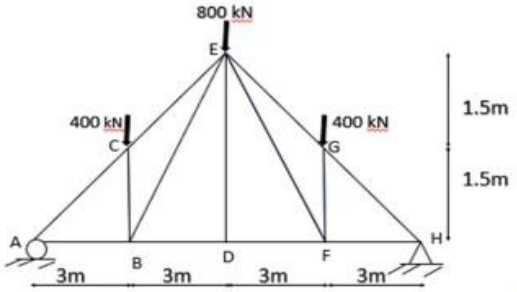
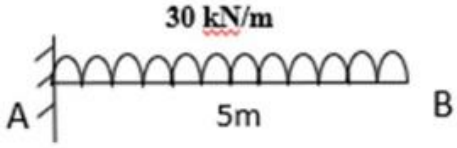
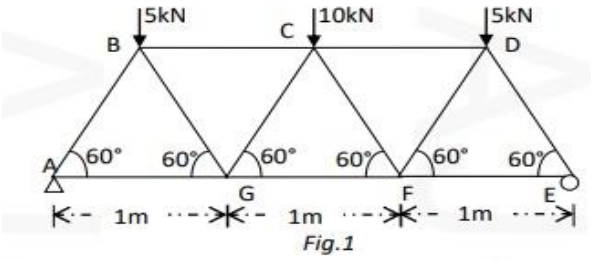
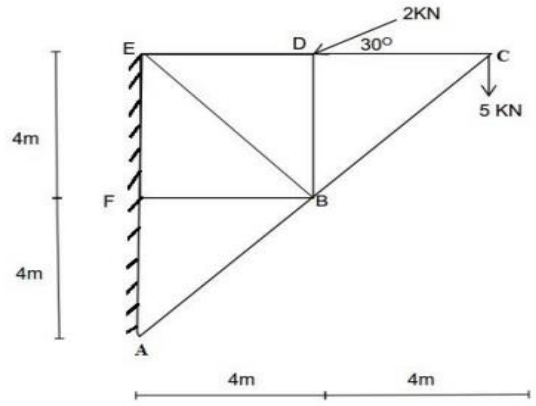
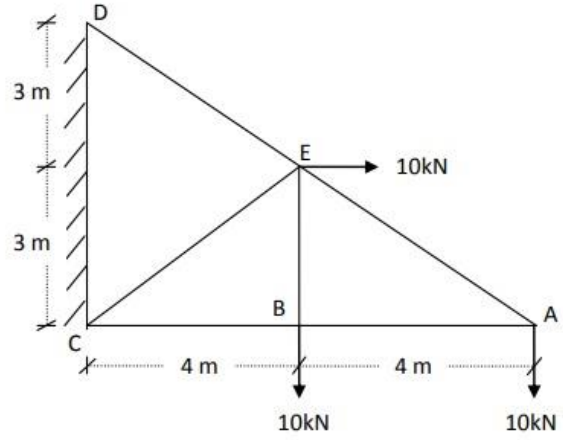
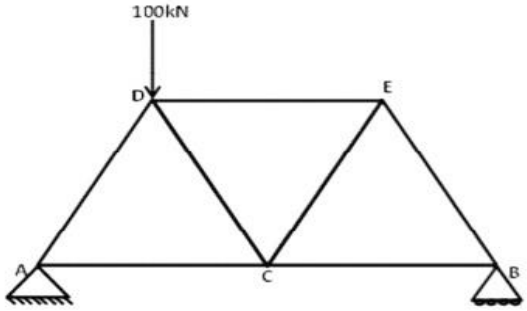
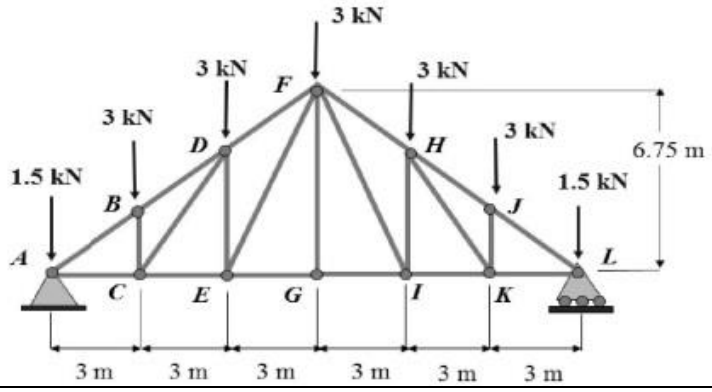
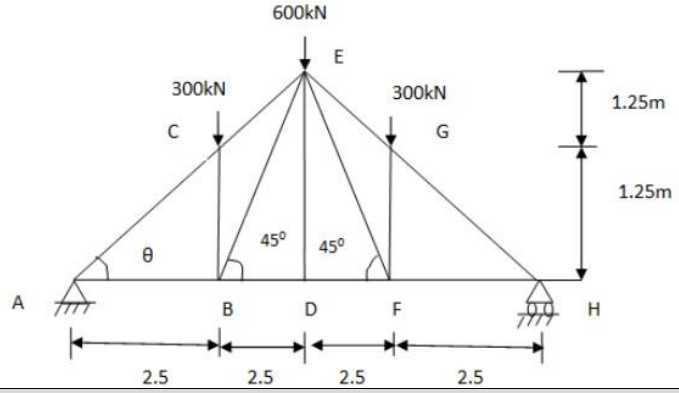
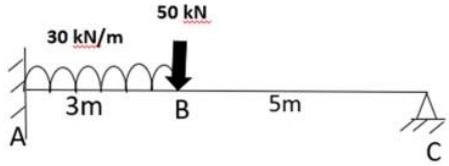
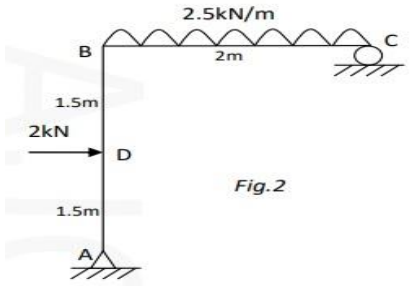
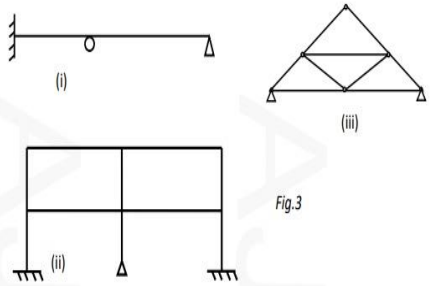
STRUCTURAL ANALYSIS – I
(QUESTION BANK)

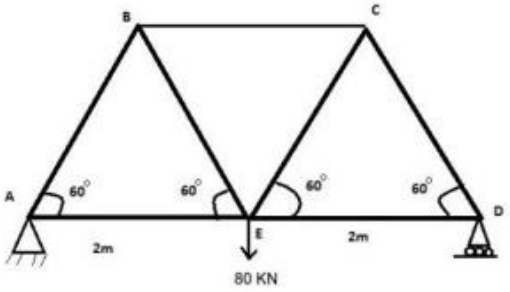
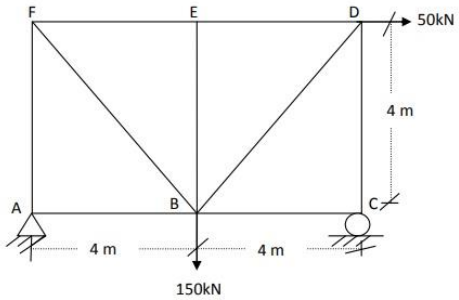
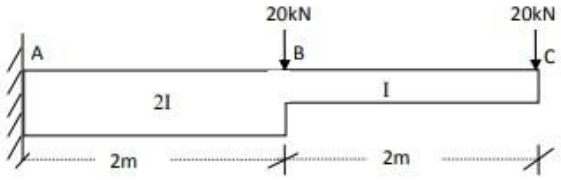
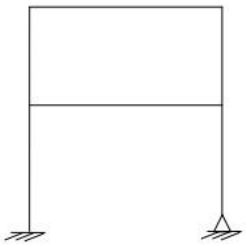
Module – 1

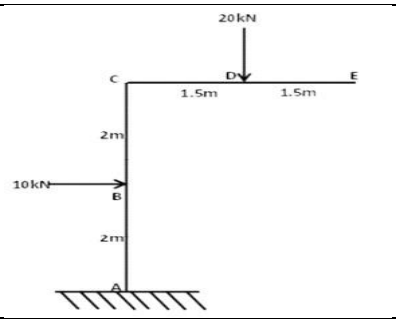
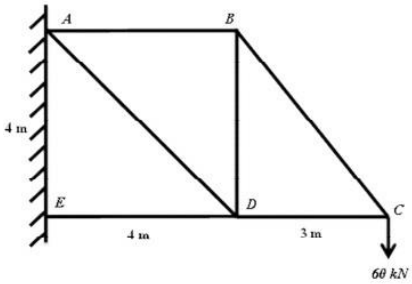
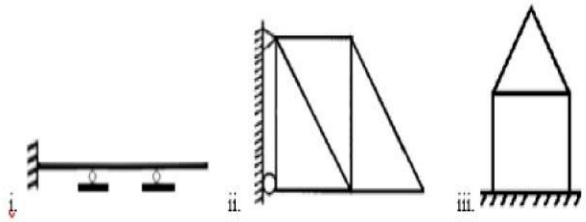
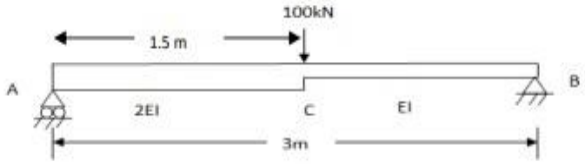
Sl.No.	Question	Marks	Question Paper
1.	State and explain Castigliano's first theorem for deflection.	3	KTU DEC 2021 (2019 Scheme)
2.	Analyse the pin jointed truss as shown in figure 1 by the method of joints.  Figure 1	14	KTU DEC 2021 (2019 Scheme)
3.	Find the slope and deflection at B of the cantilever using moment area method. E= $2x10^5$ N/mm^2, I = 8500 cm^4.  Figure 2	8	KTU DEC 2021 (2019 Scheme)
	State and explain Moment Area Theorem I and Theorem II.	6	
4.	Write the steps in the analysis of determinate truss by the 'method of sections', indicating the conditions for selection of section.	5	KTU AUG 2021 (2015 Scheme)
	Analyse the truss shown in Fig.1 and tabulate the member forces.  *Fig.1*	10	
5.	A cantilever beam of span 2 meters carries a vertical concentrated load of 8kN at the free end. Calculate the strain energy due to axial force, bending moment and shear force in the beam. Cross section is 200mm x 400mm, Young's modulus, E = 200GPa. Poisson's ratio, υ= 0.3. Also calculate the deflection at the free end using work done- strain energy relation.	12	
	Explain the effects of temperature change and lack of fit in a statically determinate truss.	3	

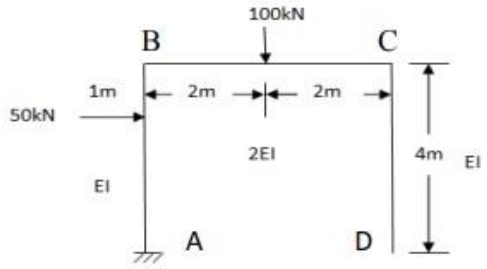
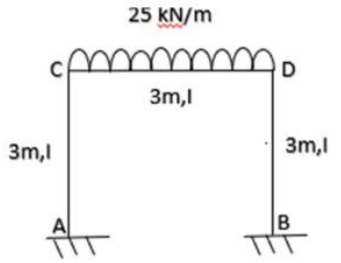
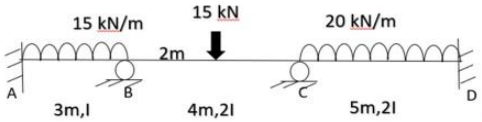
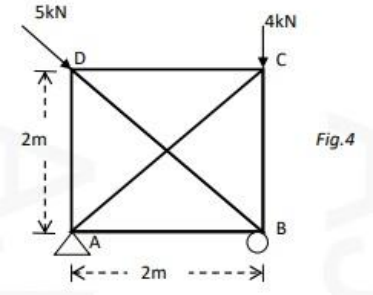
6.	Distinguish between method of joints and method of sections used in the analysis of pin jointed framed structures.	5	KTU MAY 2019 (2015 Scheme)
	Analyse the truss shown in figure by method of sections. 	10	
7.	Derive an expression for strain energy due to bending of a beam subjected to general loading.	4	KTU MAY 2019 (2015 Scheme)
	Explain Castigliano's theorems with the help of sketches.	4	
8.	Analyse the plane truss by method of joints and tabulate the forces in all the members. 	12	KTU DEC 2019 (2015 Scheme)
	Explain the 'method of sections' for the analysis of truss.	3	
9.	Briefly explain Castigliano's first and second theorems.	5	KTU DEC 2018 (2015 Scheme)
	Analyse the pin-jointed truss given below. All members have the same length and cross sectional area. Tabulate the results. 	10	
10.	State the assumptions made in the analysis of plane trusses.	3	

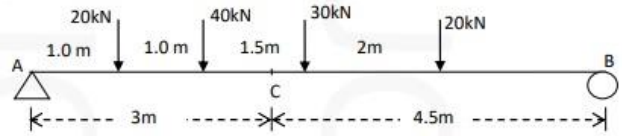
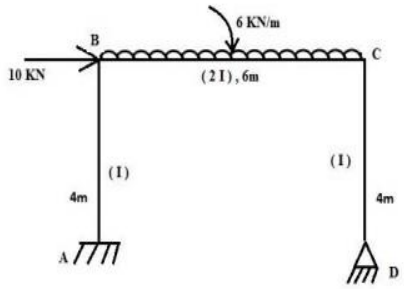
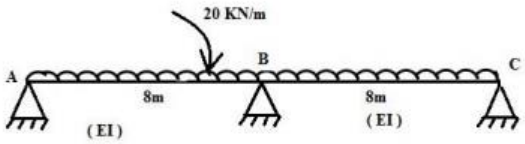
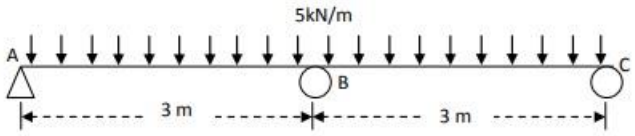
	A Pratt roof truss is loaded as shown. Using the method of sections, determine the forces in members FH and GI.  	12	KTU APR 2018 (2015 Scheme)
11.	Enumerate the methods of analysing a determinate truss and illustrate along with sketches, the significance of the methods.	7	KTU MAY 2017 (2015 Scheme)
	Using Castigliano's theorem, determine the deflection under the load. A simply supported beam of span 'L' carries a concentrated load P at a distance 'a' from left hand support. Assume uniform flexural rigidity.	8	
12.	Explain the method of sections.	5	KTU JUL 2017 (2015 Scheme)
	Analyse the pin jointed truss as shown by the method of joints.  	10	
Module – 2			
1.	Explain about the lack of fit of an indeterminate frame.	3	KTU DEC 2021 (2019 Scheme)
2.	Write the steps for analysing beam by the consistent deformation method.	3	KTU DEC 2021 (2019 Scheme)
3.	Analyse the beam shown using consistent deformation method and draw the SFD and BMD.  Figure 3	14	KTU DEC 2021 (2019 Scheme)
4.	Define static and kinematic indeterminacies with one example.	5	
	State Maxwell's law of reciprocal deflections.	4	

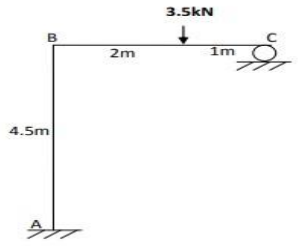
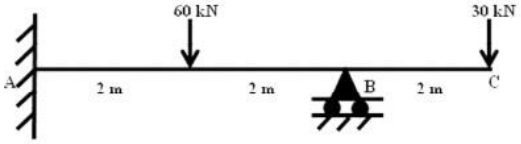
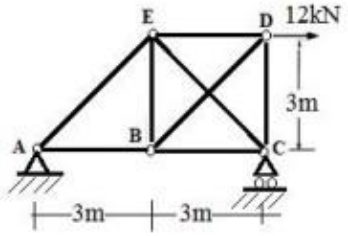
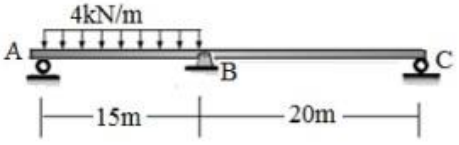
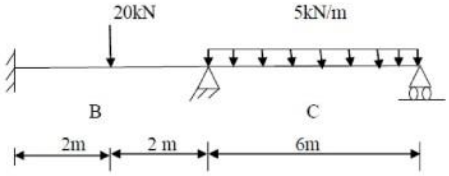
	Derive an expression for deflection by unit load method.	5	KTU DEC 2021 (2019 Scheme)
5.	A cantilever beam of span 2 meters carries a vertical concentrated load of 8kN at the free end. Calculate the strain energy due to axial force, bending moment and shear force in the beam. Cross section is 200mm x 400mm, Young's modulus, E = 200GPa. Poisson's ratio, υ= 0.3. Also calculate the deflection at the free end using work done- strain energy relation.	12	KTU AUG 2021 (2015 Scheme)
	Explain the effects of temperature change and lack of fit in a statically determinate truss	3	
6.	Determine the horizontal deflection at B by unit load method. Given E= 200GPa. Cross section of the members is circular with 150mm diameter.  Fig.2	9	KTU AUG 2021 (2015 Scheme)
	Determine the static indeterminacy and kinematic indeterminacy of the structures shown in Fig.3.  Fig.3	6	
7.	State Betti's theorem.	4	KTU MAY 2019 (2015 Scheme)
	Explain the Principle of least work.	3	
8.	Describe static and kinematic indeterminacies with the help of examples.	5	KTU MAY 2019 (2015 Scheme)
	Determine the vertical displacement of joint E of truss shown in figure by unit load method. Given, for all members cross sectional area = 1000mm^2, Young's modulus = 200 kN/mm^2.	10	

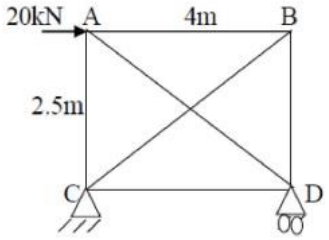
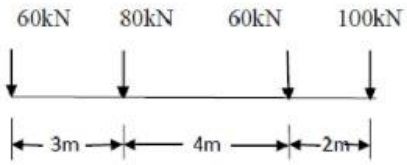
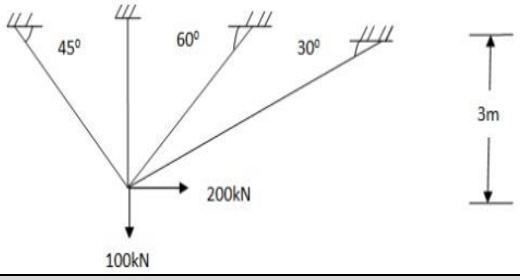
			
9.	State Maxwell's law of reciprocal deflections.	3	KTU DEC 2019 (2015 Scheme)
	Determine the vertical deflection at B using unit load method. Cross sectional area of all horizontal members: 50 sq.cm, vertical members and inclined members: 25 sq.cm. E = 200GPa. 	12	
10.	Derive the expression for strain energy due to bending moment.	3	KTU DEC 2019 (2015 Scheme)
	Determine the deflection at the free end of the cantilever using strain energy method. Given E= 200GPa, I = 6.67 x 10^7mm^4. 	10	
	Determine degree of static and kinematic indeterminacy in the structure shown in fig. Assume all members are axially rigid. 	2	
11.	Discuss Maxwell's theorem of reciprocal deflection as applied to structural systems.	5	KTU DEC 2018 (2015 Scheme)
	Determine the horizontal and vertical deflection at point E of the frame shown in figure. Assume uniform flexural rigidity EI.	10	

			
12.	Distinguish between force and displacement method of analysis.	5	KTU DEC 2018 (2015 Scheme)
	Determine the vertical deflection of point D in the pin-jointed truss shown below. The cross sectional area of members AD and AE are 1500 mm^2 while those of other members are 1000 mm^2. Take modulus of elasticity E as 200 kN/mm^2. 	10	
13.	State and prove Maxwell's law of reciprocal deflections.	6	KTU APR 2018 (2015 Scheme)
	Determine the static and kinematic indeterminacies of the structures shown. 	9	
14.	Elucidate Maxwell's theorem of reciprocal deflection and Betti's theorem.	5	KTU MAY 2017 (2015 Scheme)
	Differentiate static and kinematic indeterminacies with one example each.	5	
	Demonstrate unit load method as applied to the analysis of a rigid frame.	5	
15.	Explain Maxwell's law of reciprocal deflection.	5	KTU JUL 2017 (2015 Scheme)
	Find the deflection at C of the beam as shown in figure by strain energy method. 	10	
16.	Differentiate between static and kinematic indeterminacy with examples.	5	

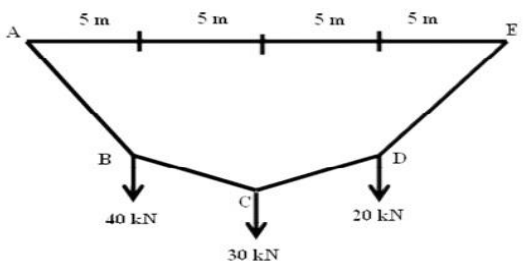
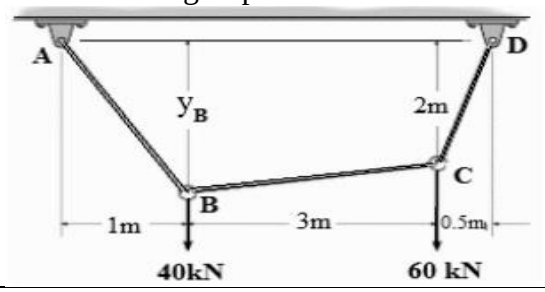
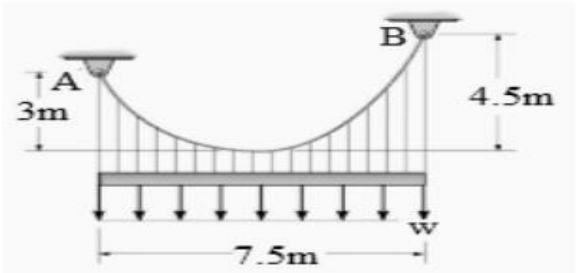
	Find the vertical deflection at the free end of the frame loaded as shown by unit load method. 	10	KTU JUL 2017 (2015 Scheme)
Module – 3			
1.	What are the reason for sway in frames?	3	KTU DEC 2021 (2019 Scheme)
2.	What are the assumptions used for the analysis of frame?	3	KTU DEC 2021 (2019 Scheme)
3.	Write a note on (i) distribution factor and (ii) carry over moment.	3	KTU DEC 2021 (2019 Scheme)
4.	Analyse the frame and draw the BMD using slope deflection method.  **Figure 4**	14	KTU DEC 2021 (2019 Scheme)
5.	Analyse the beam and Draw SFD and BMD using moment distribution method.  **Figure 5**	14	KTU DEC 2021 (2019 Scheme)
6.	Analyse the truss in Fig.4 and tabulate the member forces. Axial rigidity of all members can be assumed as AE.  *Fig.4*	13	KTU AUG 2021 (2015 Scheme)

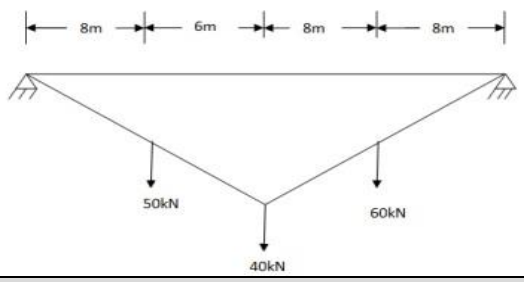
	Explain how the method of consistent deformation can be applied to determine the reaction at the prop in a propped cantilever.	2	
7.	A live load of 45kN/m, 7m long crosses a simply supported girder of span 10m. Find the maximum bending moment that can occur at a section 3m from left end.	7.5	KTU AUG 2021 (2015 Scheme)
	A girder is loaded as shown in Fig.5. Find the shear force at section C using influence line diagram.  *Fig.5*	7.5	
8.	Analyse the beam shown in Fig.6 by the method of consistent deformation and draw SFD and BMD.	7.5	KTU AUG 2021 (2015 Scheme)
9.	A uniformly distributed load of w/ unit length and length 'a' is supported on a simply supported girder of length L. Calculate the absolute maximum bending moment in the girder and specify the position of the UDL for the same. Given a<L.	7.5	
10.	Describe the steps involved in the analysis of indeterminate beams subjected to support settlement	5	KTU MAY 2019 (2015 Scheme)
	Analyse the frame shown in figure using consistent deformation method. Draw the bending moment diagram.  	10	
11.	Analyse the beam shown in figure by strain energy method and draw the bending moment diagram.  	9	KTU MAY 2019 (2015 Scheme)
12.	Explain the effect of temperature change in any member of an indeterminate truss.	5	KTU DEC 2019 (2015 Scheme)
	Determine the support reactions of the beam shown in fig. using the method of consistent deformation.  	10	

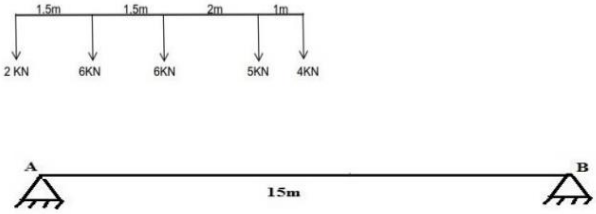
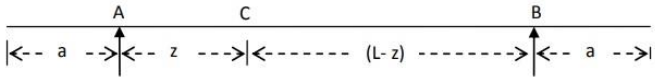
13.	Three wheel loads, each of magnitude W, are traversing a simply supported beam from left to right. If the distance between consecutive wheel loads is *a* and span of the beam is 2l, determine the maximum bending moment at mid-span of the beam. Given, a= l/4	8	KTU DEC 2019 (2015 Scheme)
	A UDL 2kN/m of length 1.5 m is traversing a simply supported beam of span 8m. Determine i) the maximum support reaction ii) Maximum shear force at a section 2m from left support. In both the cases, indicate the position of the UDL on the span.	7	
14.	Analyse the frame shown in figure using strain energy method. 	10	KTU DEC 2019 (2015 Scheme)
15.	Describe the steps involved in analysis of indeterminate beams by consistent deformation method.	5	KTU DEC 2018 (2015 Scheme)
	Analyse the beam shown in figure using consistent deformation method. 	10	
16.	Determine the force in the member BE. Axial rigidity AE of all members is constant. 	15	KTU APR 2018 (2015 Scheme)
	Analyse the beam shown using consistent deformation method and draw the SFD and BMD. 	15	KTU APR 2018 (2015 Scheme)
17.	Determine the reaction components in the beam shown using Consistent deformation method. EI is constant throughout. 	15	

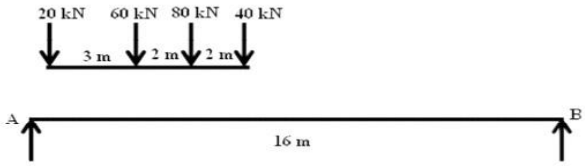
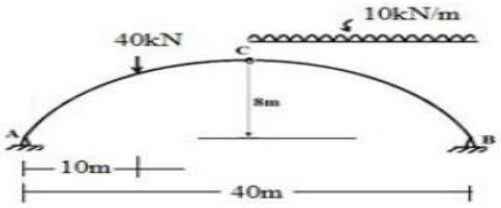
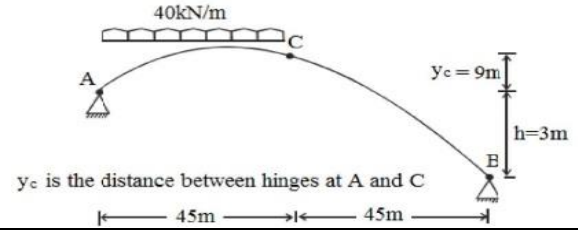
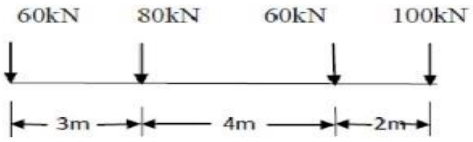
18.	Compute the forces in the members. Given for all members, cross-sectional area = 1000 mm^2, Young's modulus = 200 kN/mm^2. 	15	KTU MAY 2017 (2015 Scheme)
	A load system as shown crosses a girder of span 25m from right to left with 60kN load leading. Find the max.BM at 15m from left end. Also find the absolute maximum BM and state where it occurs. 	15	
19.	How will you account the effect of lack of fit and temperature changes in the analysis of trusses?	5	KTU JUL 2017 (2015 Scheme)
	Analyse the single jointed truss as shown in figure by the method of consistent deformation. AE is constant for all the members. 	10	
Module – 4			
1.	Explain suspension bridge and its parts with a neat figure.	3	KTU DEC 2021 (2019 Scheme)
2.	Write the equation for support reactions and H, when cable is subjected to a UDL of w kN/m over the span.	3	KTU DEC 2021 (2019 Scheme)
3.	A cable of span 200 meter and dip 12m carries a load of 10kN per meter run of horizontal span. Find 1. The maximum tension in the cable and the inclination of the cable at the support. 2. The forces transmitted to the supporting pier if the cable is clamped to a saddle with smooth rollers resting on the top of the pier. Anchor cable is inclined at 30° to the horizontal. 3. Calculate the length of the cable.	14	KTU DEC 2021 (2019 Scheme)

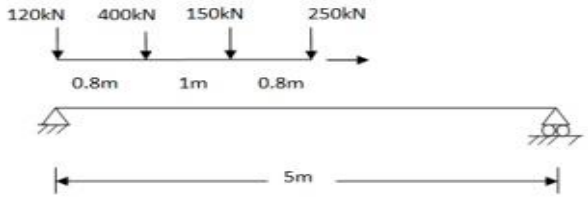
4.	A cable of span 50meter is supporting four concentrated loads 30kN, 40kN, 10kN and 15kN respectively at points C, D, E, and F which are 10m, 20m 30m and 40m from left support. Both supports are in same level. Dip of point D is 7m. Calculate the support reactions and the tensions in the various parts of the cable. Also find the length of the cable.	14	KTU DEC 2021 (2019 Scheme)
5.	A light cable is carrying a uniformly distributed load of w per unit run on the horizontal span. Its ends are supported at points which are at the same level and are l distance apart. If h is the dip, show that the profile of the cable is parabolic.	7	KTU AUG 2021 (2015 Scheme)
6.	A cable of span 50meter is supporting four concentrated loads 30kN, 40kN, 10kN and 15kN respectively at points C, D, E, and F which are 10m, 20m 30m and 40m from left support. Right support B is 5m higher than the left support A. Dip of point D is 7m.Calculate the support reactions and the tensions in the various parts of the cable.	13	KTU AUG 2021 (2015 Scheme)
7.	A cable of span 150 meter and dip 12m carries a load of 5kN per meter run of horizontal span. Find i) the maximum tension in the cable and the inclination of the cable at the support. ii) the forces transmitted to the supporting pier if the cable is clamped to a saddle with smooth rollers resting on the top of the pier. Anchor cable is inclined at 30° to the horizontal.	10	KTU AUG 2021 (2015 Scheme)
8.	A cable is suspended between two supports 120m apart, at the same level. It carries a UDL of 25kN/m over the entire span. The dip of the cable is 10m. Find i) the length of the cable ii) tension in the cable at the support iii) lowest tension in the cable.	12	KTU DEC 2019 (2015 Scheme)
	Explain the various components of a suspension bridge with the help of a neat figure.	8	
9.	A cable is suspended between two supports 120m apart, at the same level. It carries two concentrated loads each of 5kN at points 30m and 90m from left support. The length of the cable is 160m. Determine i) the support reactions ii) tension in various portions of the cable	10	KTU DEC 2019 (2015 Scheme)
10.	With neat sketch, discuss the profile/shape of cable subjected to uniformly distributed load ‘w’ per unit horizontal length.	5	KTU DEC 2018 (2015 Scheme)
	A bridge cable is suspended from towers A and B, 80 m apart and carries a load 30 kN/m on the entire span. If the maximum sag is 8m at point C, calculate the maximum tension in the cable. If the cable is supported by saddles which are stayed by wires inclined at 30 degrees to the horizontal, determine the forces acting on the towers. If the same inclination of back stay passes over pulley, determine the forces on the towers.	15	
11.	With neat sketch, explain the functions of major components of a suspension bridge.	6	KTU DEC 2018 (2015 Scheme)
	A light cable is supported at two points 20 m apart which are at the same level. The cable supports three concentrated loads as shown in figure. The deflection at first point is found to be 0.8m. Determine the tension in the different segments and the total length of the cable.	14	

			
12.	Cable ABCD supports the loading shown. Determine the maximum tension in the cable and sag of point B. 	10	KTU APR 2018 (2015 Scheme)
13.	The cable supports the uniform load of w=8kN/m. Determine the tension in the cable at each support A and B. 	10	KTU APR 2018 (2015 Scheme)
14.	A bridge cable is suspended from towers 80 m apart and carries a load of 30 kN/m on the entire span. If the maximum sag is 8 m, calculate the maximum tension in the cable. If the cable is supported by saddles which are stayed by wires inclined at 300 to the horizontal, determine the forces acting on the towers. If the same inclination of back stay passes over pulley, determine the forces on the towers. Height of the tower is 10m.	14	KTU MAY 2017 (2015 Scheme)
15.	Write sheet notes on suspension bridges.	3	KTU JUL 2017 (2015 Scheme)
16.	Show that a cable subjected to uniformly distributed load w/unit horizontal length the shape of the cable is a parabolic.	5	KTU JUL 2017 (2015 Scheme)
	A light cable is supported at two points 30m apart which are at the same level. The cable supports three concentrated loads as shown. The deflection at first point is 1m. Determine the tension in the different segments and total length of the cable.	12	

			
Module – 5			
1.	State and explain Eddy's theorem	3	KTU DEC 2021 (2019 Scheme)
2.	Write the significance of influence line diagram.	3	KTU DEC 2021 (2019 Scheme)
3.	Explain about the types of arches.	4	KTU DEC 2021 (2019 Scheme)
	A three hinged parabolic arch hinged at the supports and at the crown has a span of 30m and a central rise of 4m. It carries a concentrated load of 60kN at 18m from left support and a uniformly distributed load of 30 kN/m over the left half portion. Determine the moment, normal thrust and radial shear at a section of 7.5m from the left support.	10	
4.	Draw ILD for SF and BM at any intermediate section of overhanging beams.	4	KTU DEC 2021 (2019 Scheme)
	A simply supported beam has a span of 20m. UDL of 50 kN/m and 5m long crosses the girder from left to right. Draw ILD for SF and BM at a section 7m from left end. Calculate the maximum positive shear force, maximum negative shear force, and maximum bending moment at this section.	10	
5.	A three-hinged parabolic arch has a span of 15m and a rise of 3m. It carries a uniformly distributed load of 15kN per meter over the left half of the span and a point load of 100kN at 3m from the right end. Find the bending moment, normal thrust and radial shear at a section 3m from the left end.	12	KTU AUG 2021 (2015 Scheme)
	Draw the influence line diagram for horizontal thrust in a three-hinged parabolic arch of span L and rise h.	8	
6.	A semi-circular arch and a parabolic arch are having the same span and they support a uniformly distributed load of w per unit run over the whole span. Find the horizontal thrust and support reactions for these 3- hinged arches. Radius of the semi-circular arch is R and the rise of parabolic arch is 1/4th of its span.	10	KTU AUG 2021 (2015 Scheme)
7.	Explain with the help of sketches, the different types of arches	8	KTU MAY 2019 (2015 Scheme)
8.	State Eddy's theorem, normal thrust and radial shear at a section 2m from left support.	5	KTU MAY 2019 (2015 Scheme)
	A parabolic three hinged arch carries a UDL of 30kN/m on the left half of the span. It has a span of 16 m and a central rise of 3 m.	15	

	Determine the resultant reactions at the supports. Find the bending moment		
9.	Draw the influence lines for shear force and bending moment at a point C of the beam shown in figure. 	6	KTU MAY 2019 (2015 Scheme)
10.	What are influence lines? What are its advantages?	3	KTU MAY 2019 (2015 Scheme)
	A train of concentrated loads moves from left to right on a simply supported girder of span 15 m, and 4kN load leading as shown in figure. Determine the maximum shear force and the maximum bending moment at a section 4m from left support. 	12	
11.	For the overhanging beam AB shown in fig., draw influence line diagram for the following: i) Shear force at C ii) BM at C iii) Support reaction at A. iv) Support reaction at B. 	5	KTU DEC 2019 (2015 Scheme)
12.	A 3-hinged parabolic arch has a span of 18m and a rise of 6m. The arch is hinged at the springing A and B and at the crown C. It carries a UDL of 20kN/m over the left half of the span and a point load of 100kN at 4.5m from the right support B. Find the bending moment, normal thrust and radial shear at a section 3m from left end.	15	KTU DEC 2019 (2015 Scheme)
	Draw the influence line diagram for bending moment at any section of a three hinged arch.	5	
13.	A 3-hinged semi-circular arch of radius R carries a UDL of w/ unit run over the whole span. Find i) horizontal thrust at each support ii) location and magnitude of maximum bending moment.	10	KTU DEC 2019 (2015 Scheme)
14.	With neat sketches, explain the different types of arches.	6	KTU DEC 2018 (2015 Scheme)
	A three- hinged circular arch hinged at the springing points A and B and crown point C, has a span of 40 m and a central rise of 8m. It carries a uniformly distributed load 20kN/m over the left-half of the span together with a concentrated load of 100 kN at the right quarter span point. Find the reactions at the supports, normal thrust, radial shear and bending moment at a section D 10 m from the left support.	14	
15.	Construct ILD for BM at fixed support for a cantilever beam of span 'l'.	5	KTU DEC 2018 (2015 Scheme)
	A train of concentrated loads moves from left to right on a simply supported girder of span 16 m as shown in figure. Determine the	10	

	absolute maximum shear force and bending moment developed in the beam. 		
16.	A three-hinged parabolic arch is loaded as shown in figure. Calculate the location and magnitude of maximum bending moment in the arch. Draw bending moment diagram. 	15	KTU APR 2018 (2015 Scheme)
17.	A three-hinged symmetric parabolic arch has a horizontal span L and central rise h. It is subjected to a uniformly distributed load of w per unit length along the span. Show that the shear force and bending moment at any section normal to the profile of arch is zero. Find also the normal thrust at this section.	6	KTU APR 2018 (2015 Scheme)
18.	Analyse the three-hinged parabolic loaded arch with supports at different levels as shown. 	14	KTU APR 2018 (2015 Scheme)
19.	A load system as shown crosses a girder of span 25m from right to left with 60kN load leading. Find the max.BM at 15m from left end. Also find the absolute maximum BM and state where it occurs. 	15	KTU MAY 2017 (2015 Scheme)
20.	Justify that an arch is more economical compared to a SS beam of same span carrying the same load.	6	KTU MAY 2017 (2015 Scheme)
	A 3 hinged parabolic arch has a horizontal span of 36m with a central rise of 5m. A udl of 1kN/m acts at right half of the span. Calculate the magnitude and position of maximum positive BM in the arch. Also calculate the BM, NT and RS at left quarter point.	14	
21.	A 3 hinged semi-circular arch ACB of uniform section and radius 'r' carries a udl of w/m run over the whole span. Find the position and magnitude of maximum bending moment. Draw the BMD.	14	KTU MAY 2017 (2015 Scheme)
22.	Draw the influence line diagram for shear force at any section of an overhanging beam of span 'L' with equal overhang on each side.	3	

	For the simply supported beam AB of span 5m subjected to a train of concentrated loads moving from left to right as shown in Figure. Using influence lines find the absolute maximum bending moment and the equivalent uniformly distributed load.  	12	KTU JUL 2017 (2015 Scheme)
23.	What are the advantages of arches?	5	KTU JUL 2017 (2015 Scheme)
	Draw the bending moment diagram for a three-hinged symmetric parabolic arch of span 50m rise 10m subjected to a concentrated load of 50 kN acting at 8m from left support and a uniformly distributed load of 25 kN/m acting over the right half portion.	12	
24.	Show that the parabolic shape is a funicular shape for a three-hinged arch subjected to UDL for the entire span.	6	KTU JUL 2017 (2015 Scheme)
	Draw the influence lines for horizontal thrust 'H', Moment at any section and radial shear for a three-hinged arch of span L and rise 'h'.	14	

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CET 303 DESIGN OF CONCRETE STRUCTURES

MODULE 1

1. Explain under reinforced, over reinforced, and balanced section in limit state design of RC structures. **(3marks, KTU Dec 21)**
2. What is the purpose of limiting the neutral axis depth in the estimation of the flexural strength of reinforced concrete sections? **(3marks, KTU Dec 21)**
3. **a)** Explain the term Limit State. Enumerate the different limit states to be considered in reinforced concrete design. **(4 marks, KTU Dec 21)**

   b) A rectangular beam 250mm wide and effective depth 450 mm has 3 bars of 20mm diameter as tension steel. Find the moment of resistance of the section if M20 concrete and Fe 415 grade steel are used. Also determine the limiting moment of resistance of the section. **(10 marks, KTU Dec 21)**
4. **a)** Why is the partial safety factor for concrete (ɣc) greater than that for reinforcing steel (ɣs) in the consideration of ultimate limit states? **(3marks, KTU Dec 21)**

   b) Design and detail an RC rectangular section subjected to an udl of 15 kN/m over the entire span. Clear span is 5m. The beam is supported on masonry walls, 230 mm thick on both sides. Assume moderate exposure conditions. Use M 25 grade concrete and Fe 415 grade steel. **(11 marks, KTU Dec 21)**
5. a) Why are over reinforced sections not used in practice? **(5marks, KTU Sep 2020)**

   b) A concrete beam has 300 mm breadth and 500 mm effective depth; effective cover 50 mm, reinforced with 3 nos. 20 mm diameter steel bars at tension side. M20 concrete and Fe 415 grade steel are used. Determine the moment of resistance.

   (10 marks, KTU Sep 2020)
6. Explain characteristic strength of concrete and steel. **(5 marks, KTU, Sep 2020)**
7. Explain with figure the stress strain relationship of mild steel.

   (5 marks, KTU Sep 2020, KTU April 18)
8. a) Distinguish between balanced, over-reinforced and under-reinforced sections in limit state design. Which of these should be recommended in design?

   (5marks, KTU Dec 19)

   b) Find the moment of resistance of a singly reinforced concrete beam of 200 mm width and 400 mm effective depth, reinforced with 4 bars of 16 mm diameter of Fe415 steel. Take M20 concrete. Redesign the beam if necessary. **(10 marks, KTU Dec 19)**

9. With neat sketch explain the stress block parameters used in the design of singly reinforced concrete beam as per limit state method. **(5marks, KTU Dec 19)**

10. Derive the expressions for stress block parameters in limit state of flexure and hence the expression for moment of resistance of a singly reinforced rectangular section. **(5marks, KTU Dec 17)**

11. Determine the ultimate moment of resistance of a singly reinforced beam of width 300mm and effective depth 450mm reinforced with 3 bars of 25mm diameter. Assume M20 grade concrete and Fe415 grade steel. **(KTU April 18)**

12. Design a simply supported beam of span 6m subjected to a live load of 5kN/m. Use M20 concrete and Fe415 steel. **(KTU, DEC 2018)**

13. Draw the longitudinal and cross sections showing the reinforcement detailing for a cantilever beam. **(5 marks, KTU April 18)**

14. Differentiate between working stress and limit state method?

15. Derive the limiting values of depth of neutral axis for different grades of steel **(3 marks, model question)**

MODULE II

1. Enumerate the situations in which a doubly reinforced section become necessary. **(3marks, KTU Dec 21)**

2. Explain the term development length and explain its significance in RC design. Obtain the expression for it. **(3marks, KTU Dec 21)**

3. **a)** Explain why and how shear reinforcement is provided in beams. **(4marks, KTU Dec 21)**

   b) Design a simply supported rectangular beam to carry a superimposed load of 30kN/mover a span of 5.5m. Assume support width as 300mm. Maximum overall depth is restricted to 550mm. Use M20 concrete and Fe 415 grade steel. **(10marks, KTU Dec 21)**

4. **a)** What are the types of reinforcements used to resist shear? **(2marks, KTU Dec 21)**

5. **b)** Determine the ultimate moment of resistance of an isolated beam of T-shaped cross-section having a span of 6m and cross-sectional dimensions are flange width of 1000mm, flange thickness of 100mm, web width of 250mm and an effective depth of 520mm, having tension reinforcement of 6 x 28mm diameter bars. The materials used are concrete mix of grade M20 and mild steel of grade Fe 415. **(12marks, KTU Dec 21)**

6. a) Explain anchorage of reinforcing bars. **(3marks, KTU Se p 20)**

b) Design the shear reinforcement for a beam section of width 200 mm and effective depth 500 mm. The factored shear force is 100 kN and it is reinforced with 3 Nos 16 mm diameter bars on the tension side at the critical section. Use M20 concrete and Fe 415 steel. **(12marks, KTU Sep 20)**

7. What is the purpose of providing development length? **(3marks, KTU Sep 20)**

8. a) What are the situations that demand double reinforcement in beams? Compare the stress strain distributions in singly reinforced and doubly reinforced beams.

(5 marks, KTU Dec 19)

b) Determine the moment of resistance of beam having width b of 350 mm, depth of 900 mm with a cover of 50 mm. Beam is reinforced with 5 tension reinforcements of 20 mm HYSD bars (Fe 415) and 2 compression reinforcements of 20 mm Fe 415 steel. Grade of concrete is M15. **(10 marks, KTU Dec 19)**

9. Design the shear reinforcement for a beam with b= 350 mm, d= 550 mm, Vu= 125 kN, fck= 25 N/mm2 , fy= 415 N/mm2 . Percentage of steel is 1.67 percent.

(10 marks, KTU Dec 19)

10. Why does the code impose minimum and maximum limits regarding (i) spacing and (ii) percentage area of flexural reinforcement? **(KTU,May 2019)**

11. A 250 mm wide RC beam with 450mm depth is reinforced with 4 numbers 16 mm diameter bars of Fe 415 grade steel. Effective cover to reinforcement is 50mm. The beam is provided with 8 mm diameter 2 legged vertical stirrups at 160 mmc/c as shear reinforcement. M20 concrete is used. Determine the design strength in shear and also its limiting value.? **(KTU,May 2019)**

12. Explain how the longitudinal reinforcement bent up nearer to the supports contribute to the shear resistance of RC beams? **(KTU,May 2019)**

13. Design a rectangular beam section to resist a factored bending moment of 575 kNm. The size of the section is limited to 300 mm x 700 mm overall. Use M20 concrete and Fe 415 steel (**12 marks,KTU,april2018)**

14. Design a simply supported rectangular beam of effective span 6m carrying a super imposed load of 35kN/m. The overall depth of beam is restricted to 550 mm and width 300 mm .Use M20 and Fe 415. **(15 marks, KU, SEPT 2016)**

MODULE III

1. a) Explain briefly the need of corner reinforcement in two way restrained slab**.**

(3marks, KTU Dec 21)

b) Design and detail a simply supported slab for a room of interior dimension 5m x 4m subjected to an imposed load of 8kN/m^2 . Thickness of supporting wall is 230 mm. Use M 20 concrete and Fe 415 grade steel. **(11 marks, KTU Dec 21)**

2. a) Discuss the various loads to be considered while designing a staircase.

(2 marks, KTU Dec 21)

b) Design a staircase to be provided in an office building in two straight opposite flights of 1.35m width connected by a landing for a floor height of 3.3m. The landing which is 1.35m wide spans in the same direction as the stair slab. The rise and tread shall be 150mm and 300mm respectively. The weight of finishes 1kN/m2, live load =5kN/m2 . Use M 20 concrete and Fe 415 grade steel. **(12 marks, KTU Dec 21)**

3. Distinguish between one way slab and two-way slab. **(3 marks, KTU Dec 21)**

4. List the different types of staircases based on its geometrical shapes.

(3 marks, KTU Dec 21)

5. a) Design a one way slab with 3.5 m clear span supported on 230 mm thick walls on all four sides. The edges are simply supported. The live load on the slab is 2 kN/m2 . Use M 20 concrete and Fe 415 steel. **(12 marks, KTU Sep 20)**

b) Why do we provide reinforcement in two directions in a one way slab?

(3 marks, KTU Sep 20)

6. Draw a typical detailing of a continuous slab. **(KTU Sep 20)**

7. a) Design and detail a dog-legged stair for a building in which the vertical distance between the floors is 3.6 m. The stair hall measures 2.5 m × 5 m. The live load may be taken as 2500 N/m^2 . Assume that stair is supported at outer edges. Use M20 concrete and Fe415 steel. **(15 marks, KTU Dec 19)**

b) Sketch typical reinforcement detail in tread-riser type stairs.

(5 marks, KTU Dec 19)

8. Design a reinforced concrete slab 6.3 × 4.5 m simply supported on all the four sides. It has to carry a characteristic live load of 10 kN/m2 in addition to its dead weight. Assume M25 concrete and Fe 415 steel; also assume mild exposure conditions.

(15 marks, KTU Dec 19)

9. Design a cantilever slab of span 2m to carry imposed load of 2 kN/m2 over its entire span. Finish load=0.5 kN/m2. Use M20 concrete and Fe415 steel. The slab is supported by a beam of size 300mmx500mm. **(15 marks, KTU, May 2019)**

10. Draw the reinforcement detailing of a simply supported one way slab **(KTU, May 2019)**

11. Draw the reinforcement detailing of (i) cantilever slab (ii) one way continuous slab **(5 marks, KTU, Dec 18)**

12. Design and detail a simply supported slab for a room of interior dimension 8m x 3.5m, subjected to an imposed load of 8kN/m2. Thickness of supporting wall is 300mm. Use M20 concrete and Fe415 steel. Assume moderate exposure conditions. **(12 marks, KTU, Dec 17)**

13. What is meant by stair supported on landings? Explain the codal provision for the effective span of the stair slab in such cases? **(3marks, model question)**

14. Explain the difference in the behaviour of one-way and two-way slabs. Why it is essential to provide corner reinforcement in two way rectangular slabs whose corners are prevented from lifting up? **(3marks, model question)**

MODULE IV

1. Explain the function of transverse ties in a reinforced concrete column? What happens if ties are not provided? **(3marks, KTU Dec 21)**

2. What are uniaxially and biaxially loaded columns? **(3marks, KTU Dec 21)**

3. a) Explain how interaction curves are used in the design of column. **(4marks, KTU Dec 21)**

b) Design a circular column to carry an axial load of 1000 kN. Use M 20 concrete and Fe 415 steel. Draw a longitudinal section and a cross section showing the reinforcement. **(10 marks, KTU Dec 21)**

4. **a)** Classify the columns separately based on loadings and slenderness ratios. **(4marks, KTU Dec 21)**

b) Design a short column subjected to a factored load of 1400 kN and a factored bending moment of 135 kNm about one axis. The column has an unsupported length of 3.6 m. Use M25 concrete and Fe415 grade steel. **(10 marks, KTU Dec 21)**

5. What are the purposes of lateral ties in a column? **(KTU,Sep 2020)**

6. Differentiate between long and short columns. **(KTU,Sep 2020)**

7. Design a short column subjected to an axial load of 900kN and a moment of 130kN-m about its major axis. Use M20 concrete and Fe415 grade steel

(10 marks, KTU May 22)

8. Explain the interaction diagram of columns **(5marks, KTU,Sep 2020)**

9. Design a square column to carry a factored axial load of 1500 kN. Use M20 concrete and Fe415 steel. Draw a longitudinal section and a cross section showing the reinforcement. **(KTU,Sep 2020)**

10. Determine the area of longitudinal steel to be provided in a short column of size 600mm x 600mm subjected to a factored load of 1500 kN. Use M20 concrete and Fe415 steel.

(KTU,May 2019)

11. Design a circular short column to carry an axial load of 1000 kN using helical reinforcement. Use M20 concrete and Fe 415 steel. **(KTU, DEC 2019)**

12. Design a reinforced concrete column to carry an axial load of 1600 kN. Use M20 concrete and Fe415 steel. The column has unsupported length of 3m and is effectively held in position at both the ends, but not restrained against rotation. **(KTU, May 2019)**

13. Compare the behaviour of tied columns with spiral column subject to axial loading.

(4 marks, Model Question)

14. Draw four typical strain profiles of a short, rectangular, and symmetrically reinforced concrete column causing collapse subjected to different pairs of Pu and Mu when the depths of the neutral axis are (i) less than the depth of column D, (ii) equal to the depth of column D, (iii) $D < xu < \infty$ and (iv) $xu = \infty$. Explain the behaviour of column for each of the four strain profiles. **(10 marks, Model Question)**

15. Define slenderness ratio. What are its implications in the design of RC comp members?

(KTU DEC 2017)

16. List the functions of transverse reinforcement in column. Sketch various types of transverse reinforcements commonly used. **(KTU DEC 2017)**

MODULE V

1. Explain at what situations a combined footing is recommended.

(3 marks, KTU Dec 21)

2. What are the objectives of earthquake-resistant design of reinforced concrete structures? **(3 marks, KTU Dec 21)**

3. a) Distinguish between short term and long term deflection. **(2 marks, KTU Dec 21)**

b) Design and detail an isolated rectangular footing for a column 400 mm x 600 mm to carry a load of 1500 kN. The SBC of the soil is 180 kN/m2. Use M20 concrete and Fe415 grade steel. **(12 marks, KTU Dec 21)**

4. a) List with sketches the different types of shallow footings. **(2 marks, KTU Dec 21)**

b) Design a square footing for an axially loaded column of 450 mm x 450 mm size. Load on column is 800kN. The safe bearing capacity of soil is 190kN/m2 . Use M20 concrete and Fe415 steel. **(12 marks, KTU Dec 21)**

5. Under what circumstances a trapezoidal shape is preferred to a rectangular shape for a two column combined footing. **(5 marks, KTU May 22)**

6. Illustrate the design and detailing of an isolated footing of uniform thickness for a rectangular column 300 x 450mm supporting an axial service load of 800kN. Safe bearing capacity of the soil is 200kN/m2 . Use M20 concrete and Fe415 grade steel. **(15 marks, KTU May 22)**

7. Design a rectangular footing for an axial loaded column carrying 1200kN load, Size of the column is 300mmx500mm.Safe bearing Capacity of soil is 180 kN/m2 .Use M25 Concrete and Fe 415 Steel. Sketch reinforcement details of footing in section & plan **(15 marks, KTU Sep 20)**

8. Explain the procedure for estimation of flexural crack width in reinforced concrete members as per IS456. **(5 marks, KTU Dec 19)**

9. How does one (a) check for deflections of two way slabs, and (b) control crack width in two way slabs (**8 marks, KTU Dec 19)**

10. Explain limit state of serviceability. **(KTU Sep 20)**

11. Explain how deflection serviceability is ensured on beams. **(KTU Dec 17)**

12. What are the objectives behind the special detailing provisions in IS 13920? **(3 marks, model question)**

13. (a) Design a footing for a 400 mm x 400 mm column to carry a load of 100 kN with foundation resting on a soil of SBC 120 kN/m2. Assume M20 concrete and Fe415 steel. **(8 marks, model question)**

(b) What are the objectives of earthquake-resistant design of reinforced concrete structures? What are the design requirements of beam-column joints in earthquake resistant design? **(6 marks, model question)**

14. (a) Explain the different types of shallow footings. **(2 marks, model question)**

15. (b) Design an isolated rectangular footing for a column 450 mm x 600 mm to carry a load of 2400 kN. The SBC of the soil is 180 kN/m2. Use M20 concrete and Fe 415 grade steel. **(10 marks, model question)**

CET 307: HYDROLOGY AND WATER RESOURCES ENGINEERING

MODULE1

No.	Questions	Marks	
1	What is a Mass curve?	3	KTU Dec 2021
2	A precipitation station X was inoperative. Precipitation recorded in three stations A,B,C surrounding station X were 6.2 ,4.7and 3.5 cm respectively. Normal annual precipitation amounts to 64.3, 70.7 , 54.5 and 35. 3 cm for stations X,A, B and C. Estimate storm precipitation of X	3	KTU Dec 2021
3	Explain the Thiessen Polygon method of computation of mean precipitation	6	KTU Dec 2021
4	Plot a hyetograph using the following data Time (am): 9.00, 9.05, 9.10, 9.15, 9.20, 9.25, 9.30 Accumulated Rainfall (mm): 0, 2, 6, 12, 15, 17, 20	8	KTU Dec 2021
5	Explain the field measurement of infiltration rate using Double ring infiltrometer	6	KTU Dec 2021
6	What are the different ways to control evaporation? Explain the measurement of evaporation using IMD pan .	8	KTU Dec 2021
7	Explain the working of a Siphon type rain gauge with a neat sketch	5	
8	The average rainfall of 5 rain gauge stations in the base stations are 89, 54, 45, 41 and 55 cm. If the error in the estimation rainfall should not exceed 10 %, how many additional gauges may be required to be installed in the catchment?	9	
9	Compare different methods for determination of mean precipitation from a catchment	6	
10	Explain the use of double ring infiltrometer for the measurement of infiltration. How will you develop Horton's model?	8	
11	Explain the different forms of precipitation	3	
12	What are the methods of control of evaporation from water bodies?	3	

MODULE 2

1	Explain the Two line method of separation of base flow	3	KTU Dec 2021
2	A six hour storm rainfall with following rainfall depths occurs over a basin 2.2, 3.5,5.4,10.2,4.8,3.1 and 6.2 cm. Surface runoff is 10.7 cm. Determine the average infiltration index	3	KTU Dec 2021
3	What are the factors affecting Runoff ?	6	KTU Dec 2021
4	Determine the ordinates of unit hydrograph from the following observed flows from a drainage area of 300 sq km of 3 hours duration. Assume a	8	KTU Dec

	constant flow of 25 cumecs. 	Time	Ordinates of storm hydrograph (cumecs)
---	---
0 am	25
3 am	110.3
6 am	150.6
9 am	139.8
12 noon	126
3 pm	100.3
6 pm	75.9
9 pm	48.5
0 am	25			2021

5	What are the assumptions of Unit hydrograph theory?	6	KTU Dec 2021
6	Explain the parts of a single peaked hydrograph .	8	KTU Dec 2021
7	Define unit hydrograph. Explain its uses	3	
8	State the limitations of rational formula for runoff estimation	3	
9	The rates of rainfall for the successive 30 min period of a 3-hour storm are:1.6, 3.6, 5.0, 2.8, 2.2, 1.0 cm/hr. The corresponding surface runoff is estimated to be 3.6 cm. Estimate the φ -index	7	
10	Explain the characteristics of a single peak hydrograph from an isolated storm. How will you separate the base flow?	7	
11	Find out the ordinates of a storm hydrograph resulting from a 9 hr storm with rainfall of 2, 5.75 and 2.75 cm during subsequent 3 hr intervals. The ordinates of 3hr unit hydrograph at 3 hr intervals are 0, 100, 355, 510, 380, 300, 260, 225,165, 120,85, 55,30, 22, 10, 0 (cumecs). Assume an initial loss of 0.5 cm and φ -index of 2.5 mm/hr and a base flow of 10 cumecs.	14	

MODULE 3

1	Define i) Field capacity ii) Permanent wilting point	3	KTU Dec 2021
2	A field has an area of 50 ha. When 10 cumecs of water was supplied for 5 hours, 35 cm of water was stored in root zone. Find Field application efficiency	3	KTU Dec 2021
3	Determine the reservoir capacity for the following data if canal losses are 15 % and reservoir losses are 10% Crop / Base period / Duty (hectare/cumecs) / Area under crop (ha) Cotton / 250 / 1200 / 2500 Wheat / 130 / 1700 / 4000 Rice / 115 / 850 / 3000 Vegetables / 125 / 665 / 1000 Sugar cane / 360 / 800 / 5000	6	KTU Dec 2021
4	Explain the factors affecting duty and methods to improve duty	8	KTU Dec 2021
5	Define various Irrigation efficiencies	6	KTU Dec 2021
6	Explain the different types of Irrigation	8	KTU Dec 2021
7	Differentiate lift irrigation and flow irrigation	4	
8	Estimate the frequency of irrigation required for certain crop for the following data: Root zone depth = 90 cm Field capacity = 22 %, Wilting point=12 % Dry density of soil=1500 kg/m3. Daily Consumptive use =22 mm. Assume 70 % depletion of available moisture as an indicator for application of water	10	
9	Explain the benefits and ill effects of irrigation	4	
10	What are the factors affecting duty? How can you improve the duty of water.	10	
11	Explain irrigation efficiencies	3	
12	Define duty and delta. Obtain the relation between the two	3	

MODULE 4

1	What is Surcharge storage and Bank storage in a reservoir?	3	KTU 2021
2	Explain any one method of River stage measurement	3	KTU 2021

3	Explain the types of reservoirs	6	KTU Dec 2021
4	Explain the determination of reservoir capacity using Mass curve method	8	KTU Dec 2021
5	What is a Flow duration curve? Explain the procedure to construct the same	6	KTU Dec 2021
6	Explain River Training works	8	KTU Dec 2021
7	Explain the use of current meter for velocity measurement in streams	7	
8	Enlist the factors to be considered in the selection of site for a stream gauging station	3	
9	Explain meandering of rivers	3	
10	Explain the method of determination of useful life of a reservoir.	7	
11	Explain the features of different types of groynes	8	
12	Explain the types of storage reservoirs	6	

MODULE 5

1	Sketch a cavity type tube well and label its parts	3	KTU Dec 2021
2	Define i) Specific yield ii) Specific retention	3	KTU Dec 2021
3	A well penetrates fully a 12m thick water bearing stratum of soil having coefficient of permeability of 0.007 m/s. The well radius is 11 cm and is to be worked under a drawdown of 5 m at the well face. Calculate discharge from the well. What will be the percentage increase in discharge if the radius of well is doubled? Radius of influence is 300 m in each case	6	KTU Dec 2021
4	Explain Recuperation test for determining yield of open wells	8	KTU Dec 2021
5	Explain the zones of underground water	6	KTU Dec 2021
6	A 35 cm diameter well penetrates 25 m below the water table. The water level in a test well at 80 m is lowered by 0.6 m after 24 hours of pumping at the rate of 6000 l/minute and in a well 35 m away, the drawdown is 1.2 m. Determine a)Transmissibility of the aquifer b) Drawdown in the main well	8	KTU Dec 2021
7	Define (i) Storativity (ii) Transmissibility	3	
8	Explain well losses	3	
9	State Darcy's law and its limitations	4	
10	The following observations were recorded during a pumping out test on a tube well penetrating fully in an aquifer: Well diameter: 25 cm, Discharge from the well: 300 m3 /hr, RL of original water surface before pumping started: 122.000, RL of water in the well at constant pumping: 117.100 , RL of water	10	

	in the observation well: 121.300, RL of impervious layer: 92.000, radial distance of observation well from the tube well: 50 m. Determine : (a) field permeability coefficient of the aquifer (b) radius of zero drawdown		
11	Explain the working of a strainer type tube well with a sketch	7	

CET305 GEOTECHNICAL ENGINEERING II

MODULE I			
Sl. No.	**Question**	**Marks**	**Year**
1.a.	Explain active and passive states of plastic equilibrium. Give any one practical example of each of these	5	KU 2013
1.a.	What is the effect of surcharge on depth of tension crack in case of a retaining wall with purely cohesive backfill? Explain?	5	KU 2013
2.a.	Differentiate between Rankine's and Coulomb's theory of lateral earth pressure?	7	KTU 2017
2.a.	What is lateral earth pressure coefficient? Write down the expression for lateral earth pressure coefficient in at rest, passive and active case? Explain each term?	8	KTU 2017
3	Determine the total lateral earth pressure in the case of a 6m high retaining wall carrying a uniform surcharge of 14kPa, for the soil data given below. Upper stratum: cohesion = 16kPa, angle of internal friction = 30°. Unit weight of soil = 16kN/m3, Thickness = 2m Lower stratum; angle of internal friction = 40°. Unit weight of soil above water table =18kN/m3, saturated unit weight of soil 20kN/m3.Water table is at a depth of 4m below the surface of backfill. Assume that tension cracks are not likely to develop	15	KTU 2018
4.	Compute the total lateral earth thrust exerted by a layered backfill of height 10m if the wall has a tendency to move towards backfill. The upper layer of thickness 6m has angle of internal friction 32° and saturated unit weight 18kN/m3. The lower layer has angle of internal friction 28°, cohesion20kPa, and saturated unit weight 19kN/m3. The backfill also supports a uniform surcharge of intensity 8kN/m2 Water table is at a depth of 5m below the surface of the backfill. Also find the point of application.	15	KTU 2018
5.	A wall of 8m height retains a non-cohesive backfill of dry unit weight 18kN/m3 and φ =30°. Using Rankine's theory find the total active thrust on the wall and the point of application if it carries a uniform surcharge load of 10kPa.	8	KTU 2019
6.	A 6m high retaining wall with smooth vertical back supports a two layered stratum. Calculate the magnitude of active pressure per metre length of wall for the following data I layer : H1= 4m, c=0, ϕ= 35°,γ = 18 kN/m3 II layer : H2= 2m, c=0, ϕ= 30°,γ = 19 kN/m3	7	KTU 2020
7.	What is the effect of tension crack in earth pressure of cohesive backfill? A 5m high retaining wall supports a clayey backfill with bulk density 18 kN/m3, cohesion = 30 kN/m3 and ϕ= 30°.Determine the earth pressure developed per metre length of the wall when wall is pushed towards the backfill and also the point of application.	4	KTU 2020
8.	An excavation is to be carried out in a soil with angle of internal friction=300; cohesion=10KPa. unit weight =20 KN/m3. Find the maximum stable depth up to which excavation can be carried out without failure.	7.5	KTU 2019
9.	A retaining wall [h=5m] supports a granular backfill [angle of internal friction=360; unit weight above WT=16KN/m3; unit weight below WT=19KN/m3. WT table is at a depth of 2m	7.5	KTU 2019

	beneath the backfill surface. Determine the total active earth pressure.		
10.	List the assumptions of Rankine's earth pressure theory	7.5	KTU 2019
11.	Explain the advantages and limitations of any 3 types of shallow foundations	7.5	KTU 2021

MODULE 2			
1.a.	What are the assumptions in Terzaghi's bearing capacity theory	10	KTU 2017
1.b.	Differentiate between general and local shear failure of soil.	15	KTU 2017
2.a.	A square footing of 2mx2m is provided at a depth of 1m, in a sandy soil with an angle of internal friction of 30°. Compute the net safe bearing capacity of the soil with a factor of safety of 3, when the water table is at a depth of 0.5m & 1.5m below the ground level. Given G = 2.65, e = 0.7, Degree of saturation above water table = 80%, Nc=95, Nq=80.4, Nγ=100.2	10	KTU 2019
2.b.	What is equations and limitations of Terzaghi's bearing capacity theory.	5	KTU 2019
3.	Estimate the net ultimate bearing capacity of a circular footing of 2.5m diameter placed at 1.5m depth, in a lateritic soil (cohesion=48KPa; unit weight=18KN/m3). Bearing capacity factors are Nc=10, Nq=3, NY=1.5.	7.5	KTU 2019
4.	Write a note on influence of water table on bearing capacity?	5	KTU 2018
5.a.	What are the soil types for which local shear failure can be expected? Draw the typical pressure versus settlement curve for such a failure.	7.5	KTU 2018
5.b.	Define Gross ultimate bearing capacity, Net ultimate bearing capacity, Net safe bearing capacity and Allowable bearing capacity.	7.5	KTU 2018
6.	A square footing 2 m wide is founded at a depth of 1.4 m in sand. Soil properties are c=0, ϕ= 35°, γsat = 19 kN/m3 and unit weight above water table = 17.5 kN/m3. Bearing capacity factors are Nq= 41.4 and Nγ = 42.4 . Determine Ultimate bearing capacity if water table is at i) 3.5 m below ground level ii) 1.4 m below ground level	7	KTU 2020
7	A square footing of width 2.00 m is constructed at 1.20 m below the ground level in a homogeneous dry sand (γ = 17kN/m3, ϕ = 30°). Determine the safe bearing capacity of footing against shear failure with factor of safety 3. Nc =65.4, Nq = 49.4, Nγ = 5.4	7	KTU 2018
8	Determine the ultimate bearing capacity of a strip footing 1.2 m wide and having the depth of foundation of 1.0 m. The water table reaches at the ground surface during rainy season. (γsat = 19 kN/m3 , C = 15 kN/m2 , Nc =57.8, Nq = 41.4 and Nγ = 42.4).	8	KTU 2018
9.	Determine the net allowable load for a circular footing of 2.5 m diameter founded at a depth of 1.2m. Soil properties are c = 80 kN/m2, take factor of safety as 3.	5	KTU 2020
10.	Determine the safe load that can be carried by a circular footing [diameter=1.5m] founded at a depth of 0.9m in a soil with cohesion=55kPa and angle of internal friction=100. Water table	15	KTU 2018

	is at a depth of 2.8m beneath the ground surface. However, the soil above water table is also saturated [γ_{sat}=17kN/m3] due to capillarity. Nc=9.6; Nq=2.7; Nγ= 1.2. Assume general shear failure to materialise in the field and take factor of safety against shear failure as 3. What will be the % reduction in net safe bearing capacity, if water table rises to the ground surface?		
11.	Two footings A and B, both having length of 22m, are placed on the surface of a dry, purely granular soil. Widths of footings A and B are 2.5m and 1.5m respectively. Determine the ratio of their net safe bearing capacities.	7.5	KTU 2021

MODULE 3			
1.a.	Mention any one practical situation wherein trapezoidal combined footings are preferred to rectangular combined footings.	2	KTU 2018
1.b.	Design the plan dimensions of a combined footing for the following data: size of columns=300mm×300mm; column loads=1075kN & 925kN; centre to centre distance between columns=4m; clear space available beyond the outer face of both columns=0.10m. Safe bearing capacity=178kPa	13	KTU 2018
2.a.	What type of shear failure can be expected for footings, if the subsoil consists of dense homogeneous coarse grained soil? Draw the typical pressure versus settlement curve of in such a situation.	5	KTU 2018
2.b.	State any 3 causes of differential settlement.	3	KTU 2018
3.a.	What remedial measures can be taken to control the differential settlement of foundations?	5	KTU 2017
3.b.	Under what situations raft foundation is preferred?	5	KTU 2017
4.	Design the plan dimensions of a trapezoidal footing to support two adjacent columns at a centre to centre distance of 5m carrying loads of 1500kN and 3000kN. The smaller column is of size 400mmx400mm and is at a clear distance of 250mm from the property line. The bigger column is of size 750mmx750mm. The permissible soil pressure is 300kPa.	8	KTU 2017
5.	Design a combined trapezoidal footing for two columns of sizes 0.5 m x 0.5 m and 0.3 m x 0.3 m carrying loads 3000 kN and 2000 kN respectively. Centre to centre distance of columns = 5 m. Footings shall not project beyond the outer surface of columns. Allowable soil pressure is 250 kN/m2	7	KTU 2017
6.	Design a combined footing for 2 columns, if size of both columns are: 350mmX350mm; Column loads=1800kN and 1200kN; C/c distance between columns=4m. Clear spacing beyond the outer face of the 1200kN column= 0.175m. Safe bearing capacity of soil=219kPa.	7.5	KTU 2019
7.a.	How can the allowable bearing capacity of rafts on clay be estimated?	7.5	KTU 2019
7.b.	Mention any three causes of differential settlement. Suggest any three measures for reducing the same.	7.5	KTU 2019

8.	Design a rectangular combined footing for two columns, each of size 250mmX250mm, the magnitude of column loads being 850kN and 1050kN. c/c distance between columns is 3.8m and a clear spacing of 0.125m only is available beyond the outer face of 850kN column. Take SBC of subsoil as 202kPa.	7.5	KTU 2019
9.	What are the situations where raft foundations are preferred? What is meant by floating foundation?	7.5	KTU 2019
10.a.	What are the two criteria for design of rectangular combined footings ?	4	KTU 2021
10.b.	Design a rectangular combined footing to support two adjacent columns (size 40 cm x 40 cm). The centre lines of the columns are placed on footing at a distance of 5. 0 m between them. The boundary is 0.5 m away from centre line of column A. The column A and B carry load of 3 MN and 4 MN respectively. The allowable soil pressure is 400 kN/m2	8	KTU 2021
11.a.	Mention any one practical situation wherein trapezoidal combined footings are preferred to rectangular combined footings.	2	KTU 2021
11.b.	Design the plan dimensions of a combined footing for the following data: size of columns=300mm×300mm; column loads=1075kN & 925kN; centre to centre distance between columns=4m; clear space available beyond the outer face of both columns=0.10m. Safe bearing capacity=178kPa	13	KTU 2018

MODULE 4			
1.a.	State the I.S. guidelines for estimation of safe load on a single pile, from pile load test results.	4	KTU 2018
1.b.	Clearly differentiate between “initial test” and “routine test” on pile. What is meant by a working pile?	6	KTU 2018
1.c.	A square concrete pile[400mm×400mm] is proposed to be installed in a homogeneous clay stratum [unconfined compression strength=100kPa; unit weight of soil=18kN/m3; adhesion factor=0.4] to carry a safe load of 233kN., with a factor of safety of 2.5 against shear failure. Design the required length of pile.	10	KTU 2018
2.	Suggest any 3 methods for rectification of tilts of well foundations. Draw neat sketches to illustrate the same.	7	KTU 2018
3.	Explain with neat sketches, the various elements of a well foundation.	7	KTU 2017
4.a.	What is negative skin friction? What are the causes?	5	KTU 2017
4.b.	What is dynamic pile capacity?	5	KTU 2017
4.c.	A group of 9 piles 12m long and 250mm in diameter is to be arranged in a square form in clay with an average unconfined compressive strength of 60kN/m2. Determine the centre to centre spacing of the pile for group efficiency of 1. Neglect bearing at the tip. α=0.9	10	KTU 2017
5.	Using modified Hiley’s formula, determine the safe load that can be carried by a pile. The gross weight of the pile is 1400kg, weight of hammer 2000kg, height of fall 91cm, hammer efficiency 70%, average penetration under the last 5 blows is 10	8	KTU 2017

<table>
<tr><td></td><td>mm , coefficient of restitution is 0.55 and the factor of safety is 2.5. assume C=2.5 and e = 0.5</td><td></td><td></td></tr>
<tr><td>6.</td><td>A RCC pile weighs 50 kN. It is driven by a single acting steam hammer weighing 40 kN, height of fall is 1 m. Average set/blow is 1.0 cm. Take elastic compression as 1.8 cm. Assuming coefficient of restitution as 0.5. Find safe load on pile. Assume factor of safety of 2.5.</td><td>6</td><td>KTU 2020</td></tr>
<tr><td>7.a.</td><td>What are the IS guidelines for choosing depth and spacing of Bore holes?</td><td>6</td><td>KTU 2020</td></tr>
<tr><td>7.b.</td><td>A pile load test is done on a 30 cm diameter pile. Determine the safe load considering settlement and shear failure criteria. Take factor of safety as 2.5 for shear failure criteria.
<table><tr><td>Load (kN)</td><td>0</td><td>200</td><td>400</td><td>600</td><td>800</td><td>1000</td></tr><tr><td>Settlement (mm)</td><td>0</td><td>1.5</td><td>4.0</td><td>7.75</td><td>14.0</td><td>24.0</td></tr></table></td><td>10</td><td>KTU 2021</td></tr>
<tr><td>8.</td><td>Determine safe load for a concrete pile 30 cm diameter driven into dense sand for a depth of 7 m. The soil properties are □ = 35°, γ =19 kN/m3, K =2, Nq= 60, Ny = 42.4. Take critical depth for overburden pressure as 15 and factor of safety as 2.5.</td><td>10</td><td>KTU 2020</td></tr>
<tr><td>9.</td><td>A circular concrete pile of diameter 500mm is installed in a clay stratum having undrained shear strength of 99kPa. Determine the length of pile needed, if pile has to carry a load of 370kN with factor of safety of 3 against shear failure. Take adhesion factor as 0.5.</td><td>10</td><td>KTU 2019</td></tr>
<tr><td>10.</td><td>A 0.3m×0.3m precast concrete pile, 10m long is driven into a ground. The total penetration for the last five blows is observed as 12mm. Determine the ultimate load on pile (Qu) for the following data: weight of hammer=30kN; Height of fall of hammer=90cm; efficiency of hammer= 0.85; sum of the temporary elastic compressions [in mm] of the dolly, packing, pile and ground=(0.005)Qu. where
Qu is in kN. Efficiency of blow may be assumed as 0.5.</td><td>10</td><td>KTU 2019</td></tr>
<tr><td>11.</td><td>Results of load test on a pile [diameter=450mm] are given below: Estimate the safe load as per I.S.
<table><tr><td>Load (kN)</td><td>225</td><td>300</td><td>375</td><td>450</td><td>600</td><td>750</td><td>900</td></tr><tr><td>Settlement (mm)</td><td>2.9</td><td>4.2</td><td>5.5</td><td>7.2</td><td>11.8</td><td>21.5</td><td>45</td></tr></table></td><td>10</td><td>KTU 2019</td></tr>
<tr><td>12.</td><td>An RCC pile (of 500mmX500mm size and length 6m) is installed in a granular soil having unit weight =17kN/m3, coefficient of earth pressure = 1.5; angle of wall friction=22 o. Determine the ultimate skin friction load that can be carried by pile.</td><td>10</td><td>KTU 2019</td></tr>
<tr><td>13.</td><td>A 3X3 friction pile group, each pile having a length of 10m and diameter of 0.4m is installed in a homogeneous clay layer having undrained shear strength of 50kPa. Take adhesion factor as 0.75. Estimate the ultimate load on the pile group. c/c spacing of piles = 0.9m</td><td>10</td><td>KTU 2019</td></tr>
<tr><td>14.</td><td>Explain [with a sketch] negative skin friction on pile. A circular concrete pile of diameter 300mm and length 8m is installed in a subsoil consisting of top 2.5m of recently filled up soil (cohesion of 25kPa). Determine the negative skin friction on the pile. Take adhesion factor as 0.5.</td><td>10</td><td>KTU 2019</td></tr>
</table>

15.a.	A 50 cm concrete pile is driven in a normally consolidated clay deposit 15 m thick. Cu = 70 kN/m2, $\alpha = 0.9$ and Factor of safety is 2.0. Estimate the safe load.	5	KTU 2018
15.b.	A bored pile in a clayey soil failed at an ultimate load of 400kN. If the pile is 50 cm diameter and 10 m long, determine the capacity of a group of nine piles spaced 1 m centre to centre both ways. Take Cu = 70 kN/m2 and $\alpha = 0.5$.	8	KTU 2018
16.a.	Write Modified Hiley formula and describe each terms in the formula	5	KTU 2018
16.b.	Explain the procedure of determination of safe load from static pile load test	12	KTU 2018
17.	Write down the procedure for determination of safe load on a single pile in sands.	10	KTU 2018

MODULE 5			
1.	State the I.S. guidelines for choosing the minimum number of borings in a soil exploration programme. Find the minimum number of boreholes for a rectangular plot of size 40m ×300m.	7	KTU 2018
2.	Explain Standard Penetration test and its correlations with shear strength parameters. What are the corrections to be applied for SPT value?	7	KTU 2020
3.	What are the objectives of a Subsoil exploration programme?	4	KTU 2020
4.	Explain Wash boring method of subsoil exploration.	6	KTU 2020
5.	State the I.S. guideline for minimum number of boreholes to be taken for a rectangular area. Determine the minimum number of bore holes needed for a rectangular plot of size (i) 80mX100m and (ii) 300mX80 m?	10	KTU 2019
6.	Mention any five objectives of site investigation. Also point out any 5 information that can be collected during reconnaissance.	10	KTU 2019
7.	State any two merits of auger boring method of soil exploration compared to wash boring. Mention the soil types for which the auger boring method is applicable. Mention the different types of augers and draw a neat sketch of any one.	10	KTU 2019
8.	What is meant by dilatancy correction? What are the soil types/soil states for which the above correction is applied? Give the related equation for dilatency correction.	10	KTU 2019
9.	Mention any 2 soils in which auger boring method of soil exploration can be effectively carried out? Also mention applicable depths, and any one limitation of the method.	5	KTU 2018
10.	Explain in detail the procedure for standard penetration test. What are the corrections to be applied to the N-Value?	15	KTU 2018
11.	Explain in detail about sampling, disturbed, undisturbed and chunk samples	8	KTU 2021
12.	Briefly elaborate on the geophysical methods: Seismic Refraction method and Electrical Resistivity method.	7	KTU 2021

QUESTION BANK – MCN 301 DISASTER MANAGEMENT

MODULE -1 **MARKS**

1. Briefly explain about atmosphere and its different layers? 14
2. Explain about ozone layer and its depletion? 7
3. Explain about cyclones? 7
4. Briefly explain about Indian monsoon? 14
5. Explain about Disaster Risk Reduction and Management? 14
6. Briefly explain the following terms 12
    a. disaster mitigation
    b. disaster response
    c. damage assessment
    d. crisis counselling
7. Briefly explain the following terms 14
    a. Disaster
    b. Hazard
    c. Exposure
    d. Vulnerability
    e. Risk
    f. risk assessment
    g. risk mapping

MODULE -2

1. Briefly explain about Hazard types? 14
2. Explain about Vulnerability types and their assessment? 14
3. Differentiate between physical, social, economic and environmental vulnerability? 14
4. Explain about Disaster risk assessment procedure? 7
5. Briefly explain hazard mapping? 7

MODULE -3

1. Explain different phases of Disaster Risk Management? 14
2. Briefly explain about prevention, mitigation, and preparedness of disaster risk management? 14
3. List down the different objectives of disaster response? 7
4. Explant about different types of disaster response? 7
5. Write short notes on different international relief organizations? 7
6. Explain about response planning? 7

MODULE -4

1. Explain about disaster communication? 14
2. Briefly explain about different barriers of disaster communications? 14
3. Explain about Crisis counselling? 7
4. Write short notes on capacity building? 7
5. Explain Structural and Non-structural Measures of capacity building? 14

MODULE -5

1. Explain about Common disaster types in India? 14
2. Briefly explain about National disaster management policy? 14
3. Write short notes on Institutional arrangements for disaster management in India? 7
4. Explain about the Sendai Framework for Disaster Risk Reduction? 7
5. Write short notes on Legislations in India on disaster management? 14

SUB CODE	CET 309	SUB NAME	CONSTRUCTION TECHNOLOGY AND MANAGEMENT

QUESTIONS MARK

MODULE 1

1. How is plywood manufactured? What are its properties? 3
2. State any three applications of accelerators in concrete. 3
3. Explain with a flow chart, the manufacturing of cement by dry process. 9
4. How is the compressive strength of cement tested? 5
5. Explain the properties and uses of superplasticizers and retarders. How are these advantageous in concrete? 9
6. Explain the importance of using graded aggregates in concrete making. 5

MODULE 2

1. Distinguish between segregation and bleeding in concrete. 3
2. List the various objectives of plastering. 3
3. Explain in detail, the various stages in the manufacturing of concrete. 14
4. Explain the indirect tests to determine the tensile strength of concrete. 9
5. Discuss the classification of arches based on shape 5

MODULE 3

1. Enumerate the advantages of slip form construction. 3
2. Write a note on the process of 3D printing in construction. 3
3. Explain with a neat figure, the working principle of filler slab technology. What are its advantages? 9
4. Write a note on soil cement block masonry 5
5. Explain the concept of prestressing concrete. Differentiate between pre-tensioning and post-tensioning. 9
6. What are the various types of formwork available? 5

MODULE 4

1. Write a note on the BOT contract.. 3
2. What are the various contents of a Detailed Project Report (DPR)? 3
3. Describe the various processes involved in tendering for a construction project. 14
4. Explain any three types of contracts in detail. Discuss the advantages and disadvantages of each. 14

MODULE 5

1. Distinguish between CPM and PERT. 3
2. What is a material schedule? Illustrate with an example. 3
3. A project consists of 8 activities with their duration (in weeks) as follows

Activity	A	B	C	D	E	F	G	H
Duration	2	4	2	4	6	4	5	4

The precedence relationships of activities are as follows: A and B can be performed in parallel. C and D cannot start until A is complete. E cannot start until half the work of activity C is complete. F can start only after activity D is complete. G succeeds C. H is the last activity, which should succeed E. Draw the bar chart and find the total time of completion of the project. If there is an increase of 2 weeks in time of completion of activity A, what will be the corresponding increase in the total time of the completion of the project? 9

4. List the advantages and disadvantages of bar charts. 5