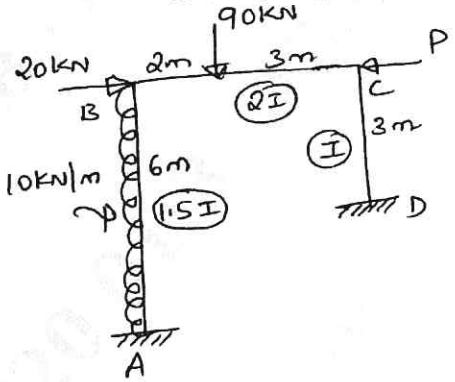

Fig.Q2 **(16 Marks)**

Module-2

3 Determine the moments for the given continuous beam shown in Fig.Q3 by moment distribution method. Sketch BMD.

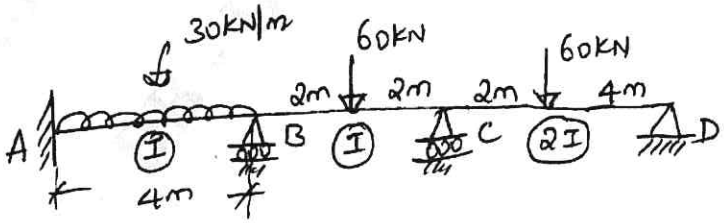

Fig.Q3 **(16 Marks)**

OR

4 Analyze the given frame shown in Fig.Q4 by moment distribution method. Sketch BMD.

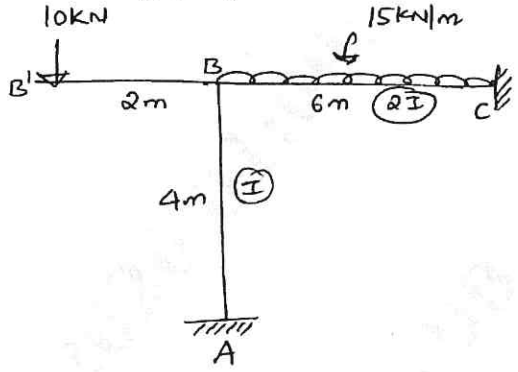

Fig.Q4 **(16 Marks)**

Module-3

5 Analyze the beam shown in Fig.Q5 by Kani's method. Draw BMD.

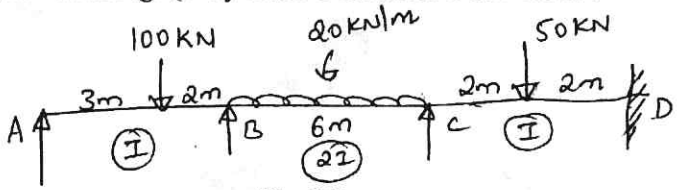

Fig.Q5 **(16 Marks)**

OR

6 Analyze the given frame shown in Fig.Q6 using Kani's method. Draw BMD.

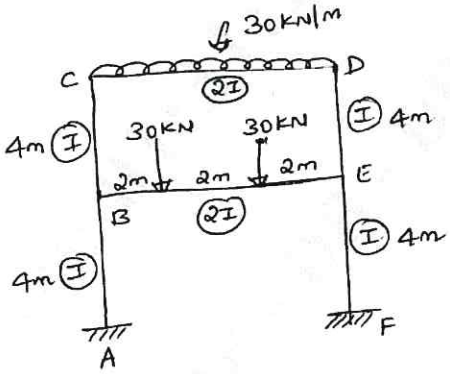

Fig.Q6 **(16 Marks)**

Module-4

7 Analyze the frame shown in Fig.Q7 and sketch BMD. Use flexibility method.

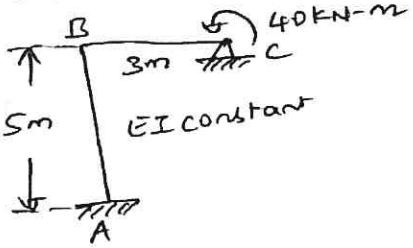

Fig.Q7 **(16 Marks)**

OR

8 Using the flexibility method, analyze the pin-jointer frame in Fig.Q8. The cross-sectional areas A and E for all members is same.

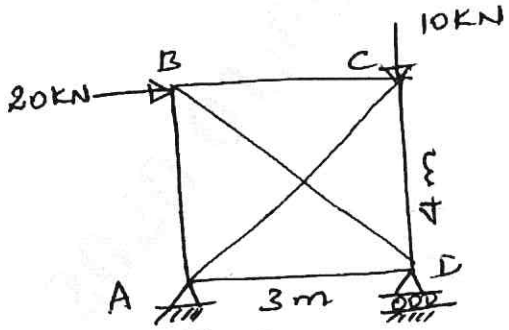

Fig.Q8 **(16 Marks)**

Module-5

9 Using displacement method, analyze the continuous beam shown in Fig.Q9 and sketch BMD.

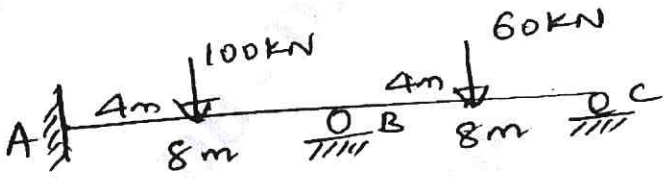

Fig.Q9 **(16 Marks)**

OR

10 Analyze the frame shown in Fig.Q10 by stiffness method.

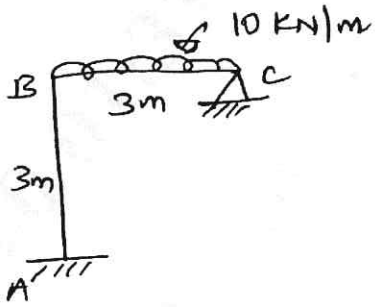

Fig.Q10 **(16 Marks)**

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CBCS SCHEME

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15CV53

Fifth Semester B.E. Degree Examination, Aug./Sept.2020
Applied Geotechnical Engineering

Time: 3 hrs. Max. Marks: 80

Note: ***Answer any FIVE full questions, choosing ONE full question from each module.***

Module-1

1 a. With a neat sketch of a soil sampler, define i) Area ratio ii) Inside clearance iii) Outside clearance iv) Recovery ratio. **(06 Marks)**

b. Briefly explain wash boring method of making boreholes, with a neat sketch. **(05 Marks)**

c. Discuss the Electrical Resistivity method of soil exploration. **(05 Marks)**

OR

2 a. List the various methods of dewatering during excavations. Explain Electro – Osmotic method of dewatering with a sketch. **(08 Marks)**

b. Estimate the ground water table for the following data. Depth up to which water is bailed out is 18 meters. Water rise on first day = 0.95m , Second day = 0.86m and Third day = 0.78m. Use Hvorselev's method. **(08 Marks)**

Module-2

3 a. Derive the equation for vertical stress below the centre of a circular area with uniform load intensity 'q'. **(08 Marks)**

b. A point load of 500kN acts on the ground surface. Calculate the vertical pressures at a point 5m directly below the load and at a distance of 4m from the axis of loading. Assume $\mu = 0$. Use i) Bousinesq's analysis ii) Westergaard's analysis. **(08 Marks)**

OR

4 a. Explain the components of total settlement. **(06 Marks)**

b. A square footing of sides 2m is founded at a depth of 1.5m below ground level carrying a load of 600kN. The soil below the foundation upto 4m depth is fully saturated clay with $r_{sat} = 20kN/m^3$, Liquid limit = 35% , Natural water content = 15% , G = 2.6. The soil abouve the base of footing is sandy soil with $r = 16kN/m^3$. Calculate the primary consolidation settlement assuming load dispersion at 2V : 1H. **(10 Marks)**

Module-3

5 a. Describe Rehbann's graphical method of determining the active earth pressure on a retaining wall. **(08 Marks)**

b. A vertical smooth wall 6m high retains cohesionless soil with $\phi = 30^0$, G = 2.65 and e = 0.8. Water table is at a depth of 2m from top. A uniform surcharge of $40kN/m^2$ is applied on top of backfill surface. Assume soil above water table is dry. Draw active earth pressure diagram and obtain the magnitude and location of active earth pressure using Rankine's theory. **(08 Marks)**

OR

6 a. Explain the causes for slope failure with sketches. Explain Swedish circle method of slices of stability analysis for slopes. **(10 Marks)**

b. An embankment is inclined at an angle of 35^0 and its height is 15m. The angle of internal friction is 15^0 and the cohesion is $200kN/m^2$. $r = 18kN/m^3$. Find the factor of safety with respect to cohesion , if $S_n = 0.06$. **(06 Marks)**

Module-4

7 a. Explain the types of shear failures with neat sketch. **(06 Marks)**

b. A strip footing 2m wide carries a load intensity of 400kN/m^2 at a depth of 1.2m in sand. r_{sat} of sand is 19.5kN/m^3 and r above water table is 16.8kN/m^3 and $\phi = 35^0$. Using Terzaghi's analysis, determine factor of safety with respect to shear failure for the following locations of water table. Take $N_q = 41.4$, $N_r = 42.4$, $C = 0$.

i) Water table 4m below ground level.

ii) Water table 1.2m below ground level.

iii) Water table at ground level. **(10 Marks)**

OR

8 a. Explain plate load test with neat sketch to determine the bearing capacity of soils. **(08 Marks)**

b. Design a square footing located at a depth of 1.3m below ground level , which carries a safe load of 800kN. The desired factor of safety is 3. Use Terzaghi's analysis for general shear failure. Take $C = 8kN/m^2$, $N_c = 37.2$, $N_q = 22.5$, $N_r = 19.7$, $r = 18kN/m^3$. **(08 Marks)**

Module-5

9 a. Explain the classification of piles based on function and based on materials. **(08 Marks)**

b. A reinforced concrete pile weighing 30kN (inclusive of helmet and dolly) is driven by a drop hammer weighing 40kN and having an effective fall of 0.8m. The average set per blow is 1.4cm. The total temporary elastic compression is 1.8cm. Assuming the coefficient of restitution as 0.25 and a factor of safety of 2, determine the ultimate bearing capacity and the allowable load for the pile. **(08 Marks)**

OR

10 a. Explain the term 'negative skin friction'. **(06 Marks)**

b. In a 16 pile group, the pile diameter is 45cm and centre to centre spacing of the square group is 1.5m. If $C = 50kN/m^2$, determine whether the failure would occur with the pile acting individually or as a group? Neglect bearing at the tip of the pile. All piles are 10m long. Take $m = 0.7$ for shear mobilization around each pile. **(10 Marks)**

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CBCS SCHEME

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15CV51

Fifth Semester B.E. Degree Examination, July/August 2021
Design of RC Structural Elements

Time: 3 hrs. Max. Marks: 80

Note: 1. ***Answer any FIVE full questions.***
2. ***Use of IS456-2000 and SP(16) are permitted.***

1 a. Write the difference between working stress method and limit state method. **(06 Marks)**

b. Derive an expression for area of stress block – $0.36f_{CK}X_u$ and depth of centre of compressive force from the extreme fibre in compression $0.42\ x_u$. **(10 Marks)**

2 a. What are the factors influences short term and long term deflection? **(06 Marks)**

b. Derive an expression of resistance of moment for a balanced section in terms of F_y and p. **(10 Marks)**

3 a. What are the differences between singly reinforced and doubly reinforced beam. **(06 Marks)**

b. Determine the moment of resistance (flexural). For the rectangular beam of size 250×450 mm consist of 4 bars of 18 mmϕ in tension zone.The beam is simply supported over a span of 5 m. Also determine the uniformly distributed load (UDL) which the beam can carry. Use M-20 concrete and Fe-415 steel. Assume clear cover is 40 mm. **(10 Marks)**

4 a. Determine moment of resistance for a cantilever beam 300×400 mm consist of 2 bars of 18mmϕ in bottom and 4 bars of 18 mmϕ in top. Use M20 concrete and Fe415 steel. **(06 Marks)**

b. Determine the moment of resistance of a T beam. The effective width of the flange is 2500 mm, depth of flange (D_F) 150 mm, width of the rib (B_W) is 300 mm and effective depth (d_f) is 800 mm. F_{CK} is 20 N/mm^2, $F_y = 415$ N/mm^2. Take area of steel is 6000 mm^2. **(10 Marks)**

5 Design a simply supported rectangular beam of clear span 5 m, supported on 230 mm thick wall. It is also subjected to an uniformly distributed load (UDL) 25 kN/m along with 10 kN point load at midspan. Use M20 concrete and Fe-415 steel. Design the beam for flexural and shear and also sketch the reinforcement details. **(16 Marks)**

6 A T-beam slab floor of an office comprises a slab of 150 mm thick spanning between ribs or webs of 250 mm wide spread at 3.2 m centre to centre. Clear span of beam is 7.7 m. The beam is 600 mm deep including slab and simply supported over a walls of 300 mm wide. Live load on floors 4 kN/m^2, floor and ceiling finishing is 0.75 kN/m^2. The beam also supports a partition wall which transmit a load of 12 kN/m. Design one of the intermediate beam for flexure and shear. Two main bars are to be bent near the support. Assume effective cover is 50 mm. **(16 Marks)**

7 Design a rectangular slab $4\text{m} \times 6\text{m}$ continuous over two adjacent edges to support a live load of 3 kN/m^2. Characteristic strength of concrete and steel is 20 and 415 N/mm^2. Use limit state method of design and sketch the reinforcement details. **(16 Marks)**

8 Design a open wall staircase for an residential building of a room size $4m \times 5.5m$. Take riser height 150 mm, thread 250 mm, floor to floor height is 3.6 m width of the stair is 1.5 m. Use M25 concrete and Fe500 steel. Also sketch the reinforcement details. **(16 Marks)**

9 Design a rectangular column 3.5 m long restrained in position and direction at both the ends to carry an axial load of 2000 kN. Use M25 concrete and Fe415 steel. Also draw the reinforcement pattern. **(16 Marks)**

10 Design a square footing for a square column of size $450 \times 450mm$ carrying a service load of 2000 kN. Take Safe Bearing Capacity of soil (SBC) is 300 kN/m^2 at a depth 1.5 m below ground level. Adopt M20 concrete and Fe415 steel. **(16 Marks)**

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CBCS SCHEME

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15CV52

Fifth Semester B.E. Degree Examination, July/August 2021
Analysis of Indeterminate Structures

Time: 3 hrs. Max. Marks: 80

Note: *Answer any FIVE full questions.*

1 Analyze the continuous beam shown in Fig. Q1 by slope deflection method. Draw BMD and Elastic curve. **(16 Marks)**

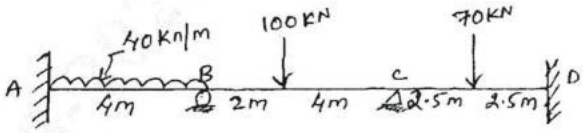

Fig. Q1

2 Analyze the portal Frame shown in Fig. Q2 by slope deflection method. Draw BMD. **(16 Marks)**

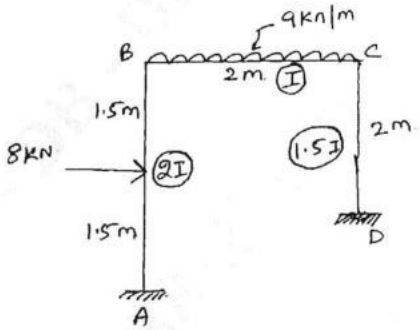

Fig. Q2

3 Analyze the continuous beam by moment distribution method shown in Fig. Q3. The support 'C' sinks by 9 mm. Take EI = 1000 kN-m^2. Draw BMD and Elastic curve. **(16 Marks)**

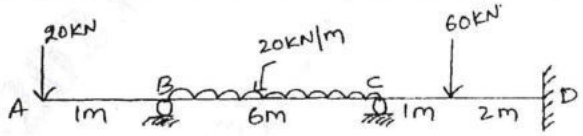

Fig. Q3

4 Analyze the portal frame shown in Fig. Q4 by moment distribution method. Draw BMD. **(16 Marks)**

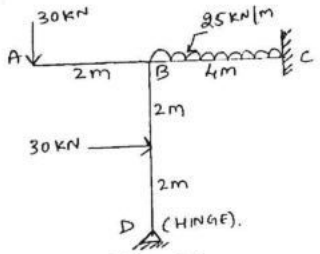

Fig. Q4

5 Analyze the continuous beam by Kani's method shown in Fig. Q5. Draw BMD. **(16 Marks)**

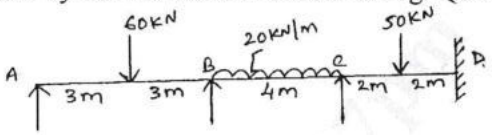

Fig. Q5

6 Analyze the portal frame shown in Fig. Q6 by Kani's method. Draw BMD. **(16 Marks)**

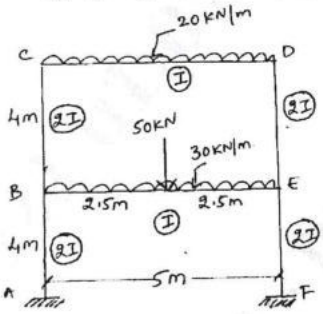

Fig. Q6

7 Analyze the beam shown in Fig. Q7 by flexibility matrix method. Draw BMD. **(16 Marks)**

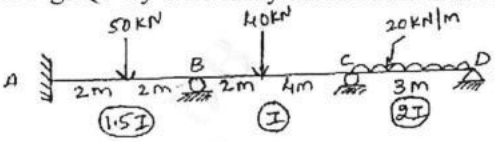

Fig. Q7

8 Analyze the portal frame shown in Fig. Q8 by flexibility matrix method. Draw BMD. **(16 Marks)**

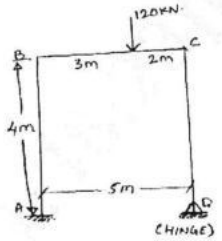

Fig. Q8

9 Analyze the continuous beam shown in Fig. Q9 by stiffness matrix method. Draw BMD. **(16 Marks)**

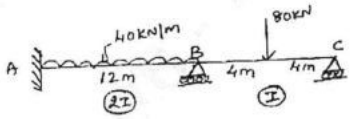

Fig. Q9

10 Analyze the portal frame shown in Fig. Q10 by stiffness matrix method. Draw BMD. **(16 Marks)**

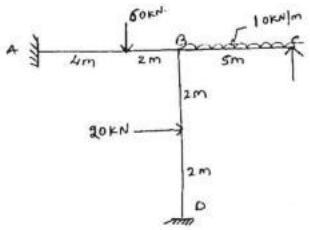

Fig. Q10

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15CV53

Fifth Semester B.E. Degree Examination, July/August 2021
Applied Geotechnical Engineering

Time: 3 hrs. Max. Marks: 80

Note: ***Answer any FIVE full questions.***

1 a. Determine the Area ratios for the following soil samplers and comment on the nature of samples obtained using each of the samplers.

i) Core cutter	165mm	OD	150mm ID
ii) Split barrel	51mm	OD	35mm ID
iii) Seamless tube (Shelby)	51mm	OD	48mm ID

(08 Marks)

b. What is borehole log? Give a typical bore hole log format. **(05 Marks)**

c. What are the objectives of dewatering? **(03 Marks)**

2 a. Explain briefly Seismic refraction method of geophysical method of exploration. **(06 Marks)**

b. With respect to a sampling tube, define i) Area ratio ii) Inside clearance iii) Outside clearance iv) Recovery ratio. **(06 Marks)**

c. What are the objectives of sub surface exploration? **(04 Marks)**

3 a. Define isobar. Using Boussinesq's equation construct isobar of intensity 0.25Q where Q is point load acting on the surface. **(08 Marks)**

b. Differentiate between Boussinesq's and Westergaurd's method of determination of stresses in soil. **(04 Marks)**

c. A circular area of 7.5metre in diameter on the ground surface carries a uniformly distributed load of $3kN/m^2$. Find the intensity of vertical pressure below the centre of the loaded area at a depth of 6m below ground level. **(04 Marks)**

4 a. The base of a tower consists of a equilateral frame, on the corners of which the three legs of the tower is supported. The total weight of the tower is 600kN, which is equally carried by all the three legs. Compute the increment in the vertical stress in the soil caused at a point 5m below one of the legs. **(06 Marks)**

b. Explain the construction and use of Newmark's chart with a Influence value of 0.005q. **(06 Marks)**

c. A normally consolidated clay settled by 2cm when the effective stress was increased from 100kPa to 200kPa. Calculate the settlement when the effective stress was increased to 400kPa. **(04 Marks)**

5 a. Explain with relevant diagrams earth pressure at rest, active earth pressure and passive earth pressure on retaining wall. **(06 Marks)**

b. A retaining wall with a smooth vertical back retains sand backfill for 6m. The backfill has a horizontal surface and has the following properties.
$c^1 = 0$, $\phi^1 = 28°$, $r = 16kN/m^3$ and $r_{sat} = 20kN/m^3$ water table is at a depth of 3m. Draw the earth pressure diagram. Determine the total active earth pressure on the retaining wall and find its point of application. **(10 Marks)**

6 a. Explain Fellenius method of determination of centre of critical slip circle of failure of slopes. **(06 Marks)**

b. Explain all the steps to determine the active earth pressure in coarse grained soil using Rankine's method. **(10 Marks)**

7 a. Differentiate between general shear, local shear and punching shear failure of soil. **(06 Marks)**

b. A ship footing 1.2m wide, is supported on a soil with its base at a depth of 1m below ground surface. The soil properties are as follows:
$C = 15kN/m^2$, $\phi = 35°$, $r_t = 18kN/m^3$ submerged unit weight $r^1 = 10kN/m^3$
Determine the ultimate bearing capacity if
i) Water table is at great depth.
ii) Water table is at the level of the base of the footing.
iii) The water table is at ground level.
Use Terzaghi's bearing capacity theorem. Bearing capacity factors $N_c = 57.8$, $N_q = 41.4$, $N_r = 42.4$ **(10 Marks)**

8 a. Explain the effect of water table on bearing capacity of soils. **(04 Marks)**

b. How plate load test results are correlated to find bearing capacity and settlement of foundations. **(06 Marks)**

c. A trapezoidal footing is to be proposed to support two square columns of 30cm and 50cm sides respectively. Columns are 6m apart and the safe bearing capacity of soil is $400kN/m^2$. The bigger column carries 5000kN and smaller 3000kN. Design a suitable size of the footing so that it does not extend beyond the faces of the columns. **(06 Marks)**

9 a. Give a brief description of classification of piles based on materials and function. **(10 Marks)**

b. What is negative skin friction in piles? Under what field conditions piles are subjected to negative skin friction. How it is estimated in different soils. **(06 Marks)**

10 a. Explain in detail the determination of load carrying capacity of piles using static formula. **(10 Marks)**

b. Give a brief description of group load carrying capacity of piles. **(06 Marks)**

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CBCS SCHEME

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17CV/CT51

Fifth Semester B.E. Degree Examination, July/August 2021
Design of RC Structural Elements

Time: 3 hrs. Max. Marks: 100

Note: 1. ***Answer any FIVE full questions.***
2. ***Use of IS456 – 2000, SP – 16 Permitted.***
3. ***Assume any missing data suitably.***

1 a. What is a Stress block? Derive from fundamentals the expression for area of stress block $0.36f_{uc}\ x_u$ and depth of centre of compressive force from the extreme fibre in compression $0.42x_u$. **(10 Marks)**

b. Briefly explain the modes of failure of beam sections with sketches. **(10 Marks)**

2 A rectangular simply supported beam of span 5m is 300mm × 650mm in cross section and is reinforced with 3 bars of 20mm on tension side as an effective cover of 50 mm. Determine short term deflections due to an imposed load of 20kN/m. Assume grade of concrete M_{20} and Fe 415 grade steel. **(20 Marks)**

3 A singly reinforced beam 300mm × 450mm in section is reinforced with 3 – bars of 20mm diameter with an effective cover of 50mm. Effective span of the beam is 6m. Assuming M_{20} concrete and Fe 415 steel, determine the Central Concentrated load P that can be carried by the beam in addition to its self weight. **(20 Marks)**

4 Calculate the area of reinforcement required for L – beam of flange width 1000mm , flange thickness 120mm , width of rib 250mm , total depth 750mm and effective cover 70mm to resist an ultimate bending moments (a) 400 kN-m (b) 75 kN – m. Assume concrete grade M_{20} and steel of grade Fe 415. **(20 Marks)**

5 A T – beam slab floor has 125mm thick slab forming part of T – beams which are of 8m clear span. The end bearings are 300mm thick. Spacing of T – beams is 3.5m. The live load on floor is $3kN/m^2$. Design one of the intermediate beams. Using M_{20} grade concrete and Fe 415 grade steel. Design the beam and sketch the details of reinforcement. **(20 Marks)**

6 Design a rectangular beam of section 230mm × 600mm of effective span 6m. Effective cover should be kept as 50mm imposed load on the beam is 40kN/m. Use M_{20} concrete and Fe 415 steel. **(20 Marks)**

7 Design a Cantilever slab projecting 1.5m from a beam. Adopt live load of $2.5\ kN/m^2$. Use M_{20} concrete and Fe 415 steel. Design the slab and sketch the details of reinforcement. **(20 Marks)**

8 Design a dog legged stairs for an office building in a room measuring 2.8m × 5.8m clear. Vertical distance between the floor is 3.6m. Width of the flight is to be 1.25m. Allow a live load of $3kN/m^2$. Use M_{20} concrete and Fe 415 grade steel. Assume the stairs are supports on 230mm walls at the end of outer edges of landing slabs. **(20 Marks)**

9 Design a square footing for a short axially loaded column of size 300mm × 300mm carrying 600kN load. Use M20 concrete and Fe 415 steel. SBC of soil is $180\ kN/m^2$. Sketch the details of reinforcement. **(20 Marks)**

10 An R.C. column of unsupported length 2.75m has to be designed for an ultimate axial load 3250 kN. Find cross – sectional dimensions of the column and reinforcement required. Use M_{20} grade of concrete and Fe 415 steel. Sketch the details of reinforcement. **(20 Marks)**

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CBCS SCHEME

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17CV52

Fifth Semester B.E. Degree Examination, July/August 2021
Analysis of Indeterminate Structures

Time: 3 hrs. Max. Marks: 100

Note: *Answer any FIVE full questions.*

Module-1

1 a. Analyse the continuous beam shown in Fig. Q1 (a) by slope deflection method. Draw bending moment diagram. Take EI constant. **(10 Marks)**

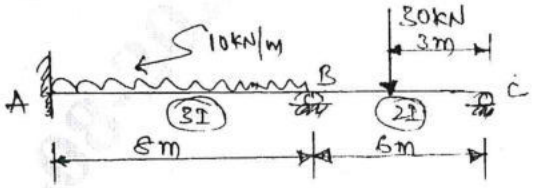

Fig. Q1 (a)

b. Analyse the portal frame shown in Fig. Q1 (b) by slope deflection method. Draw bending moment diagram. **(10 Marks)**

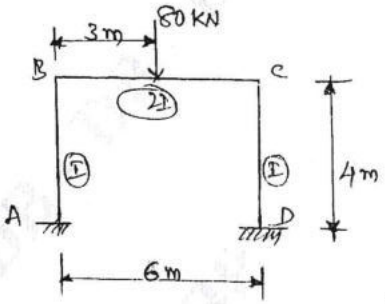

Fig. Q1 (b)

OR

2 a. Analyse the beam shown in Fig. Q2 (a) by slope deflection method. Draw bending moment and shear force diagram. Take EI constant. **(08 Marks)**

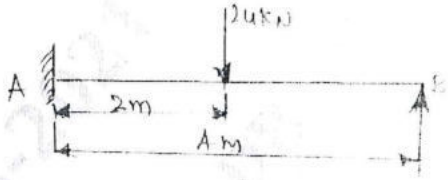

Fig. Q2 (a)

b. Analyse the frame shown in the Fig. Q2 (b) by slope deflection method. Draw bending moment diagram. **(12 Marks)**

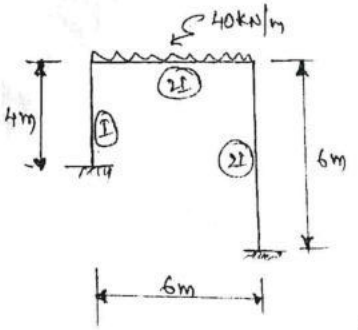

Fig. Q2 (b)

Module-2

3 Analyse the beam shown in Fig.Q3 by moment distribution method. Draw BMD, SFD and elastic curve. **(20 Marks)**

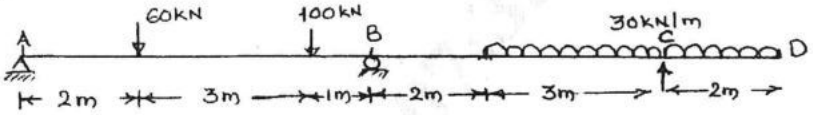

Fig. Q3

OR

4 Analyze the portal frame by moment distribution method. Draw bending moment diagram. Refer Fig. Q4. Take EI constant. **(20 Marks)**

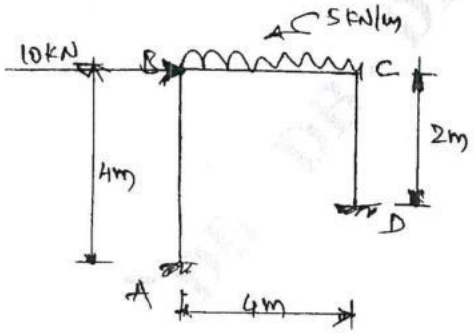

Fig. Q4

Module-3

5 Analyse the continuous beam by Kani's method. Refer Fig. Q5. Draw bending moment diagram. **(20 Marks)**

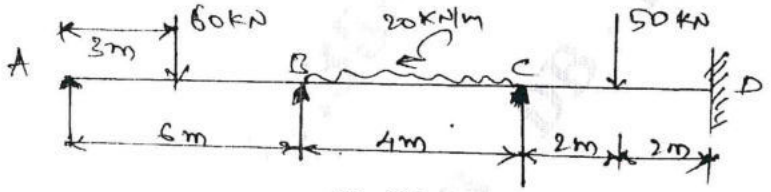

Fig. Q5

OR

6 Analyse the portal frame shown in Fig. Q6 by Kani's method. Draw bending moment diagram. **(20 Marks)**

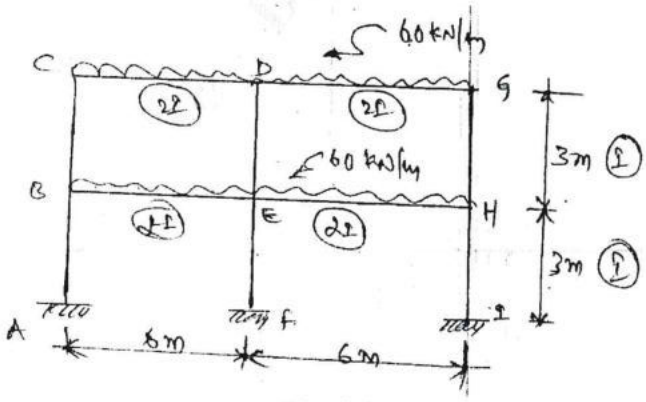

Fig. Q6

Module-4

7 Analyse the continuous beam shown in Fig. Q7 by flexibility method and draw bending moment diagram. Take EI constant. **(20 Marks)**

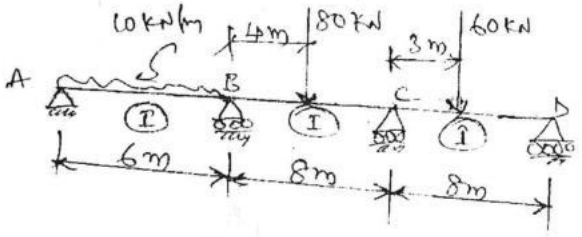

Fig. Q7

OR

8 Analyze the pin jointed truss shown in Fig. Q8 by flexibility matrix method and determine the forces in the members. Take force in the number OA is redundant. **(20 Marks)**

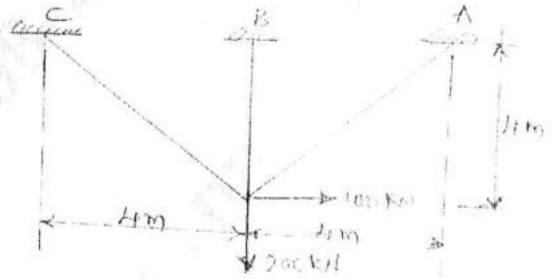

Fig. Q8

Module-5

9 Analyse the Portal frame shown in Fig. Q9 by stiffness method. Draw bending moment diagram. **(20 Marks)**

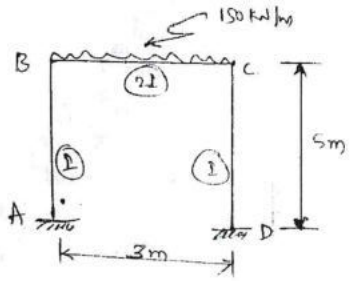

Fig. Q9

OR

10 Analyse the truss shown in Fig. Q10 by stiffness method and find the forces in the members. **(20 Marks)**

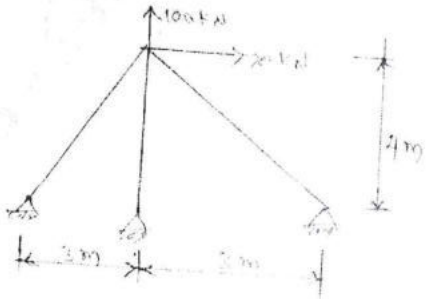

Fig. Q10

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CBCS SCHEME

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17CV53

Fifth Semester B.E. Degree Examination, July/August 2021
Applied Geotechnical Engineering

Time: 3 hrs. Max. Marks: 100

Note: 1. ***Answer any FIVE full questions.***
2. ***Use of IS : 6403 is permitted.***

1 a. What are the objectives of soil exploration? List the methods of exploration. **(08 Marks)**

b. Explain the terms with the help of a neat sketch of sampling tube :
   i) Inside clearance.
   ii) Outside clearance. Determine the area ratio for a sampler having outer diameter of cutting edge as 75mm and wall thickness as 1.7mm. Also state the type of sampler. **(07 Marks)**

c. Explain various types of soil samples. **(05 Marks)**

2 a. List the methods of dewatering during excavation and construction of foundations. Explain any one. **(06 Marks)**

b. Predict the ground water table given the following data :
Depth upto which water is boiled out = 18m , Water rise in I day = 0.95m , II day = 0.86m and III day = 0.78m. Use Hvorslev's method for predicting ground water table. **(06 Marks)**

c. Explain Seismic refraction method of exploration, with a neat sketch. **(08 Marks)**

3 a. Distinguish between Boussinesq's and Westergaard's theory of stress distribution. **(04 Marks)**

b. Find the intensity of vertical pressure at a point 4m directly below a 20kN point load acting on a horizontal surface. What will be the vertical pressure at a point 2m horizontally away from the axis of loading and also at the same depth of 4m? **(06 Marks)**

c. Construct an Isobar for a vertical stress of $20kN/m^2$ when ground surface is subjected to a concentrated load of 500kN. **(10 Marks)**

4 a. Explain equivalent point load method for determining vertical stress at any point within the loaded area. **(04 Marks)**

b. Explain components of settlement with its formula. **(08 Marks)**

c. A stratum of clay with an average liquid limit of 45% is 6m thick. Its surface is located at a depth of 8m below the ground surface. The natural water content of the clay is 40% and specific gravity is 2.7. Between ground surface and clay the subsoil consists of fine sand. The water table is located at a depth of 4m below the ground surface. The average submerged unit weight of sand is $10.5kN/m^3$ and the unit weight of sand above the water table is $17kN/m^3$. The weight of building that will be constructed on the sand above clay increases the overburden pressure on the clay by $40kN/m^2$. Estimate the settlement of building. **(08 Marks)**

5 a. Distinguish between Active earth pressure and Passive earth pressure with sketch. **(04 Marks)**

b. Explain Culmann's graphical method of finding Active earth pressure. **(06 Marks)**

c. A retaining wall 5m high retains a cohesion less backfill. The top 2.5m of the fill has a unit weight of $17kN/m^3$ and $\phi = 35^0$. Water table is at a depth of 2.5m from ground surface. The bottom 2.5m has a saturated unit weight of $18kN/m^3$ and $\phi = 38^0$. Draw active earth pressure distribution diagram. Determine total active earth pressure and its point of application. **(10 Marks)**

6 a. List the assumptions made in slope stability analysis. **(04 Marks)**

b. Calculate the factor of safety with respect to cohesion of a clay soil laid at a slope angle of 26.5^0 to a height of 10m, if $\phi = 10^0$, $C = 25kN/m^2$ and $\gamma = 19kN/m^3$. What will be the critical height of the slope in this soil? For $\beta = 26.5^0$ and $\phi = 10^0$, $S_n = 0.064$. **(04 Marks)**

c. A cutting 8.5m deep is to be made in a cohesive soil whose shear strength increases with depth. The slope of the cutting in 2H:1V. The properties of the soil are effective cohesion = $30kN/m^2$, Angle of internal friction = 20^0 and Unit weight = $19kN/m^3$. Determine the FOS for a trial slip circle passing through the toe of the slope by method of slices. The centre of slip circle can be located by Fellenius directional angles. For $\beta = 26.6^0$, $\alpha_A = 25^0$ and $\alpha_B = 35^0$. **(12 Marks)**

7 a. With the help of sketch, explain effect of eccentric loading on bearing capacity of soil. **(04 Marks)**

b. Explain different modes of shear failure, with neat sketches. **(06 Marks)**

c. A column carries a load of 1000kN. The soil is a dry sand weighing $19kN/m^3$ and having $\phi = 40^0$. A minimum factor of safety of 2.5 is required and Terzaghi's factors are required to be used $N_\gamma = 42$, $N_q = 21$.

i) Find the size of square footing if placed at the ground surface.

ii) Find the size of square footing if placed at 1m below ground surface with water table at ground surface. Assume $\gamma_{sat} = 21kN/m^3$. **(10 Marks)**

8 a. Explain the procedure for determining the ultimate load capacity of soil by plate load test with a neat sketch. List its limitations. **(08 Marks)**

b. Calculate the net ultimate bearing capacity of a rectangular footing 1.8m × 3.6m in plan founded at a depth of 1.6m below the ground surface. The load on the footing acts at an angle of 16^0 to the vertical and it is eccentric in the direction of width by 15cm. The unit weight of soil is $18kN/m^3$. The shear parameters are $C' = 15kN/m^2$ and $\phi' = 30^0$. Natural water table is at a depth of 2m below the ground surface. Use BIS recommendations as contained in IS6403 – 1981. **(12 Marks)**

9 a. Explain in detail classification of piles based on material and function. **(10 Marks)**

b. A group of 9 piles, 10m long is used as a foundation for a bridge pier. The piles used are 30cm diameter with centre to centre spacing of 0.9m. The subsoil consists of clay with unconfined compressive strength of $15kN/m^2$. Determine the efficiency neglecting the bearing action. Take adhesion factor as 0.9. **(10 Marks)**

10 a. With the help of sketch, explain : i) Negative skin friction ii) Under reamed piles. **(10 Marks)**

b. A group of 9 piles arranged in a square pattern with diameter and length of each pile as 25cm and 10m respectively, is used as a foundation in soft clay deposit. Taking the unconfined compressive strength of clay as $120kN/m^2$ and the pile spacing as 100cm center to centre. Find the capacity of the group , Assuming bearing capacity factor $N_C = 9$, Adhesion factor = 0.75 and FOS = 2.5. **(10 Marks)**

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CBCS SCHEME

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18CV51

Fifth Semester B.E. Degree Examination, July/August 2021
Construction Management and Entrepreneurship

Time: 3 hrs. Max. Marks: 100

Note: *1. Answer any FIVE full questions.*
2. Assume the factors accordingly.

1 a. Explain in brief the types of plans based on various factors. **(08 Marks)**
b. What are the characteristics of management? **(08 Marks)**
c. What is Gantt chart? Explain with its significance. **(04 Marks)**

2 a. What is project organization? Explain with a typical project organization chart. **(08 Marks)**
b. Differentiate between AOA and AON. **(04 Marks)**
c. Draw the network from the following activity and find critical path and total project duration:

Activity	A	B	C	D	E	F	G
Predecessor	-	-	A	A	B	B	D, F
Duration days	10	9	9	8	7	11	5

(08 Marks)

3 a. Classify the construction equipments based on different functions. **(08 Marks)**
b. Determine the output of a Bulldozer having 215 HP engine, fitted with '5' blade rated capacity 4.4m^3. The dozer is employed for excavating a hard clayey soil with average ranking of 50mts with an ideal output of 160LCM (approx) on a downhill with slope 20%. It has direct drive transmission and its expected performance is 55 minutes per hour. Assume the correction factors accordingly. **(08 Marks)**
c. Write a note on labour productivity rates and its measurement. **(04 Marks)**

4 a. Explain in brief the different types of constructing equipment maintenance methods. **(08 Marks)**
b. A company has purchased a construction equipment for Rs.2,00,000/- with an estimated life of 5 years and its resale value after the estimated life is 10% of the cost of equipment. Determine the depreciation charge and book value at the end of each year. Also calculate the hourly depreciation if the equipment is planned to operated 1500 hours per year. **(08 Marks)**
c. Explain in brief the inventory control techniques used in material management. **(04 Marks)**

5 a. Explain the dimensions of quality in a construction project. **(08 Marks)**
b. Explain the significance of TQM in the project. **(08 Marks)**
c. List out the benefits of ethics at work place. **(04 Marks)**

6 a. Explain the different types of conflict of interest. **(08 Marks)**
b. Explain the safety procedure to be adopted during demolition of RCC structure. **(08 Marks)**
c. Write a note on ISO standards for construction process. **(04 Marks)**

7 a. Explain the benefit of engineering economy in construction management. **(08 Marks)**

b. A firm invest in one of the two mutually exclusive alternative. Determine the best alternative based on annual equivalent method with the given details. **(12 Marks)**

i = 20%

Alternative	Investment (Rs)	Annual equal return (Rs)	Salvage value (Rs)
A	2,50,000	90,000	20,000
B	2,75,000	1,00,000	50,000

8 a. Differentiate between Micro and Macro economics. **(08 Marks)**

b. Determine the effective interest rate for a nominal rate of 6 percent that is compounded i) Daily ii) Monthly iii) Quarterly iv) Half yearly v) Annually. **(12 Marks)**

9 a. Explain the stages of entrepreneurial process. **(08 Marks)**

b. What is MSME? Explain its significance. **(04 Marks)**

c. Explain the role and scope of i) TECSOK ii) SIDBI. **(08 Marks)**

10 a. Explain the business planning process. **(08 Marks)**

b. Mention the mode of non-equity arrangement for international entrepreneurial entry with its benefit. **(04 Marks)**

c. Explain the concept of feasibility study and its report for starting a project. **(08 Marks)**

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CBCS SCHEME

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18CV52

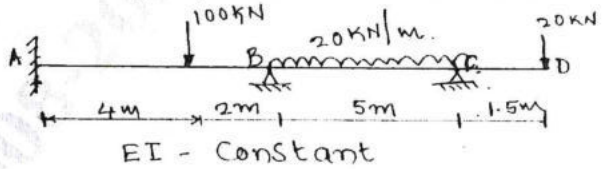
Fifth Semester B.E. Degree Examination, July/August 2021
Analysis of Indeterminate Structure

Time: 3 hrs. Max. Marks: 100

Note: Answer any FIVE full questions.

1 Analyze continuous beam ABCD by slope deflection method. Construct SFD and BMD.

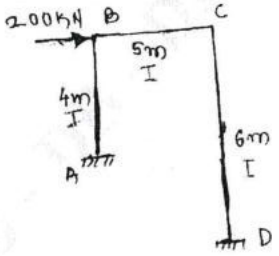
Fig.Q1



(20 Marks)

2 Analyze the frame shown in Fig.Q2 by slope deflection method and draw BMD.

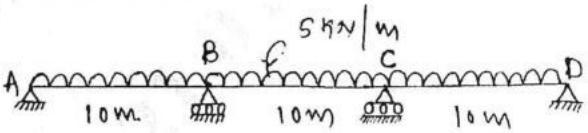
Fig.Q2



(20 Marks)

3 Analyze the continuous beam ABCD loaded as shown in Fig.Q3 if settlement in support B and C are 5 mm and 10 mm respectively. Use moment distribution method. Take $EI = 2.7 \times 10^5$ kN-m^2. Draw BMD.

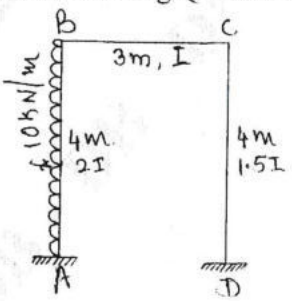
Fig.Q3



(20 Marks)

4 Analyze the frame loaded as shown in Fig.Q4. Use moment distribution method.

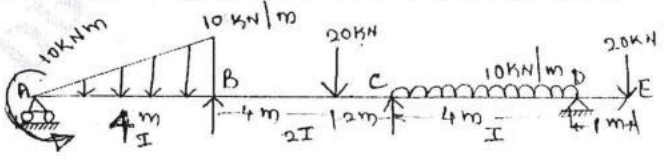
Fig.Q4



(20 Marks)

5 Analyze the beam shown in Fig.Q5 by Kani's method. Draw BMD.

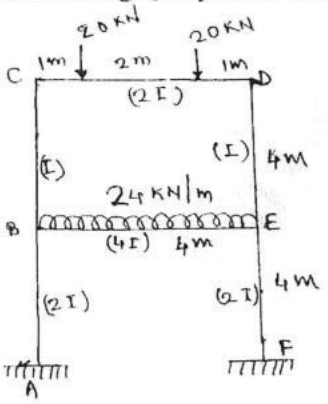
Fig.Q5



(20 Marks)

6 Analyze the frame shown in Fig.Q6 by Kani's method. (Make use of symmetry)

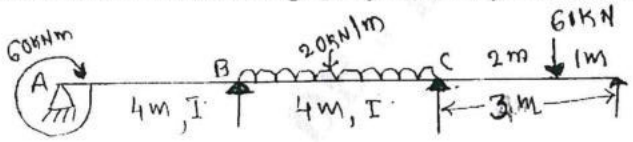
Fig.Q6



(20 Marks)

7 Analyze the continuous beam shown in Fig.Q7 by flexibility method. Draw BMD.

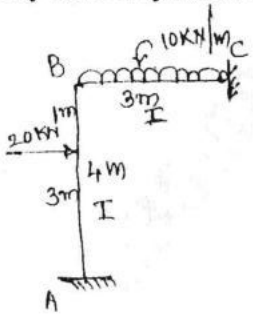
Fig.Q7



(20 Marks)

8 Analyze frame shown in Fig.Q8 by flexibility matrix approach. Draw BMD.

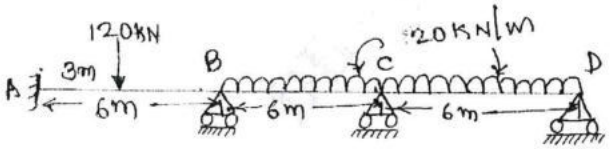
Fig.Q8



(20 Marks)

9 Analyze the continuous beam shown in Fig.Q9 by stiffness matrix method. Take EI constant.

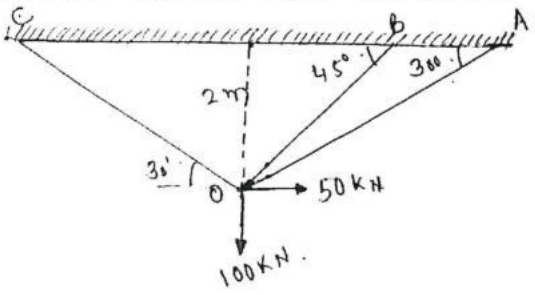
Fig.Q9



(20 Marks)

10 Analyze the pin-jointed truss shown in Fig.Q10 by stiffness matrix method. Take cross-sectional area for all members = 1000 mm^2 and E = 200 kN/mm^2.

Fig.Q10



(20 Marks)

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18CV53

Fifth Semester B.E. Degree Examination, July/August 2021
Design of RC Structural Elements

Time: 3 hrs. Max. Marks: 100

Note : 1. ***Answer any FIVE full questions.***
2. ***Use of IS : 456 – 2000 , SP16 is permitted.***
3. ***Assume suitable data, if necessary.***

1 a. Explain the principles of limit state design. **(06 Marks)**

b. Explain briefly under reinforced, over reinforced and balanced section with sketch. **(06 Marks)**

c. A simply supported beam of rectangular section spanning 6m has a width of 300mm and overall depth of 600mm. The beam is reinforced with tensile steel of area 1963mm^2 with an effective cover of 50mm. Diameter of bars is 25mm spaced at 50mm centers. The beam is subjected to a moment of 160KN-m at centre of span. Check the beam for serviceability limit state of cracking. Assume f_{ck} = 25 N/mm^2 and f_y = 415 N/mm^2. **(08 Marks)**

2 a. Write a brief note on :
i) Partial safety factors for materials.
ii) Characteristic loads.
iii) Characteristic strength.
iv) Partial safety factors for loads. **(12 Marks)**

b. A simply supported beam of rectangular section spans over 10m and has an effective depth of 700mm. The beam is reinforced with 1% reinforcement on the tension side. Check for the deflection control of the beam by empirical method if :
i) Fe415 HYSD bars are used ii) Fe500 HYSD bars are used. **(08 Marks)**

3 a. Derive from fundamentals the expression for the area of stress block 0.36 f_{ck} X_u. **(08 Marks)**

b. Determine the moment of resistance of T – beam for the following data :
Width of the flange = 2500mm , Effective depth = 800mm , Width of Web = 300mm , Depth of flange = 150mm , Number of bars = 8 of 25mm diameter. Assume M_{20} concrete and Fe415 steel. **(12 Marks)**

4 a. Derive the moment of resistance equation for doubly reinforced rectangular section. **(10 Marks)**

b. A singly reinforced concrete beam of 250mm × 450mm deep upto the centre of reinforcement with 3 bars of 16mm diameter at an effective cover of 50mm, effective span of 6m. Use M_{20} concrete and Fe415 steel. Determine the central point load that can be supported in addition to the self weight. **(10 Marks)**

5 A reinforced concrete beam is to be designed over an effective span of 5m to support a design service load of 8 kN/m. Adopt M_{20} grade concrete and Fe415 HYSD bars and design the beam to satisfy the collapse and serviceability limit states. **(20 Marks)**

6 A T – beam slab floor of an office building comprises of a slab 150mm thick spanning between ribs spaced at 3m centres. The effective span of the beam is 8m. LL on the floor is 4 kN/m^2. Using M_{20} concrete and Fe415 steel, design one of the intermediate T – beams. **(20 Marks)**

7 Design a RCC slab for an office floor 4.5m × 5.5m with four edges discontinuous and corners held down. The LL on the slab is 3kN/m^2. Assume floor finish as 0.6 kN/m^2 and ceiling finish as 0.4kN/m^2. Use M_{20} grade concrete and Fe415 steel. Sketch the reinforcement. **(20 Marks)**

8 a. Distinguish between one way slab and two way slab. **(04 Marks)**

b. Design a Dog legged stair for an office building in a room measuring 2.8m × 5.8m , clear distance between floors is 3.6m. The width of the flight is to be 1.25m. Assume Live load of 3kN/m^2. Use M_{20} grade concrete and Fe415 steel. Assume that the stair supported on 230mm at the outer edge of landing stairs. Sketch the reinforcement details. **(16 Marks)**

9 a. What is the role of transverse reinforcement in columns? What are the codal provisions to design transverse reinforcement? **(06 Marks)**

b. Explain the difference between Short columns and Long columns. **(04 Marks)**

c. A column size 300mm × 400mm has an effective length of 3.6m and is subjected to P_u = 1100kN and M_u = 150 kN m about the major axis. Assuming the bars on two sides. Design the column using M_{25} concrete and Fe415 steel. **(10 Marks)**

10 Design an isolated footing for a rectangular column of 300mm × 500mm supporting an axial load of 1500 kN factored. Assume SBC of soil as 185 kN/m^2. Use M_{20} grade concrete and Fe415 steel. Sketch the reinforcement and perform the necessary checks. **(20 Marks)**

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CBCS SCHEME

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18CV54

Fifth Semester B.E. Degree Examination, July/August 2021
Basic Geotechnical Engineering

Time: 3 hrs. Max. Marks: 100

Note: ***Answer any FIVE full questions.***

1 a. With the help of 3 – phase diagram, define Void ratio , Porosity , Water content and Degree of saturation. **(08 Marks)**

b. The mass of wet soil when compacted in a mould was 19.17N. The water content of the soil mass was 16%. If the volume of mould was 0.945 litres, determine
i) Dry density ii) Void ratio iii) Degree of saturation iv) Percent air voids.
Take G = 2.68. **(12 Marks)**

2 a. Define Liquid limit, Plastic limit and Shrinkage limit ; Liquidity index and Relative consistency. **(06 Marks)**

b. Explain determination of In-situ density of soil by Sand replacement method. **(08 Marks)**

c. The liquid limit test on soil sample gives the following results. The plastic limit of the soil is 40%.

No. of Blows	12	18	22	34
Water content %	56	52	50	45

Plot a flow curve and obtain i) Liquid limit ii) Flow Index iii) Plasticity Index and iv) Toughness Index. **(06 Marks)**

3 a. List and explain various soil structures. **(06 Marks)**

b. Briefly explain the factors affecting compaction. **(06 Marks)**

c. A standard proctor test was performed on a soil sample of specific gravity 2.70, with the following results :
Maximum dry unit weight = 18kN/m^3 ; Optimum moisture content = 16%.
If the compaction effect was increased so that the maximum unit weight is 19.2 kN/m^3, assuming same degree of saturation, what should be the corresponding OMC. **(08 Marks)**

4 a. Explain Common clay minerals with sketches. **(06 Marks)**

b. Explain Electrical diffuse double layer and adsorbed water. **(06 Marks)**

c. A soil in the borrowpit is at a dry density of 16.67 kN/m^3 with water content of 12%. If the soil of 2000m^3 is excavated from it and compacted in an embankment with porosity of 0.32, calculate the volume of embankment which can be constructed out of this material.
Take G = 2.70. **(08 Marks)**

5 a. Explain the following : i) Effective stress analysis ii) Seepage analysis. **(06 Marks)**

b. With the help of a neat sketch, derive the equation to determine permeability by Falling Head Permeability Test. **(06 Marks)**

c. Calculate the seepage through an earth dam resting on an impervious foundation. The relevant data are given below :
Height of Dam = 60.0m ; Free Board = 2.5m ; Upstream slope = 2.75 : 1 ;
Crest width = 8.0m ; Downstream slope = 2.50 : 1 ; Length of drainage blanket = 120.0m.
Coefficient of permeability of the embankment material in x – direction = 8×10^{-7} m/s ;
y – direction = 2×10^{-7} m/s. **(08 Marks)**

6 a. What is a Flownet? What are the characteristics and uses of the Flownet? **(06 Marks)**

b. Describe the Casagrande's method to locate the phreatic line in a homogeneous earth dam with a horizontal filter @ its toe. **(06 Marks)**

c. A soil sample of height 60mm with cross sectional area 8000mm^2 was subjected to a falling head permeability test. In a time interval of 6 minutes, the head dropped from 750mm to 300mm. If the cross sectional area of stand pipe is 150mm^2, compute the coefficient of permeability. If the same sample is subjected to a constant head of 200mm, compute the total quantity of water that will get discharged through the sample in a time interval of 10 minutes. **(08 Marks)**

7 a. Explain Mohr – Coulomb failure theory of soil. **(06 Marks)**

b. List the different methods to measure the shear strength of soil. Explain any one of them. **(06 Marks)**

c. A shear test was carried out and the following results are recorded :

Normal stress (kN/m^2)	200	250
Shear stress (kN/m^2)	100	125

Find shear parameters, what would be the deviator stress at failure if a biaxial test is carried out from the same soil with cell pressure of 100kN/m^2. **(08 Marks)**

8 a. Explain the advantages of Triaxial shear test over Direct shear test. **(06 Marks)**

b. What are the factors affecting the shear strength of soil? **(06 Marks)**

c. A cylindrical specimen of saturated clay 40mm in diameter and 80mm in length is tested in an unconfined compression test. Find shear strength of clay, if the specimen fails under an axial load of 350N. The change in length of the specimen @ failure is 8mm. Also find the shear parameters if the angle made by the failure plane with horizontal is 50^0. **(08 Marks)**

9 a. Enumerate the assumptions and limitations of Terzaghi's Consolidation theory. **(06 Marks)**

b. Briefly explain normally consolidated, under consolidated and over consolidated soils. **(06 Marks)**

c. A soil sample 20mm thick takes 20 minutes to reach 20% consolidation. Find the time taken for a clay layer 6m thick to reach 40% consolidation. Assume double drainage in both cases. **(08 Marks)**

10 a. Explain Mass – Spring Analogy. **(06 Marks)**

b. Explain determination of coefficient of consolidation by square root of Time Fitting method. **(06 Marks)**

c. In a consolidation test, the void ratio of soil sample decreases from 1.20 to 1.10. When the pressure increased from 200kN/m^2 to 400kN/m^2. Calculate the coefficient of consolidation if the coefficient of permeability is 8×10^{-7} mm/s. **(08 Marks)**

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18CV55

Fifth Semester B.E. Degree Examination, July/August 2021
Municipal Waste Water Engineering

Time: 3 hrs. Max. Marks: 100

Note: ***Answer any FIVE full questions.***

1 a. Explain the need for sanitation along with different types of Sewerage systems. **(10 Marks)**

b. Explain the factors affecting dry weather flow and the effects of flow variations in the design of sewerage system. **(10 Marks)**

2 a. Explain the different methods of domestic waste water disposal along with advantages and disadvantages. **(10 Marks)**

b. A city has a projected population of 50,000 residing over an area of 40 hectares. Find the design discharge for the sewer line for the following data :

i) Rate of water supply = 200 ℓpcd

ii) Time of concentration = 50 minutes.

iii) Average impermeability coefficient for the entire area = 0.3.

The sewer line is to be designed for a flow equivalent to the wet weather flow plus twice the dry weather flow. Use U.S ministry of health formula. Assume that 75% of water supply reaches in sewer as waste water. **(10 Marks)**

3 a. Draw a neat flow diagram and explain the Municipal Waste water treatment unit operations and process. **(10 Marks)**

b. A 40cm diameter sewer is to flow at 0.4 depth on a grade ensuring a degree of self cleansing equivalent to that obtained at full depth at a velocity of 80cm/sec. Find

i) The required grade.

ii) Associated velocity.

iii) Rate of discharge at this depth.

Given : i) Manning's rugosity coefficient = 0.014

ii) Proportionate area = 0.252 iii) Proportionate HMD (r/R) = 0.684. **(10 Marks)**

4 a. What are the aims and objectives of Sampling technique involved in the waste water analysis? **(04 Marks)**

b. Define the terms :

i) Self Cleansing Velocity ii) Turbidity iii) BOD. **(06 Marks)**

c. BOD of sewage incubated for one day at 30 °C has been found to be 100mg/ℓ. What will be the 5 day 20 °C BOD? Assume K = 0.12 [Base 10] at 20 °C. **(10 Marks)**

5 a. Explain the importance of screens and types of screens in the Sewage treatment process. **(10 Marks)**

b. Write a note on Necessity of Sedimentation tanks. Explain the types along with a neat sketch of rectangular settling tank. **(10 Marks)**

6 a. Discuss in detail the process of Deoxygenation and Reoxygenation with respect to self purification of Natural water, with a neat sketch. **(10 Marks)**

b. The domestic sewage of a town is to be discharged into a stream after treatment. Determine the maximum permissible effluent BOD and the percentage purification required in the treatment plant given the following particulars :
Population of town = 50,000 ; D.W.F of sewage = 150 ℓpcd
BOD contribution per capita = 0.075 kg/day ;
Minimum flow of stream = $0.20 m^3/sec$; BOD of stream = 3mg/ℓ ;
Maximum BOD of stream on downstream = 5mg/ℓ. **(10 Marks)**

7 a. Explain the working of a conventional Activated Sludge Process (ASP) with flow diagram. **(10 Marks)**

b. Design a primary settling tank of rectangular shape for a town having a population of 50,000 with a water supply of 180 ℓpcd. Assume detension period = 2 hrs , Length = 4 times the breadth , Depth = Between 2.4 to 3.6m , Average over flow rate = $30 m^3/d/m^2$, Breadth = Not more than 7.5m. **(10 Marks)**

8 a. Explain the Constructional details of a Conventional trickling filter, with a neat sketch. **(10 Marks)**

b. Design a low rate filter to treat 6MLD of sewage of BOD 210 mg/ℓ. The final effluent should be 30mg/ℓ and organic loading rate is 320 $g/m^3/d$. **(10 Marks)**

9 a. Discuss in brief the Biological and Chemical methods of removal of Phosphorous from waste water. **(10 Marks)**

b. Draw a neat sketch of a septic tank with soak pit and write the design criteria required for septic tank. **(10 Marks)**

10 a. Write a note on two Pit latrines and Eco toilet. **(10 Marks)**

b. Define Advanced Wastewater Treatment (AWT). What are its objectives? How do you select the AWT process for removal of contaminants? **(10 Marks)**

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18CV56

Fifth Semester B.E. Degree Examination, July/August 2021
Highway Engineering

Time: 3 hrs. Max. Marks: 100

Note: *Answer any FIVE full questions.*

1 a. Discuss the Socio-economic impact of improving transport infrastructures. **(04 Marks)**

b. What are the recommendations of Jayakar Committee and how they are implemented? **(08 Marks)**

c. Explain the saturation system for finding the optimum road length. **(08 Marks)**

2 a. Determine the length of different categories of road by the year 2001, using third road development formula by using the following data. Assume missing data suitably,
Total area of the state = 80,000 sq.km
Total number of towns as per 1981 census = 86. **(04 Marks)**

b. What are the salient features of the following programme / schemes:
(i) NHDP (ii) PMGSY. **(08 Marks)**

c. What are the data/details collected in Reconnaisance and preliminary survey of highway alignment. **(08 Marks)**

3 a. Write a neat sketch of Highway in,
(i) Embankment (ii) Cutting and label various components. **(04 Marks)**

b. Calculate the Head Light Distance (HSD) and Intermediate Sight Distance (ISD) from the following data:
Design speed = 80 kmph, Coefficient of friction = 0.35, Reaction time = 2.5 sec. **(08 Marks)**

c. Design the rate of super elevation for horizontal curve of a highway of radius 500 m and speed 100 kmph. **(08 Marks)**

4 a. Write a short note on different types of gradients of a highway. **(04 Marks)**

b. Design the length of transition curve from the following data:
Ruling design speed V = 80 kmph, Normal pavement width = 7.0 m, Rate of introduction of super elevation = 1 in 150, Pavement is rotated about inner edge. Assume two lane road and wheel base as 6.0 m. **(08 Marks)**

c. Design the length of valley curve from the following data to fulfill comfort conditions and HSD:
(i) A descending grade of 1 in 25 meets ascending of 1 in 30.
(ii) Design speed of 80 kmph
(iii) Assume C = 0.6 m/sec^3
(iv) Assume t = 2.5 sec, f = 0.35 **(08 Marks)**

5 a. List the desirable properties of soil used as a highway material. **(04 Marks)**

b. A plate load test was conducted on soaked subgrade during the mansoon season using a plate diameter of 30 cm. Determine the modulus of subgrade reaction for the standard plate using the following data: **(08 Marks)**

Mean settlement values, mm	0	0.24	0.52	0.76	1.02	1.23	1.53	1.76
Load values, kg	0	460	900	1180	1360	1480	1590	1640

c. Mention any four tests conducted on (i) Aggregates (coarse) (ii) Bitumen
Also mention the standard values / range of each test. **(08 Marks)**

6 a. Differentiate between Bitumen and Tar. **(04 Marks)**

b. With the help of a neat sketch, explain the different component parts of a flexible pavement. Also mention their functions. **(08 Marks)**

c. Explain the concept of ESWL with the help of a neat sketch. **(08 Marks)**

7 a. Explain the method of soil aggregate blending by Rothfutch's method. **(10 Marks)**

b. Explain the step by step procedure of construction of Granular Sub Base (GSB) layer of pavement by mentioning physical properties of aggregate, gradation requirement (either for G-II or G-III) and quality control test for the layer. **(10 Marks)**

8 a. Explain the step by step procedure of construction of Bituminous Macadam (BM) layer of pavement by mentioning physical properties of aggregate, Gradation requirement (for G-II) and quality control test for the layer. **(10 Marks)**

b. Explain the step by step procedure of construction of Dry Lean Concrete (DLC) of a rigid pavement by mentioning physical properties of aggregates. Gradation requirement and Quality control tests for the layer. **(10 Marks)**

9 a. List the requirements and importance of Highway drainage. **(06 Marks)**

b. Explain with the help of a neat sketch:

(i) Lowering the high water table in permissible soil strata.

(ii) Control of seepage flow in Highway drainage. **(07 Marks)**

c. The maximum quality of water expected in one of the open longitudinal drain on a clayey soil is 0.9 m^3/sec. Design the cross section and longitudinal slope of trapezoidal drain assuming the bottom width of trapezoidal section to be 1.0 m and cross slope to be 1.0 vertical to 1.5 horizontal. The allowable velocity of flow in drain is 1.2 m/sec and Mannings roughness coefficient is 0.02. **(07 Marks)**

10 a. Write a note on:

(i) Motor Vechicle operation cost.

(ii) Annual Highway cost. **(06 Marks)**

b. Write a note on:

(i) Rate of return method.

(ii) Benefit-cost ratio method of economic analysis of highway project. **(07 Marks)**

c. Write a note on:

(i) BOT and BOOT

(ii) Sources of Revenue for highway development and maintenances **(07 Marks)**

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