SRM VALLIAMMAI ENGINEERING COLLEGE

(An Autonomous Institution)

SRM Nagar, Kattankulathur – 603 203

DEPARTMENT OF CIVIL ENGINEERING

QUESTION BANK

VI SEMESTER

1903602- STRUCTURAL ANALYSIS II

Regulation – 2019

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Prepared by

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SRM VALLIAMMAI ENGINEERING COLLEGE

SRM Nagar, Kattankulathur – 603 203.

DEPARTMENT OF CIVIL ENGINEERING

QUESTION BANK

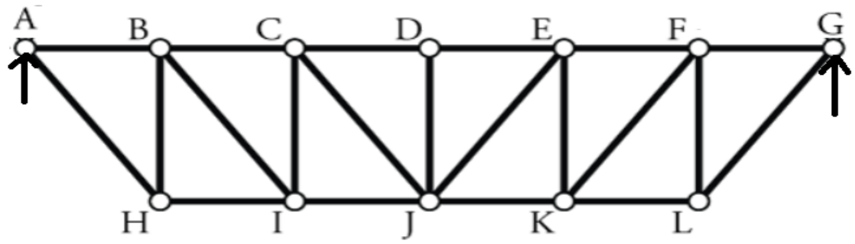
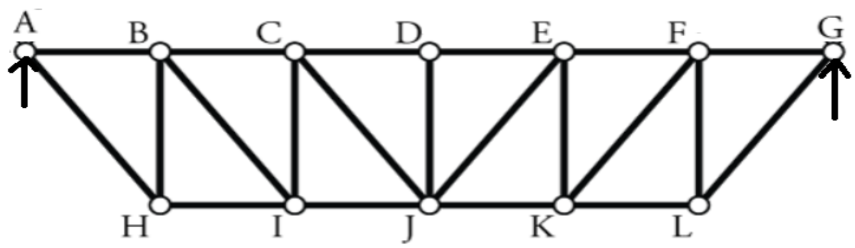
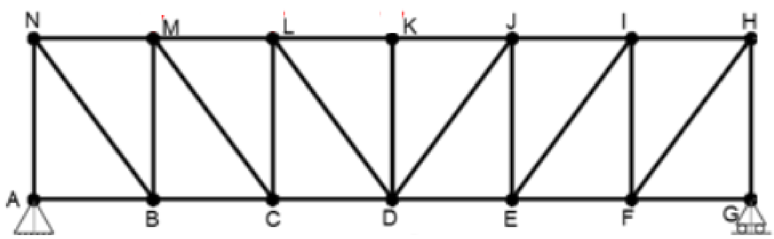
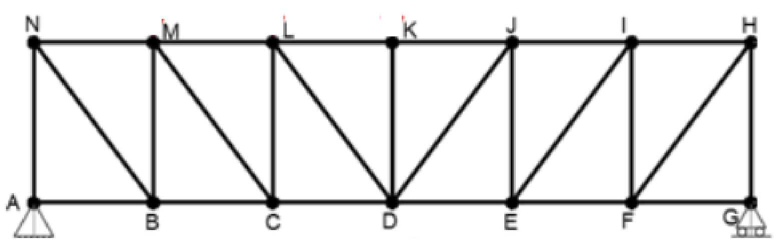
SUBJECT : STRUCTURAL ANALYSIS - II

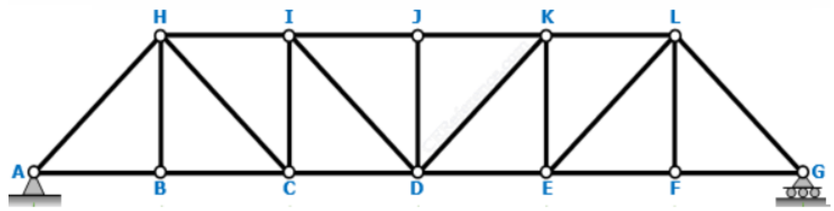
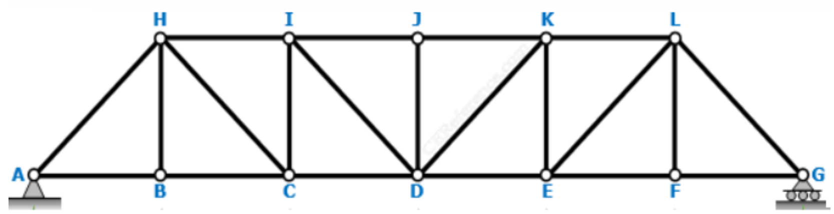
SEM / YEAR : VI / III

UNIT I INFLUENCE LINES FOR DETERMINATE BEAMS			
Influence lines for reactions in statically determinate beams – Influence lines for shear force and bending moment – Calculation of critical stress resultants due to concentrated and distributed moving loads – absolute maximum bending moment - influence lines for member forces in pin jointed plane frames.			
PART A			
Q.No.	**Questions**	**BT Level**	**Competence**
1.	What is meant by influence lines?	BT-1	Remembering
2.	What is Begg's deformeter?	BT-1	Remembering
3.	Biefly explain Muller Breslau principle.	BT-1	Remembering
4.	What are the uses of influence line diagrams?	BT-1	Remembering
5.	Draw the influence line diagram for shear force at a point X in a simply supported beam AB of span l.	BT-1	Remembering
6.	Draw the ILD for bending moment at any section X of a simply supported beam.	BT-1	Remembering
7.	Give the condition at which maximum absolute bending moment occurs in simply supported beam when a number of point loads are moving on it.	BT-2	Understanding
8.	What is meant by absolute maximum bending moment?	BT-2	Understanding
9.	What is meant by absolute shear force diagram?	BT-2	Understanding
10.	Sketch the ILDs for the support reactions in a simply supported beam.	BT-2	Understanding
11.	Define the term reversal of stresses.	BT-2	Understanding
12.	State Maxwell-Bett's theorem.	BT-1	Remembering
13.	What is use of Begg's deformeter?	BT-1	Remembering
14.	State the principle on which indirect model analysis is based.	BT-1	Remembering
15.	What is the necessity of Influence line diagram?	BT-2	Understanding
16.	Differentiate Determinate and Indeterminate Structures.	BT-2	Understanding
17.	What are the types of connections possible with the model used with Begg's deformeter?	BT-3	Applying
18.	What is the use of a micrometer microscope in model analysis with Begg's deformeter?	BT-3	Applying

<table>
<tr><td>19.</td><td>Give the condition at which maximum absolute bending moment occurs in a simply supported beam when a number of point loads are moving on it.</td><td>BT-3</td><td>Applying</td></tr>
<tr><td>20.</td><td>What are the Properties of influence lines?</td><td>BT-1</td><td>Remembering</td></tr>
<tr><td>21.</td><td>Name the type of rolling loads for which the absolute maximum bending moment occurs at the mid span of the beam.</td><td>BT-1</td><td>Remembering</td></tr>
<tr><td>22.</td><td>Sketch the shapes of the influence lines for the support reaction and the hogging moment at the continuous support B of a two span continuous beam ABC. Assume the extreme ends A and C to be fully fixed.</td><td>BT-1</td><td>Remembering</td></tr>
<tr><td>23.</td><td>Determine the vertical reaction at B for 10m span simply supported beam with point load of 100 kN ,50 kN and 200 kN at a interval of 2m,2m and 3m using influence line diagram.</td><td>BT-2</td><td>Understanding</td></tr>
<tr><td>24.</td><td>Determine the vertical reaction at B for a simply supported beam of 9m span for a distributed load of 60kN/m of 4m long at a distance of 1m from left support.</td><td>BT-1</td><td>Remembering</td></tr>
<tr><td colspan="4">PART B</td></tr>
<tr><td>1.</td><td>Draw the ILD for shear force and bending moment for a section at 50m from the left hand support of a simply supported beam, 200m long, Hence calculate the maximum bending moment and shear force at the section due to an uniformly distributed rolling load of length 80m and intensity 100kN/m.</td><td>BT-3</td><td>Applying</td></tr>
<tr><td>2.</td><td>Two point loads of 60kN and 120kN crosses a span of 12m from left to right. The 60kN load is leading with 2m ahead of the 120kN load. Determine the absolute maximum bending moment values.</td><td>BT-2</td><td>Understandin
g</td></tr>
<tr><td>3.</td><td>Four point loads of 120kN, 160kN, 160kN and 80kN spaced 2m between consecutive loads move on the girder of 25m span, from left to right with the 120kN load leading. Calculate the maximum bending moment at a point 10m from left support. Also calculate the position and value of absolute maximum bending moment.</td><td>BT-2</td><td>Understandin
g</td></tr>
<tr><td>4.</td><td>A girder of 15m span is traversed by a moving load of 150kN (Point load) at a distance of 3m,2m,2m,2m from the left support and UDL of 60kN/m spread over a distance of 4.5m from right support. Determine the maximum bending moment at D, 7m from the left hand support.</td><td>BT-3</td><td>Applying</td></tr>
<tr><td>5.</td><td>A system of moving loads crosses a girder of 36m span simply supported at its ends. The load and the distance are as follows:
<table>
<tr><td>Wheel Load(kN)</td><td colspan="2">100</td><td colspan="2">100</td><td colspan="2">200</td><td colspan="2">200</td><td colspan="2">160</td></tr>
<tr><td>Distance in m</td><td></td><td colspan="2">3</td><td colspan="2">4.5</td><td colspan="2">4</td><td colspan="2">3.5</td><td></td></tr>
</table>
Determine the absolute maximum bending moment in the girder.</td><td>BT-2</td><td>Understandin
g</td></tr>
<tr><td>6.</td><td>Four wheel loads of 60, 40, 80 and 50 kN cross a girder of 20m span, from left to right followed by udl of 8kN/m and 2m long with the 60kN load leading. The spacing between the loads in the same order is 3m, 3m and 2m. The head of the udl is at 4m from the last 50kN load, Using influence lines calculate the S.F and B. M at a</td><td>BT-3</td><td>Applying</td></tr>
</table>

<table>
<tr><td></td><td>section 8m from the left support when the 40kN load is at centre of the beam.</td><td></td><td></td></tr>
<tr><td>7.</td><td>Two wheel loads 80kN and 200kN spaced 2m apart move on a girder of span 16metres. Find the maximum positive, negative shear force and maximum bending moment at a section 4 metres from the left end. Any wheel load can lead the other.</td><td>BT-3</td><td>Applying</td></tr>
<tr><td>8.</td><td>A live load of 15kN/m, 5m long moves on a girder simply supported on a span of 13m. Find the maximum bending moment and shear force that can occur at a section 6m from the left end.</td><td>BT-1</td><td>Remembering</td></tr>
<tr><td>9.</td><td>Two point loads of 100kN and 200kN spaced 3m apart cross a girder of span 12 meters from left to right with the 100kN leading. Draw the ILD for shear force and bending moment and find the values of maximum bending moment. Find the values of maximum shear force and bending moment at a section 4m from the left hand support. Evaluate the absolute maximum bending moment due to the given loading system.</td><td>BT-2</td><td>Understanding</td></tr>
<tr><td>10.</td><td>A simply supported beam has a span of 16m is subjected to a UDL (dead load) of 5 kN/m and a UDL (live load) of 8kN/m (longer than the span) traveling from left to right. Draw the ILD for shear force and bending moment at a section 4m from the left end. Use these diagrams to determine the maximum shear force and bending moment at this section.</td><td>BT-2</td><td>Understanding</td></tr>
<tr><td>11.</td><td>The following system of wheel loads crosses a span of 25m
<table>
<tr><td>Wheel Load</td><td>16</td><td>16</td><td>20</td><td>20</td><td>20kN</td></tr>
<tr><td>Distance Between Centres</td><td></td><td>3</td><td>3</td><td>4</td><td>4m</td></tr>
</table>
Find the maximum value of bending moment and shearing force in the span.</td><td>BT-2</td><td>Understanding</td></tr>
<tr><td>12.</td><td>A simply supported beam has a span of 15m is subjected to a UDL of 30 kN/m, 5m long traveling from left to right. Draw the ILD for shear force and bending moment at a section 6m from the left end. Use these diagrams to determine the maximum shear force and bending moment at this section.</td><td>BT-2</td><td>Understanding</td></tr>
<tr><td>13.</td><td>A Girder having a span of 18m is simply supported at its ends. It is traversed by a train of load 150 kN,150 kN,250 kN and 100kN at a distance of 3m between each loads with 100kN leading. Find the equivalent UDL.</td><td>BT-2</td><td>Understanding</td></tr>
<tr><td>14.</td><td>Evaluate and draw the ILD for the forces in members BC,BH, BI and HI of the trusses as shown in figure. The height of the truss is 4m and each segment is 3m long.</td><td>BT 4</td><td>Analyzing</td></tr>
</table>

			
15.	Evaluate and draw the ILD for the forces in members CI, CD,CJ and IJ of the trusses as shown in figure. The height of the truss is 4m and each segment is 3m long. 	BT 4	Analyzing
16.	Draw the ILD for the forces in members AB, BC and BM and BN of the trusses as shown in figure. The height of the truss is 4m and each segment is 4m long. 	BT 4	Analyzing
17.	Evaluate and draw the ILD for the forces in members CD,DK and DL of the trusses as shown in figure. The height of the truss is 4m and each segment is 4m long. 	BT 4	Analyzing
PART C			
1.	Draw the influence line diagram for the forces in the members HA,HB,HC,BC and HI of the through type bridge truss shown in figure. The height of the truss is 4m and each segment is 4m long.	BT 4	Analyzing

			
2.	Explain in detail about the necessity of Influence lines and elaborate its applications.	BT-1	Remembering
3.	Analysis the IL for force in member AB, BC,AH, HI and CI for the truss shown in figure. The height of the truss is 4m and each segment is 4m long. 	BT 4	Analyzing
4.	A system of four loads 80, 160, 160 and 120 kN crosses a simply supported beam of span 25m with the 120 kN load leading. The loads are equally spaced at 2m. Determine the values of the following using influence lines. Calculate Maximum bending moment at a section 10m from left support and Absolute maximum bending moment in the beam.	BT-3	Applying
5.	Two point loads of 100kN and 200kN spaced 30m apart cross a girder of span 150 m from left to right with the 100kN leading. Draw the ILD for shear force and bending moment and find the values of maximum bending moment. Find the values of maximum shear force and bending moment at a section D, 60m from the left hand support. Evaluate the absolute maximum bending moment due to the given loading system.	BT-1	Remembering

UNIT II INFLUENCE LINES FOR INDETERMINATE BEAMS			
Muller Breslau's principle– Influence line for Shearing force, Bending Moment and support reaction components of propped cantilever, continuous beams (Redundancy restricted to one), and fixed beams, Indirect model analysis for Indeterminate Structures.			
Part - A			
Q. No.	**Questions**	**BT Level**	**Competence**
1	State the importance of Influence line diagram.	BT 1	Remembering
2	What is begg's deformeter?	BT 1	Remembering
3	Define the term reversal of stresses.	BT 1	Remembering
4	What do you understand by Indeterminate structures?	BT 1	Remembering
5	State Maxwell-Bett's theorem.	BT 1	Remembering
6	How will you obtain degree of static determinacy?	BT 1	Remembering
7	Define degree of indeterminacy.	BT 2	Understanding
8	Explain the use of Beggs deformeter.	BT 2	Understanding
9	Sketch the influence line diagram for the propped reaction of a propped cantilever beam.	BT 2	Understanding
10	What are the three types of connections possible with the model used with Begg's deformeter?	BT 2	Understanding
11	What is 'dummy length' in models tested with Begg's deformeter?	BT 3	Applying
12	State the principle on which indirect model analysis is based.	BT 3	Applying
13	What do you understand by an influence line for bending moment?	BT 3	Applying
14	State Muller Breslau principle.	BT 2	Understanding
15	State Maxwell-Bett's theorem.	BT 3	Applying
16	Illustrate the principle of dimensional similarity?	BT 2	Understanding
17	State the importance of ILD?	BT 3	Applying
18	What is meant by absolute shear force diagram?	BT 1	Remembering
19	What do you understand by absolute maximum bending moment?	BT 2	Understanding
20	State the importance of Muller Breslau principle.	BT 2	Understanding
21	Write the importance of model analysis?	BT 2	Understanding
22	What are the Properties of influence lines?	BT 1	Remembering
23	Differentiate Determinate and Indeterminate Structures.	BT 2	Understanding
24	What are the types of connections possible with the model used with Begg's deformeter?	BT 2	Understanding
Part – B			
Q. No.	**Questions**	**BT Level**	**Competence**
1.	Determine the influence line for R_A for the two span continuous beam with 4m span length. EI=Constant. Support A and C with roller support and support B with Pinned support. Compute ordinates at 1m interval.	BT 4	Analyzing
2.	Determine the influence line for the reaction at the middle support B of the two span continuous beam with 5m span length. Support A and C with roller support and support B with Pinned support. Compute ordinates at 1m interval.	BT 3	Applying

3.	Draw the influence line diagram for the propped reaction of a propped cantilever beam having span 6m. Take EI=constant. Compute the ordinates at 1m interval.	BT 3	Applying
4.	Sketch the ILD for the propped cantilever reaction of a propped cantilever beam having span 10 m. EI is constant. Compute the ordinates at 2m interval.	BT 4	Analyzing
5.	Determine the influence line for R_A for the two span continuous beam with 5m span length. EI=Constant. Support A and C with roller support and support B with Pinned support. Compute ordinates at 1m interval.	BT 3	Applying
6.	Draw the influence line for M_B of the continuous beam ABC Simply supported at A and C using Muller Breslua's principle. AB=3m, BC=4m. EI=Constant.	BT 3	Applying
7.	Using Muller Breslau principle, draw the influence line for bending moment at the mid point D of span AB=9m of the continuous beam ABC with AB=9m, BC=6m. Determine the influence line ordinates at suitable intervals and plot them.	BT 4	Analyzing
8.	Determine the influence line for shear force at D, the mid point of span BC of a continuous beam AB=6m and BC=6m. Compute the influence line ordinates at 1.5m intervals.	BT 4	Analyzing
9.	Draw the influence line for M_B for the continuous beam ABC of span AB = BC = 4m Simply supported at A, B &C. Compute the ordinates at every 1m interval, EI= constant.	BT 4	Analyzing
10.	Draw the influence line for M_A for the continuous beam ABC of span AB = 3m and BC = 4m Simply supported at A, B &C. Compute the ordinates at every 1m interval using Muller Breslau principle. EI= constant.	BT 3	Applying
11.	Draw the IL for reaction at B and for the support moment M_A at A for the propped cantilever AB of 10m. Compute influence line coordinates at 2 m intervals.	BT 3	Applying
12.	A continuous beam ABC is simply resting on support A and C, continuous over the support B and has an internal hinge D at 4m from A and E at middle of span BC. The span AB is 7m and the span BC is 8m. Draw the influence lines for Reaction at A,B and C, Shear to the right of B, Bending moment at E.	BT 3	Applying
13.	Using Muller Breslau Principle, draw Influence line for bending moment at mid span BC.AB=BC=4m	BT 4	Analyzing
14.	Explain the procedure and applications of Beggs deformeter.	BT 5	Evaluating
15.	Determine the influence line for the reaction at the middle support B of the two span continuous beam with 6m span length. Support A and C with roller support and support B with Pinned support. Compute ordinates at 1m interval.	BT 3	Applying
16.	Determine the influence line for R_A for the two span continuous beam with 4m span length. EI=Constant. Support A and C with roller support and support B with Pinned support. Compute ordinates at 1m interval.	BT 4	Analyzing

17.	Construct influence lines for R_A , R_B,F_D and M_E for the beam AB with C as intermediate support.	BT 4	Analyzing

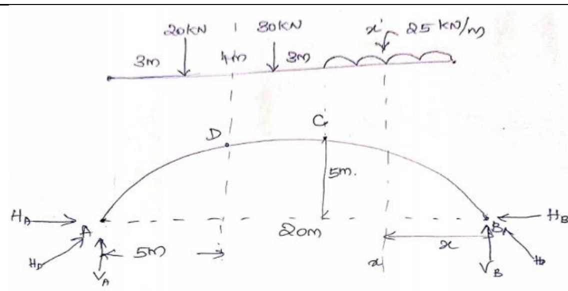
Part - C

Q. No.	Questions	BT Level	Competence
1.	Draw the influence line for reaction at B and for the support moment M_A at A for the propped cantilever of span AB=12m, consider a section xx at a distance of x from support B. Compute the influence line ordinates at 1.5m intervals.	BT 5	Evaluating
2.	Explain in detail about the practical considerations in Muller Breslau's Principle.	BT 4	Analyzing
3.	Elaborate in detail about the indirect model analysis.	BT 4	Analyzing
4.	Write the Muller Breslau principle and explain in detail about the application of principle to determinate structures.	BT 5	Evaluating
5.	Explain in detail about the application of principle to indeterminate structures.	BT 5	Evaluating

UNIT III ARCHES			
Arches - Types of arches –Examples of Structures- Analysis of three hinged and two hinged arches with effect of temperature change-rib shortening-yielding of supports Parabolic and circular arches – Settlement effects.			
PART-A			
1.	What is an arch? Explain.	BT 1	Remembering
2.	List the methods used for the analysis of fixed arches?	BT 1	Remembering
3.	Name the different types of arch as per structure configuration.	BT 1	Remembering
4.	Write the types of arches based on the number of hinges.	BT 1	Remembering
5.	What is meant by degree of static indeterminacy of a structure?	BT 1	Remembering
6.	Write the difference between circular arch and parabolic arch	BT 1	Remembering
7.	Give the equation for temperature effect in arches.	BT 2	Understanding
8.	Derive the expression for the horizontal thrust in a three hinged parabolic arch carrying UDL over entire span.	BT 2	Understanding
9.	Write down the expression for the horizontal thrust when the two hinged arch is subjected to uniformly distributed load throughout the span.	BT 2	Understanding
10.	Find the maximum bending moment at a section 30 m from the left end of the three hinged stiffening girder of span 100 m when a UDL of 10 kN/m, 5 m length crosses the girder.	BT 3	Applying
11.	Derive the expression for the horizontal thrust in a three hinged parabolic arch carrying UDL over entire span.	BT 3	Applying
12.	Which theorem is utilized in solving the two hinged arch? State the theorem.	BT 2	Applying
13.	Give an expression for the determination of horizontal thrust of a two hinged arch considering bending deformation only.	BT 1	Remembering
14.	Compare the two hinged and three hinged arches	BT 3	Applying
15.	Give the applications of two hinged arches	BT 3	Applying
16.	Differentiate between the cable and arch.	BT 3	Applying
17.	Define Horizontal Thrust.	BT 3	Applying
18.	State Eddy's theorem for an arch.	BT 1	Remembering
19.	Define radial shear and normal thrust.	BT 3	Applying
20.	Under what conditions will the bending moment in an arch be zero throughout?	BT 1	Remembering
21.	Write the formula to calculate the change in rise in three hinged.	BT 2	Understanding
22.	State General Cable Theorem.	BT 2	Understanding
23.	Define a linear arch.	BT 2	Understanding
24.	Write the equation for a semi circular arch with UDL at left or right side of the arch and point load at an angle α either at left or right side of the arch.	BT 2	Understanding
PART-B			
1.	A Three hinged semicircular arch of the radius R carries a UDL of W Per unit run over the whole span. Find the horizontal thrust at each support and the location and magnitude of the maximum Bending Moment for the arch.	BT 4	Analyzing

2.	A three hinged arch has a span of 30m and a rise of 10m. The arch carries the UDL of 60 kN/ m on the left half of the span. It also carries two concentrated load of 160 kN and 100 kN at 5m and 10m from the right end. Determine the horizontal thrust at each support.	BT 4	Analyzing
3.	A three hinged arch has a span of 20m and a rise of 4m carries the UDL of 20 kN/ m on the left half of the span. Find the bending moment for the arch.	BT 3	Applying
4.	A three hinged arch ABC consisting of quadrantal parts AC and BC of radii 4m and 6m respectively carries two point loads of 100 kN each at crown and 3m from the crown at right half of the span. Find the reaction at the supports and the bending moment at height of 2m from left support and 3m from right support.	BT 4	Analyzing
5.	A three hinged arch consisting of two qudrantal parts AC and CB radius 2m and 4m respectively. For the load system 40kN at the centre of left half of the span and 60kN at the centre of right half of the span acting on the arch calculate the reaction at supports and B.M under the loads.	BT 3	Applying
6.	A circular three hinged arch of span 25m with a central rise of 5m is hinged at the crown and the end supports. It carries a point load of 10kN at 7.5m from the left support. Examine and Calculate the horizontal thrust, reaction at the supports and Moment under the load.	BT 4	Analyzing
7.	A two hinged parabolic arch of span l and rise h carries a concentrated load W at the crown. Show that the horizontal thrust equals $\frac{2}{128}\frac{Wl}{h}$ at each support.	BT 4	Analyzing
8.	A two hinged parabolic arch of span l and rise h carries a concentrated load W at a distance 'a' from the left end. Show that the horizontal thrust at each support is given by $\frac{5}{8}\frac{W}{hl^3}\ a(l-a)(l^2 + la - a^2)$	BT 3	Applying
9.	A two hinged parabolic arch of span l and rise h carries a UDL of W per unit run over the whole span. Find the horizontal thrust at each support.	BT 5	Evaluating
10.	A two hinged semicircular arch of radius R carries a UDL of W per unit run over the whole span. Determine the horizontal thrust at each support. Assume uniform rigidity.	BT 4	Analyzing
11.	A two hinged semicircular arch of radius 10m is subjected to a rise of temperature 40^0C.Find maximum stress due to rise in temperature. Take E=$2x10^5$ N/mm^2 and α=$12x10^{-6}$ per ^{0}C . The depth of the arch section is 1000mm.	BT 3	Applying
12.	A two hinged parabolic arch of span 40m and rise 8m is subjected to a rise of temperature 30^0C.Find maximum bending stress at the crown due to rise in temperature. The rib section is 1000mm deep.Take E=$2x10^5$ N/mm^2 and α=$12x10^{-6}$ per ^{0}C .	BT 4	Analyzing
13.	A two hinged parabolic arch of span 20m and rise 8m carries a uniformly distributed load of 20kN/m. Calculate the horizontal thrust. If now a support yields laterally with respect to other support by 0.02m. What will be the horizontal thrust? E=200 kN/mm^2 and	BT 4	Analyzing

	$I=1.7x10^7 mm^4$.		
14.	A symmetrical three hinged arch has a span of 40 & rise 8m carries a uniformly distributed load of 30kN/m over the left half of the span. The hinges are provided at the supports and at the centre of the arch. Calculate the reaction at the supports. Also calculate the bending moment, radial shear and normal thrust at a distance of 10m from the left support.	BT 3	Applying
15	Formulate the expression for horizontal thrust in a two hinged semi-circular arch of radius R, carrying a point load W at the crown.	BT 4	Analyzing
16	Analyse and derive the expression for horizontal thrust in a two hinged parabolic arch carrying a point load P at a distance one fourth span from left support .Assume $I=I_o \text{ Sec } \theta$.	BT 3	Applying
17	A three hinged parabolic arch of 30m span and 6m central rise carries a point load of 8kN at a distance of 10m horizontally from the left hinge. Calculate the normal thrust, shear force at the section. Also calculate and discuss the maximum positive and negative bending moment.	BT 4	Analyzing
	Part C		
Q.No	**Questions**	**BT Level**	**Competence**
1.	The three hinged parabolic arch of 40m span has a abutments at unequal levels. The highest point of the arch is 4m above the left support and 9m above the right abutment. The arch is subjected to an UDL OF 15kN/m over its entire horizontal span. Find the horizontal thrust, resultant reaction at supports, B.M at a point 8m from the left support, radial shear at 8m from A, normal thrust at 8m from A.	BT 4	Analyzing
2.	A segmental arch has a span of 40m and a rise of 8m and is hinged at the springing. Both the hinges are at the same level. The arch supports a load of 100kNat the crown. Find the horizontal thrust at each support.	BT 4	Analyzing
3.	A two hinged parabolic arch of span 50m and rise 5m is subjected to a concentrated load of 60kN.It has an elastic support which yields by 0.0001mm/kN. Take $E=200 \text{ kN/mm}^2$ and $I=5x10^9 \text{ mm}^4$ average area $A_m=10000mm^2$, $\alpha=10x10^{-6} / {}^0C$. Calculate the horizontal thrust developed when the temperature rises by 20^0C, neglecting rib shortening and considering rib shortening.	BT 4	Analyzing
4.	The three hinged circular arch of span 16m and a rise 4m it is subjected to two points of 100kN and 80kN at the left and right quarter span points respectively. Find the reaction at the supports and also find the radial shear and normal thrust at 6m from left support A.	BT 5	Evaluating
5.	A Parabolic 3 hinged arch carries loads as shown in figure. Determine the resultant reaction at supports. Find the BM, Normal Thrust and Radial Shear at D 5m from A. What is the maximum BM.	BT 5	Evaluating

	20kN 80kN 25 kN/m 3m 4m 3m D C 5m. 20m 5m x A B H_A H_B V_A V_B		

UNIT IV CABLES AND SUSPENSION BRIDGES			
Equilibrium of cable – length of cable-Horizontal thrust on the cable- anchorage of suspension cables – stiffening girders - cables with three hinged stiffening girders –Influence lines for three hinged stiffening girders.			
PART-A			
Q.No	**Questions**	**BT Level**	**Competence**
1.	What are cable structures. Mention its needs	BT 1	Remembering
2.	What are the types of stiffening girder?	BT 1	Remembering
3.	List out the main functions of stiffening girders in suspension bridges.	BT 1	Remembering
4.	Briefly explain the cable over a guide pulley	BT 1	Remembering
5.	Mention the different types of cable structures.	BT 1	Remembering
6.	What is the true shape of cable structure?	BT 1	Remembering
7.	Explain two ways by means of which a cable can be supported or anchord.	BT 2	Understanding
8.	What is the nature of forces in the cables?	BT 2	Understanding
9.	Compose the expression for determining the tension in the cable.	BT 2	Understanding
10.	Write about the temperature effect on cable.	BT 2	Understanding
11.	Describe catenary.	BT 3	Applying
12.	Give the range of central dip of the cable.	BT 3	Applying
13.	Give expression for calculating Tension T on a girder.	BT 3	Applying
14.	Briefly explain cable over saddle.	BT 2	Understanding
15.	Write about the temperature effects on cables.	BT 2	Understanding
16.	List out the necessity of stiffening girders in suspension bridges.	BT 3	Applying
17.	Draw the influence line for horizontal reaction, H in a three hinged stiffening girder.	BT 3	Applying
18.	Differentiate three hinged girder and two hinged girder influence line for H an w.	BT 2	Understanding
19.	Explain cable over a guide pulley.	BT 3	Applying
20.	What is the need for cable structure?	BT 2	Understanding
21.	What are the main elements of suspension bridge.	BT 3	Applying
22.	Give the expression for calculating equivalent UDL on a girder.	BT 2	Understanding
23.	Sketch the shape of the flexible cable if it is applied uniformly distributed load and concentrated load at centre.	BT 2	Understanding
24.	Give the application of three hinged stiffening girders.	BT 1	Remembering
PART – B			
Q.No	**Questions**	**BT Level**	**Competence**
1.	A suspension bridge has a span 50 m with a 15 m wide runway. It is subjected to a load of 30 kN/m^2 including self-weight. The bridge is supported by a pair of cables having a central dip of 4 m. find the cross sectional area of the cable necessary if the maximum permissible stress in the cable materials is not to exceed 600 MPa.	BT 4	Analyzing
2.	A suspension cable of horizontal span 95m is supported at two	BT 3	Applying

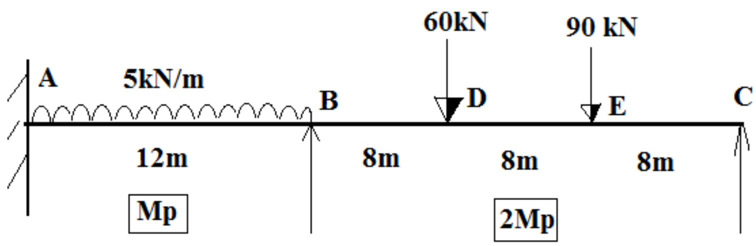
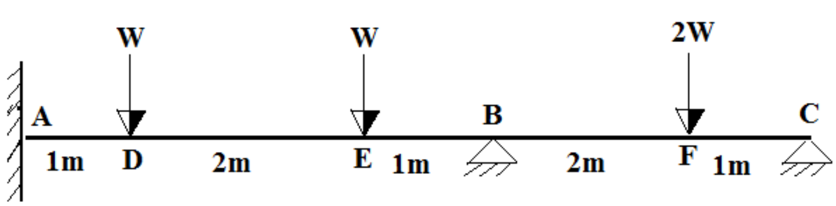
	different levels. The right support is higher than the left support by 4m.The dip to the lowest point of the cable below the left support is 5m.The cross sectional area of the cable is $3500mm^2$.Find the uniformly distributed load that can be carried by the cable if the maximum stress is limited to $600N/mm^2$.		
3.	A suspension bridge has a span 50 m with a 16 m wide roadway. It is subjected to a load of 25 kN/m^2 including dead load. The bridge is supported by a pair of cables having a central dip of 4.2 m. find the cross sectional area of the cable necessary if the maximum permissible stress in the cable materials is not to exceed 600 N/mm^2.	BT 3	Applying
4.	A suspension cable having supports at the same level, has a span of 30m and a maximum dip of 3m.The cable is loaded with a UDL of 10kN/m throughout its length. Evaluate the maximum tension in the cable.	BT 4	Analyzing
5.	A three hinged stiffening girder of a suspension bridge of 100 m span subjected to two point loads 10 kN each placed at 20 m and 40 m respectively from the left hand hinge. Determine the bending moment and shear force in the girder at section 30 m from each end. Also determine the maximum tension in the cable which has a central dip of 10 m.	BT 3	Applying
6.	A suspension bridge is of 160 m span. The cable of the bridge has a dip of 12 m. the cable is stiffened by a three hinged girder with hinges at either end and at centre. The dead load of the girder is 15 kN/m. find the greatest positive and negative bending moments in the girder when a single concentrated load of 340 kN passes through it. Also find the maximum tension in the cable.	BT 3	Applying
7.	A suspension cable of 75 m horizontal span and central dip 6 m has a stiffening girder hinged at both ends. The dead load transmitted to the cable including its own weight is 1500 kN. The girder carries a live load of 30 kN/m uniformly distributed over the left half of the span. Assuming the girder to be rigid, calculate the shear force and bending moment in the girder at 20 m from left support. Also calculate the maximum tension in the cable.	BT 4	Analyzing
8.	A suspension cable of horizontal span 95m is supported at two different levels. The right support is higher than left support by 4m.The dip to the lowest point of the cable below the left support is 5m.The cross sectional area	BT 4	Analyzing
9.	A suspension is supported at two points 25m apart the left support is 2.5m above the right support, the cable is loaded with a UDL of 10kN/m throughout the span. The maximum dip in the cable from the left support is 4m. Find the maximum and minimum tension in the cable.	BT 4	Analyzing
10.	A suspension cable of 130m horizontal span is supported at the same level it is subjected to a UDL of 28.5kN/horizontal m. If the max tension in the cable is limited to 5000kN.Calculate the minimum central dip needed.	BT 3	Applying
11.	A cable of horizontal span 21m is to be used to support 6 equal loads	BT 3	Applying

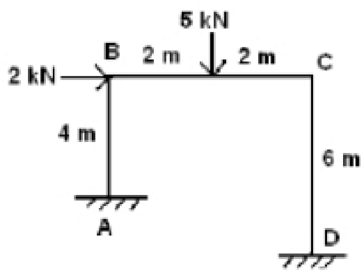
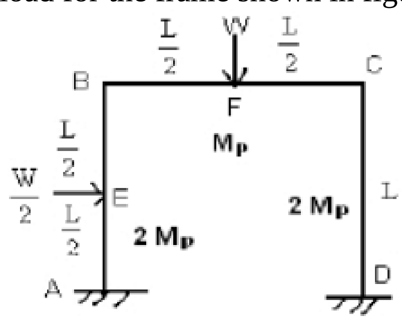
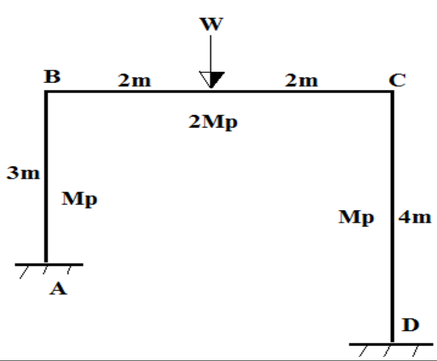
	of 40kN each at the spacing of 3m the central dip of the cable is 2m. Find the length of cable required and also its sectional area if the safe tensile stress limited to 750N/mm^2 .		
12.	A suspension cable is supported at two points 25m apart, the left support is 2.5m above the right support. The cable is loaded with the UDL of 10 kN/m below the span. The maximum width in the cable from the left support is 4m. Find the maximum and minimum tension in the cable.	BT 3	Applying
13.	A suspension cable of span 100m is subjected at the same level. It is subjected to a UDL of 28.5kN/m. If the maximum tension in the cable is limited to 4000kN. Calculate the minimum central dip needed.	BT 4	Analyzing
14.	A Suspension bridge cable of 90 m span and central dip 6 m is suspended from the same level at two towers. The bridge cable is stiffened by three hinged girder which carries a single concentrated load of 25kN at a point of 40m from one end. Shetch the SFD for the girder.	BT 5	Evaluating
15.	A suspension bridge has a span of 60m with a 15m wide runway. It is subjected to a load 35KN/m including self-weight. The bridge is supported by a pair of cables having a central dip of 6m.Find the cross sectional area of the cable necessary, if the maximum permissible stress in the cable material is not to exceed 650 MPa	BT 3	Applying
16.	A suspension cable is supported at 2 points 30m apart .The left support is 3m above the right support. The cable is loaded with a uniformly distributed load of 40kN/m throughout the span. The maximum dip in the cable from the left support is 5m. Quote the maximum and minimum tensions in the cable.	BT 4	Analyzing
17.	A cable of span 100 m has its ends at heights 8m and 15 m above the lowest point of the cables. It carries a UDL of 10KN/m per horizontal run of the span. Determine the horizontal and vertical reactions at the supports. What is the length of the cable?	BT 4	Analyzing
	PART – C		
Q.No	**Questions**	**BT Level**	**Competence**
1.	A suspension cable of span 100m and dip 10m carries a uniformly distributed load of 8kN/m of horizontal span over the full span. Find the vertical and horizontal forces transmitted to the supporting pylons, (a) If the cable is passed over a smooth pulley. (b) If the cable is clamped to a saddle with rollers on the top of the piers. The anchor cable makes 30^0 to the horizontal at the pylons.	BT 5	Evaluating
2.	A suspension bridge of 250m span has two numbers of three hinged stiffening girder supported by cables with a central dip of 25m. If 4 point load of 300kN each are placed at the centre line of the roadway at 20, 30, 40 and 50m from the left hand hinge, Estimate the shear force and bending moment in each girder at 62.5m from each end.	BT 4	Analyzing

	Estimate also the maximum tension in the cable.		
3.	A three hinged stiffening girder of a suspension bridge of 100 m span subjected to two point loads 20 kN each placed at 10m, 15m and 20 m, respectively from the left hand hinge. Determine the bending moment and shear force in the girder at section 30 m from each end. Also determine the maximum tension in the cable which has a central dip of 10 m.	BT 4	Analyzing
4.	A suspension cable has a span of 120m and a central dip of10m is suspended from the same level at both towers. The bridge is stiffened by a stiffening girder hinged at the end supports. The girder carries a single concentrated load of 100kN at a point 30m from left end. Assuming equal tension in the suspension hangers. Find The horizontal tension in the cable and the maximum positive bending moment.	BT 5	Evaluating
5.	A semi circular beam of radius R in plan is subjected to UDL and simply supported by three columns spaced equally. Derive the expression for bending moment and torsional moment at x-be a point on the beam making an angle a' with axis passing through the base of the circle.	BT 5	Evaluating

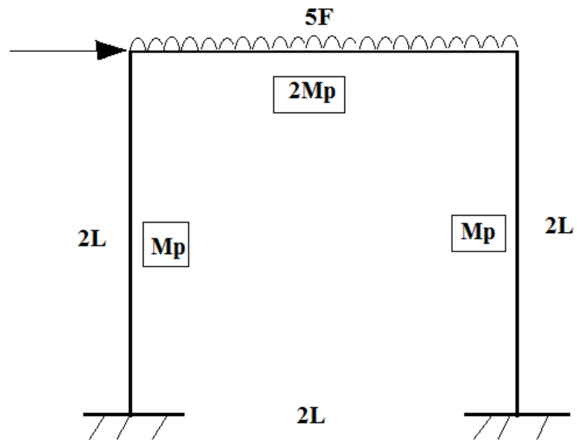
UNIT V: PLASTIC ANALYSIS			
Plastic theory - Statically indeterminate structures – Plastic moment of resistance – Plastic modulus – Shape factor – Load factor – Plastic hinge and mechanism – collapse load - Static and kinematic methods –Upper and lower bound theorems –Plastic analysis of indeterminate beams and frames.			
Part - A			
Q. No.	**Questions**	**BT Level**	**Competence**
1	Define the term load factor.	BT 1	Remembering
2	Define shape factor.	BT 1	Remembering
3	Define plastic hinge.	BT 1	Remembering
4	What is a mechanism?	BT 1	Remembering
5	Classify the different types of mechanisms.	BT 1	Remembering
6	Differentiate between plastic hinge and mechanical hinge.	BT 1	Remembering
7	Define collapse load	BT 2	Understanding
8	Write the assumptions made for plastic analysis.	BT 2	Understanding
9	Explain Plastic Theory in brief.	BT 2	Understanding
10	List out the shape factors for rectangular, triangular, circular and diamond sections.	BT 2	Understanding
11	Write the section having maximum shape factor.	BT 3	Applying
12	Compose upper bound theory.	BT 3	Applying
13	Discuss lower bound theory.	BT 2	Applying
14	Classify the types of frames.	BT 1	Remembering
15	Explain about symmetric frames and how are they analyzed.	BT 3	Applying
16	Explain about unsymmetrical frames and how are they analyzed.	BT 3	Applying
17	Formulate the shape factor of a hollow circular section in terms of the shape factor of an ordinary circular section.	BT 3	Applying
18	Formulate the governing equation for bending.	BT 3	Applying
19	Compose plastic moment of resistance.	BT 1	Remembering
20	Describe plastic modulus of a section Z_P.	BT 3	Applying
21	Give the theorems for determining the collapse load.	BT 1	Remembering
22	Define Plastic modulus.	BT 2	Understanding
23	Draw the stress distribution in a section which is fully plastic?	BT 2	Understanding
24	Derive the shape factor for rectangular cross section?	BT 2	Understanding
25	What are unsymmetrical frames and how are they analyzed?	BT 2	Understanding

Part -B			
Q. No.	**Questions**	**BT Level**	**Competence**
1.	Calculate the shape factor for a Rectangle section and Diamond section of breadth 'b', depth'd'.	BT 4	Analyzing
2.	A mild steel I-section 200mm wide and 250mm deep has a mean flange thickness of 20mm and a web thickness of 10mm.Analyse the S.F. and the fully plastic moment if σ_y=252N/mm².	BT 4	Analyzing

3.	Analyse the shape factor of the I-section with top flange 100mm wide, bottom flange 150mm wide, 20mm thick and web depth 150mm and web thickness 20mm.	BT 3	Applying
4.	Examine the shape factor of the T-section beam of dimension 100x12mm web dimension 138x12mm thick.	BT 4	Analyzing
5.	Determine the collapse load in case of a fixed beam with w/unit length throughout the span by using upper bound theorem.	BT 3	Applying
6.	A continuous beam ABC is loaded as shown in the Fig. Examine the required M_p if the load factor is 3.2. 	BT 4	Analyzing
7.	A fixed beam of span ‘l’ carries a uniformly distributed load ‘w’ on the right half portion. Find the value of collapse load $W_{c.}$ The beam is of uniform moment of resistance.	BT 4	Analyzing
8.	A Simply supported beam of span 5m is to be designed for a udl of 25 kN/m. Design a suitable I section using plastic theory, Assuming yield stress in steel as f_y = 250 N/mm^2	BT 3	Applying
9.	A beam fixed at both ends is subjected to two concentrated loads ‘W’, each at one third points of the span. Determine the collapse load for the beam in terms of its M_p.	BT 5	Evaluating
10	A uniform beam of span 4 m and fully plastic moment M_P is simply supported at one end and rigidly clamped at other end. A concentrated load of 15 kN may be applied anywhere within the span. Find the smallest value of M_P such that collapse would first occur when the load is in its most unfavorable position.	BT 4	Analyzing
11.	A three span continuous beam ABCD has the span lengths of AB= BC= CD=8m and carries an udl of 40kN/m completely covering the spans and A & D are simply supported ends. If the load factor is 1.5 and Shape factor is 1.15 for the “T” section. Find the section modulus needed. Assume the yield stress for the material as 300N/mm^2.	BT 3	Applying
12.	Determine the collapse load of the beam load as shown in fig. 	BT 4	Analyzing

13.	A two span continuous beam ABC has span length AB=6m and BC=6m and carries an udl of 30 kN/m completely covering the spans AB and BC. A and C are simple supports. If the load factor is 1.8 and the shape factor is 1.15 for the I-section, Evaluate the section modulus, assume yield stress for the material as 250N/mm².	BT 4	Analyzing
14.	Find the fully plastic moment required for the frame shown in figure, if all the members have same value of M_P. 	BT 3	Applying
15.	Find the collapse load for the frame shown in figure. 	BT 4	Analyzing
16.	Examine and find out the collapse load for the frame shown in fig. 	BT 3	Applying
17.	A two span continuous beam ABC has span AB=12m, BC=24m subjected to an UDL of 5kN/m on span AB with M_p and on span BC two point load 60kN and 90kN are placed at a interval of 8m from B with $2M_p$.Determine the required M_p if the load factor is 3.2.	BT 4	Analyzing

Part -C			
Q. No.	**Questions**	**BT Level**	**Competence**
1.	Find the collapse load for the portal frame as shown in fig.	BT 4	Analyzing

			
2	A Rectangle portal frame of span L and height L/2 is fixed to the section through with its fully plastic moment of resistance equal to My. It is loaded with point load W at the center of span as well as a horizontal force W/2 at its top right corner. Calculate the value of W at the collapse of the frame	BT 4	Analyzing
3	Derive the shape factor for I section and circular section	BT 4	Analyzing
4	Analyze a propped cantilever of length L and subjected to a uniformly distributed load of w/m length of entire span and also find the collapse load.	BT 5	Evaluating
5	Determine the collapse load ‘W’ for a three span continuous beam of constant plastic moment ‘M_P’ loaded with point load in span AB and BC at center as W and 2W at the center in span CD. With the span length AB=BC=CD=L.	BT 5	Evaluating