MOHAMMED SATHAK AJ COLLEGE OF ENGINEERING

DEPARTMENT OF CIVIL ENGINEERING

QUESTION BANK

VII SEMESTER

CE8703 - Structural Design and Drawing

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UNIT – I – RETAINING WALLS

Q. NO	QUESTIONS	BT LEVEL	COMPETANCE
1.	A square RCC column of size 300 mm x 300 mm carrying an axial load of 500kN.If the safe bearing capacity of the soil is 150kN/m^2. Design a suitable footing. Use M20 concrete and Fe415 steel.	BT-4	Analyzing
2.	Design and Sketch the details of reinforcements of a footing which carries a rectangular RCC column of size 300 mm x 500 mm with an axial load of 900kN.If the safe bearing capacity of the soil is 200kN/m^2 Use M25 concrete and Fe415	BT-4	Analyzing
3.	A Circular RCC column of size 300 mm diameter carrying an axial load of 500kN.If the safe bearing capacity of the soil is 200kN/m^2. Design a suitable footing. Use M20 concrete and Fe415 and Sketch the details of reinforcements	BT-4	Analyzing
4.	Design a combined footing for the two columns at a multi-storey building. The columns of size 400mmx400mm transmit a working load of 300kN each and they are spaced at 5m c/c .The safe bearing capacity of soil at site is 200kN/m^2. Adopt M20 grade concrete and Fe415 grade steel. Sketch the details of reinforcements in the combined footing.	BT-4	Analyzing
5.	Analyze and Design the strap footing for two columns C1 and C2 carrying a load of 600 kN and 800 kN respectively. Size of the column is 400 X 400 mm and us spaced at a distance of 4 m centre to centre. The face of the column C1 is on the property line. The bearing capacity of the soil is 200 kN/m^2. Use M20 and Fe 415 grades.	BT-4	Analyzing
6.	Two columns carrying 500 kN and 650 kN spaced 3.75 m apart and they have to provide with a foundation on soil having a net safe bearing capacity of 160 kg/cm2. The footing must be restricted to 2.25 m. Use M 25 grade concrete and Fe 415 grade steel. Analyze and design a combined footing.	BT-4	Analyzing
7.	Write down the step by step design procedure of trapezoidal combined footing with neat model sketch.	BT-1	Remembering
8.	Design a Cantilever retaining wall to retain 4m of horizontal backfill. The Density of the soil is 18kN/m^3 Safe Bearing Capacity of the Soil=200kN/m^2 Angle of internal Friction of Soil=30^o The Coefficient of friction between base slab and concrete=0.55 Use M20 concrete and Fe415 Steel. Draw cross section and longitudinal section.	BT-4	Analyzing
9.	Design Counterfort retaining wall to retain 6m of horizontal backfill. The Density of the soil is 16kN/m^3 Safe Bearing Capacity of the Soil=160kN/m^2 Angle of internal Friction of Soil=33^o Spacing of counterfort is 3m c/c. Use M20 concrete and Fe415	BT-4	Analyzing

	Steel. Draw sectional elevation and sectional plan of counterforts at the base.		
10.	Design a Cantilever retaining wall with sloping surcharge to retain 4.5m of backfill. The Density of the soil is 1500 kg/m^3 Safe Bearing Capacity of the Soil=200kN/m^2 Angle of internal Friction of Soil=30^o The Coefficient of friction between base slab and concrete=0.55 Surcharge angle = 20^o Use M20 concrete and Fe415 Steel. Draw cross section and longitudinal section.	BT-4	Analyzing
11.	Write down the step by step design procedure of Counterfort retaining wall with neat model sketch.	BT-1	Remembering
12.	Differentiate the design steps between cantilever and L-Shaped retaining wall.	BT-2	Understanding
13.	Estimate the reinforcement and design a T shaped cantilever retaining wall for the following data. Height of the wall above ground 3.5m Depth of foundation 1.3m Safe Bearing Capacity of the Soil=140kN/m^2 Angle of internal Friction of Soil=25^o The Coefficient of friction between base slab and concrete=0.44 Unit weight of earthfill is 18kN/m^3. Adopt M25 grade concrete and Fe 415 grade steel.	BT-4	Analyzing
14.	Design Counterfort retaining wall to retain 9m of horizontal backfill. The Density of the soil is 16kN/m^3 Safe Bearing Capacity of the Soil=200kN/m^2 Angle of internal Friction of Soil=30^o Surcharge angle = 10^o Spacing of counterfort is 3.5m c/c. Use M20 concrete and Fe415 Steel. Draw sectional elevation and sectional plan of counterforts at the base.	BT-4	Analyzing

UNIT II – FLAT SLAB AND BRIDGES

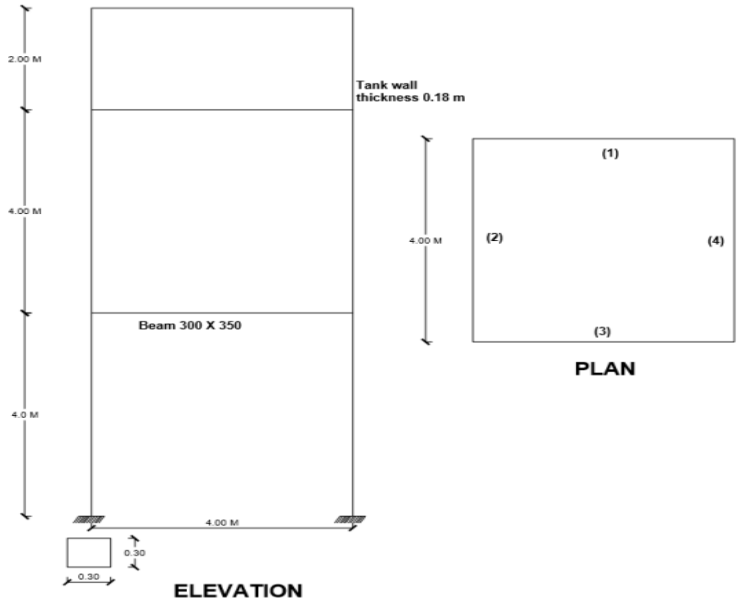
Q. NO	QUESTIONS	BT LEVEL	COMPETANCE
1.	Design a slab over a room 5 m x 7 m as per I.S. code. The slab is supported on masonry walls all round with adequate restraint and the corners are held down. The live load on the slab is 330 N/m^2. The slab has a bearing of 150 mm on the supporting walls. Assume the grade of materials.	BT-4	Analyzing
2.	Design a one way reinforced concrete slab - simply supported at the edges for a public building with a clear span of 4 m supported on	BT-4	Analyzing

	200 mm solid concrete masonry walls. Live load on slab is 5 kN/m^2. Adopt M20 grade concrete and Fe 415 HYSD bars.		
3.	Design a simply supported RCC slab for a roof of a hall 4m x 10m width 230mm wall thickness all around. Assume a live load of 4 kN/m^2 and a finish $1kN/m^2$.Use M20 & Fe415 grade of materials.	BT-4	Analyzing
4.	A simply supported one way slab of 4 m span carries a live load of 3 N/m^2 and the load of floor finish as 1.25 kN/m^2. The slab is having a total depth of 150mm is reinforced with 8 mm diameter bars @100 mm c/c at a nominal cover of 20 mm. Assuming a permanent load equal to dead load plus 20% of live load, compute the total maximum deflection and check it as per code requirements. Use M20 concrete and Fe415 steel.	BT-4	Analyzing
5.	A flat slab system of a ware house is 24m X 24m and divided into 6m x 6m (interior slab) along column centre lines. Loading is estimated as $5kN/m^2$. Supporting column diameter is 400 mm. Choosing the thickness of the slab (from stiffness criteria) and appropriate dimensions for column head and drops, Design the Interior Panel and sketch the reinforcement details.	BT-4	Analyzing
6.	Design the exterior panel of a flat slab system of a ware house is 24m X 24m and divided into 6m x 6m panels. Loading is estimated as $5kN/m^2$. Supporting column diameter is 400 mm. Height of the storey is 3m. Thickness of slab at column strip and middle strip is 300 mm and 200 mm respectively. Sketch the reinforcement details also.	BT-4	Analyzing
7.	Design an Interior panel of a flat slab system for an industry workshop layout of size 20m X 30m. Column and middle strips are kept equal. Loading class is 750 $kg/m^{2.}$ Use M25 and Fe 250 grade of materials.	BT-4	Analyzing
8.	Design an Interior panel of a column grid 8m X 8m. Isolated Drops were provided. Column and middle strips are not equal. Loading class is 1000 $kg/m^{2.}$ Use M20 grade concrete and grade I steel.	BT-4	Analyzing
9.	Design a Deck slab bridge single lane for Class A loading with the following data Clear Span - 3m Road width - 3.8m Safety kerbs - 60cm wide Average thickness of wearing coat - 8 cm Materials - M20 and grade I steel & Use IRC Standards.	BT-4	Analyzing
10.	Design a Deck slab bridge two lane for Class A loading with the following data Clear Span - 6 m Road width - 6.8m Safety kerbs - 60cm wide Average thickness of wearing coat - 8 cm Materials - M15 and grade I steel & Use IRC Standards.	BT-4	Analyzing
11.	Differentiate the design steps between Interior and Exterior panel design of a flat slab in detail.	BT-1	Remembering
12.	Design a Deck slab bridge two lane for Class AA loading (tracked vehicle) with the following data	BT-4	Analyzing

	Clear Span - 6 m Road width - 6.8m Safety kerbs - 60cm wide Average thickness of wearing coat - 8 cm Materials - M15 and grade I steel Use IRC Standards.		
13.	Write down the design procedure of Truss girder bridge in detail.	BT-4	Analyzing
14.	Write down the design procedure of steel foot over bridge in detail.	BT-4	Analyzing

UNIT III – LIQUID STORAGE STRUCTURES

Q. NO	QUESTIONS	BT LEVEL	COMPETANCE
1.	Design a circular tank with flexible base for capacity of 500000 liters. The depth of water is to be 4m, including a free board of 300mm.Overall height of the tank is restricted to 5m. Use M25 grade concrete and Fe415 grade steel.	BT-4	Analyzing
2.	Design an underground tank of internal dimensions 8 m x 2 m x 2 m. the soil surrounding the tank is likely to get wet. Angle of respose of soil in dry state is 30^0 and in wet state is 6^0 soil weighs 20 kN/m^3.	BT-4	Analyzing
3.	Write down the design procedure as per IS code for dome, top ring beam and side walls in an over head water tank.	BT-1	Remembering
4.	Design a rectangular RC water tank (resting on ground) with an open top for a capacity of 80000 litres. The inside dimension of the tank may be taken as 6 m X 4 m. Use M20 grade of concrete and Fe 250 grade I mild steel. Sketch the reinforcement details also.	BT-4	Analyzing
5.	Design a circular water tank of capacity $400m^3$ resting on ground and having a fixed base. Use M25 and Fe 415 grade of materials.	BT-4	Analyzing
6.	Design a rectangular RC water tank (resting on ground) with an open top for a capacity of 90000 litres. The inside dimension of the tank may be taken as 7.5 m X 3 m. Use M20 grade of concrete and Fe 415 grade I mild steel. Sketch the reinforcement details also.	BT-4	Analyzing
7.	Design an underground water tank 4m X 10m X 3m deep. the sub soil consists of sand having angle of repose of 30^o and saturated unit weight of 17 kN/m^3. The water table is likely to rise up to ground level. Use M20 concrete and HYSD bars.	BT-4	Analyzing
8.	An overhead flat bottomed cylindrical RCC water tank for a capacity of 100 Kilo litres. The top of the tank is covered with a dome. the height of the staging is 12m above G.L. Provide 2m depth of foundation. Intensity of pressure is taken as $1.5kN/m^2$. SBC of the soil is taken as 100 kN/m^2. Bracings are at 4m intervals with columns supporting them as 6 no's. Adopt M 25 grade of concrete and Fe 415 grade of steel. Design the following 1. Size of the tank 2. Ring beam at junction of dome and side walls 3. Side walls of tank 4. Bottom ring girder	BT-4	Analyzing

	5. Tank floor slab		
9.	Design a cylindrical steel tank with hemispherical bottom for a capacity of 350 m^3 with the elevation of the tank as 18 m. The free board is 15cm and bearing on the concrete is 40 $kg/cm^{2.}$ Take SBC of soil as 15 t/m^3. Use IS 804, IS 800 and IS 875 code books.	BT-4	Analyzing
10.	Design a cylindrical steel tank with hemispherical bottom for a capacity of 200 m^3 with the elevation of the tank as 20 m. The free board is 15cm and bearing on the concrete is 40 $kg/cm^{2.}$ Take SBC of soil as 12 t/m^3. Use IS 804, IS 800 and IS 875 code books.	BT-4	Analyzing
11.	Give the step by step design methodology for Intze type water tank.	BT-1	Remembering
12.	Give the design procedure of hemispherical steel water tank.	BT-1	Remembering
13.	Design an Open Elevated water tank of capacity 100000 litres with free board 15 cm and Elevation 15 m. Take wind load as 150 kg/m^2. Use M20 and Fe 250 grade of materials.	BT-4	Analyzing
14.	Design the overhead water tank show in figure using M20 and Fe415 grade of materials 	BT-4	Analyzing

UNIT IV – INDUSTRIAL STRUCTURES

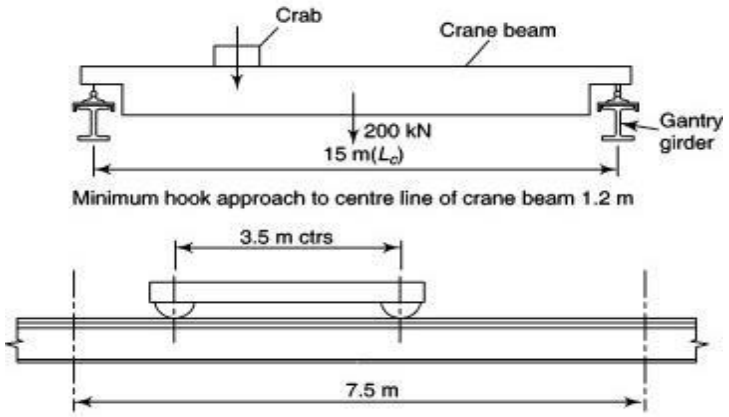
Q. NO	QUESTIONS	BT LEVEL	COMPETANCE
1.	Design an I-section for an industrial building to support a galvanized corrugated iron sheet roof. Given: Spacing of the trusses = 5.0 m Spacing of purlin = 1.5 m Inclination of main rafter to horizontal = 30^o Weight of galvanized sheets taking into account laps and connecting bolts = $130N/m^2$ Imposed snow load = $1.5kN/m^2$ Wind load = 1.0 kN/m^2	BT-4	Analyzing
2.	A column of ISMB 400 is subjected to an axial force of	BT-4	Analyzing

	750kN. Analyze and design suitable base plate. Assume necessary data required.		
3.	Design a column with single lacing system to carry a factored axial load of 1500kN. The effective height of the column is 4.2m. Use two channels placed toe to toe	BT-4	Analyzing
4.	Design a suitable slab base for a column section ISHB 400@ 822N/m. Supporting an axial load 500kN. The base plate is to rest on a concrete pedestal of M20 grade concrete.	BT-4	Analyzing
5.	A built up column consists ISHB 400@ 77.40 kg/m with one 300mm x 12mmflange plate on each side. The column carries an axial load of 2600kN. Determine the suitable dimension for a gusseted base, if the column is supported on concrete pedestal with a bearing pressure of $5N/mm^2$.	BT-4	Analyzing
6.	A batten column of 10-m long is carrying a factored load of 1150 kN. The column is restrained in position but not in direction at both ends. Design a built up column using channel sections placed back to back	BT-4	Analyzing
7.	A steel column ISHB 400 @ 759.3 N/m is subjected to a factored axial load of 2000 kN. Design a slab base plate for the column. Assume that the bearing surfaces of the column and base plate are machined and the concrete footing is of M20 grade.	BT-4	Analyzing
8.	Design an angle purlin for the following data by simplified method: Spacing of truss = 3.5 m Spacing of purlins = 1.6 m Weight of A.C. sheets including laps and fixtures = 0.205 kN/m^2 Live load = 0.6 kN/m^2 Wind load = 1 kN/m^2. Inclination of main rafter of truss = 21^0.	BT-4	Analyzing
9.	Design a steel roof truss to suit the following Span of truss = 10 m Type of Truss = Fan-Type Roof Cover = Galvanized corrugated sheet Materials = Rolled steel angles Spacing of roof truss = 4.5 m Wind Pressure = 1.0 kN/m^2 Draw the elevation of roof truss and detail the joints.	BT-4	Analyzing
10.	Design a tubular truss to suit the following Span of truss = 16 m Type of Truss = Fink-Type Roof Cover = Galvanized corrugated sheet Materials = steel tubular confirming to IS 1161-1976 Spacing of roof truss = 4.5 m Wind Pressure = 1.0 kN/m^2 Draw the elevation of roof truss and detail the joints.	BT-4	Analyzing
11.	Write the design procedure of Steel roof truss in detail.	BT-1	Remembering
12.	Design a purlin for a roof truss having the following data: Span of the truss = 6.0 m Spacing of truss = 3m c/c Inclination of roof = 30^o Spacing of Purlin = 2m c/c	BT-2	Understanding

	Wind pressure = 1.5 kN/m^2 Roof coverage= A.C Sheeting weighing 200 N/m^2 Provide a channel section Purlin.		
13.	A beam-column of effective length of 6 m carries an axial load of 450 kN and equal end moments of 50 kN-m each about the major axis. Design the H-Section of the Column. Assume that members in the frame where side sway is prevented and not subjected to transverse loading between their supports and column bends either in single or in double curvature.	BT-4	Analyzing
14.	A column having effective length of 6 m carries an axial load of 300 kN, along with end moments of 50 kN-m about its major axis and 10 kN-m about its minor axis. Find suitable H- Section for the column. Take C_m = 1.0 – Major axis & C_m = 0.8 – Minor Axis	BT-4	Analyzing

UNIT V – GIRDERS AND CONNECTIONS

Q. NO	QUESTIONS	BT LEVEL	COMPETANCE
1.	Design a welded plate girder (with Thick web plate) of 20m span to support a UDL (live load) of 70kN/m over the span with yield stress of steel as 250 N/mm^2. Use IS 800-2007 and steel tables.	BT-4	Analyzing
2.	Design a welded plate girder (with Thin web plate of 8 mm) of 18m span to support a UDL (live load) of 60kN/m over the span with yield stress of steel as 250 N/mm^2. Use IS 800-2007 and steel tables.	BT-4	Analyzing
3.	Explain in detail about the behavior of components in gantry girders.	BT-1	Remembering
4.	Explain the step by step procedure for design of horizontal stiffeners in a plate girder.	BT-2	Understanding
5.	Design a welded plate girder for a multi storey departmental store for a span of 20m as per NBC and IS codal provisions. Assume necessary data required.	BT-4	Analyzing
6.	Design a welded plate girder (with Thin web plate of 8 mm) of 20m span to support a UDL (live load) of 70kN/m over the span with yield stress of steel as 250 N/mm^2. Use IS 800-2007 and SP-6.	BT-4	Analyzing
7.	Explain the step by step procedure for design of Intermediate stiffeners in a plate girder	BT-2	Understanding
8.	Design a hand operated overhead crane, which is provided in a shed, whose details are: Capacity of crane = 50 kN Longitudinal spacing of column = 6m Center to center distance of gantry girder = 12m Wheel spacing = 3m Edge distance = 1m Weight of crane girder = 40 kN Weight of trolley car = 10 kN	BT-4	Analyzing
9.	Find the suitable design for a gantry girder to be used in an industrial building carrying an EOT crane for the following data:	BT-4	Analyzing

	Crane capacity = 200 kN. Total self-weight of all components = 240 kN Minimum approach at the carne hook of gantry girder = 1.2m Wheel base = 3.5m C/C distance between gantry rails = 16m C/C distance between columns = 8m Self-weight of rail section = 300 N/m Yield stress = 250 N/mm^2 Design the main gantry section. Connection design not required.		
10.	Explain the step by step procedure for design of Gantry Girder.	BT-4	Analyzing
11.	Explain the step by step procedure for design of vertical stiffeners in a plate girder.	BT-1	Remembering
12.	Discuss about moment resisting connections and its design in detail.	BT-2	Understanding
13.	Design a gantry girder, without lateral restraint along its span, to be used in an industrial building carrying an overhead travelling crane for the following data  Centre-to-centre distance between columns (i.e., span of the gantry girder) = 7.5 m Crane capacity = 200 kN Self-weight of the crane girder excluding trolley = 200 kN Self-weight of trolley, electrical motor, hook, etc. = 40 kN Minimum hook approach = 1.2 m Distance between wheel centres = 3.5 m Centre-to-centre distance between gantry rails (i.e., span of the crane) = 15 m Self-weight of the rail section = 300 N/m Yield stress of steel = 250 MPa	BT-4	Analyzing
14.	Explain about the design of eccentric shear and its design of section.	BT-4	Analyzing