ASSIGNMENT 1: INTRODUCTION

1	Explain Working stress method and Limit state method of structural Design Philosophy.	A
2	Define (i) Limit State (ii) Characteristic strength (iii) Partial Safety Factor	A
3	Write Advantages and Disadvantages of R.C.C. Structures.	A
4	Discuss different kinds of loads to be taken into account for the design.	A

DESIGN OF BEAMS

ASSIGNMENT 2: FLEXURE - SINGLY REINFORCED BEAM

1	Explain the modes of failure for Under- reinforced and Over- reinforced beam	A
2	Sketch neatly the Design Stress and Strain Block Parameters and derive equation for Depth of Neutral Axis and Moment of Resistance for a balanced beam section.	A
3	For Limiting Singly Reinforced section 300x500mm effective, Calculate the following Take M20 and Fe415 Steel 1. maximum compression stress in concrete and max tensile stress in steel 2. Maximum Depth of Neutral axis3.Lever arm4. Total compression and Tension	C
4	Find the Moment of Resistance of a singly reinforced concrete beam of 200mm width and 410 mm effective depth, reinforced with 4 bars of 12 mm diameter of Fe415 and M20 concrete. If span length is 3m the find out safe working UDL on beam.	C/A
5	Design a rectangular beam having 3.5 m simply supported clear span. Assume support width to be 230 mm. Beam is subjected to a dead load of 15 kN/m and live load of 20.0kN/m. Design the beam for M20 and Fe 415 grade of materials.	C
6	A reinforced concrete rectangular beam 300mmx600mm deep is subjected to a uniformly distributed load 25kN/m over a simply supported span of 6m. Design the beam for flexure using M20 and Fe415.	C
7	A singly reinforced rectangular beam of width 230 mm and 460 mm effective depth is reinforced with 3 no. 20 mm diameter bars. Find out the factored moment of resistance of the section.	A
8	Design a singly RC beam 300 mm wide and rectangular size resist working UDL of 30 kN/m including self weight of beam carries throughout of effective span 3.6 m. Use M-20 , Fe-415 and effective cover 50 mm also use steel dia. of 20mm.	A

ASSIGNMENT 3: FLEXURE- DOUBLY REINFORCED BEAM

1	An R. C. C. beam of size 300 wide and 500mm deep is reinforced by tension bars as 4nos. of 25mm dia. and compression bars as 2nos. of 16mm dia. Calculate the moment of resistance of beam if the clear cover is 30mm on both the sides.	C
2	An R. C. C. beam of size 300 wide and 600mm deep is reinforced by tension bars as 5nos. of 25mm dia. and compression bars as 3nos. of 20mm dia. Calculate the moment of resistance of beam if the clear cover is 25mm on both the sides.	A
3	A beam 250 mm X 500 mm effective deep is doubly reinforced with 2 Nos. 16 mm diameter compression steel and 4 Nos. 25 mm diameter tension steel. Effective cover is 50 mm. find the moment of resistance of doubly reinforced beam section. Use M20 grade concrete and Fe-415 grade steel.	A
4	A doubly reinforced beam of size 250mmx600mm is required to resist a moment of 300kN.m. Using concrete of grade M20 and Fe415, calculate the amount of steel required. Assume effective cover as 50mm.	A
5	Design a doubly reinforced section for a rectangular beam having an effective span of 4.0 m. The superimposed load is 40 kN/m and size of beam is 230 mm x 450 mm. Assume the suitable data. Design for the M25 and fe415 grades of materials.	C
6	Design a Doubly R.C. beam of 300 mm X 600 mm overall size to resist a Factored moment 310 kNm. The effective cover is 50 mm for tensile and Compression steel. Use M-20 concrete and Fe- 415 steel.	A

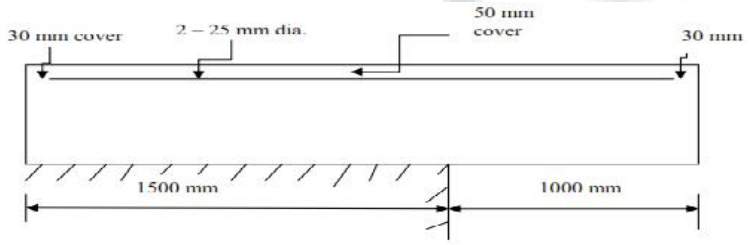
ASSIGNMENT 4: FLEXURE - T – BEAM

1	Find the Moment of Resistance of a T beam of M20 Concrete grade with following details: D_f = 120mm; b_f = 750mm; d = 400mm; b_w = 230mm; A_{st} = 4-16mm dia Fe415 bars	C
2	Calculate Moment of Resistance of a T beam of M20 Concrete grade with following details: D_f = 100mm; d = 400mm; b_w = 300mm; A_{st} = 4-16mm dia Fe415 bars, effective length of beam is 7 m.	C
3	An R. C. C. T-beam has breadth of flange as 1100mm, thickness of flange 120mm, effective depth 600mm and width of web 230mm. It is reinforced by 4 nos. of 20mm and 25mm dia. bars. Calculate the ultimate moment of resistance for the same.	C/A
4	Find the Moment of Resistance of a T beam of M15 Concrete grade with following details: D_f = 110mm; b_f = 730mm; d = 410mm; b_w = 230mm; A_{st} = 4-20mm dia Fe415 bars	C
5	A singly reinforced slab 120 mm thick is supported by T-beam spaced 3.2 m centre to centre. The effective depth and width of web are 560 mm and 450 mm respectively. 8 nos. of Tor steel of 20 mm dia are provided in 2 layers. The effective cover to the bars in lower layer is 50 mm. The effective span of simply supported beam is 3.60 m. Determine the depth of Neutral Axis and the Moment of resistance of T-beam section.	C
6	Find moment of resistance of a flanged T beam having 150 mm flange thickness,1500 mm effective flange width, 300 mm web thickness,450 mm effective depth reinforced using 6 nos.#20 bars at tension face	A
7	Design T beam for effective span of 4m. It has to support concrete slab 120 mm thick with LL = 2 kN/m^2. Take spacing of beam is 4m, M20 grade of concrete and Fe 415 steel.	

ASSIGNMENT 5: COMBINED FLEXURE AND TORSION DESIGN OF BEAM

1	Discuss the procedure for the design of beam subjected to combined bending and torsion in concrete.	A
2	A rectangular beam section of size 230 mm x 600 mm overall depth is subjected to a factored sagging BM = 48 kN.m; factored SF = 48 kN and factored TM = 18 kN.m. Design the main reinforcement only at the section. Use M20 – Fe 415.	C
3	A Reinforced Concrete beam of rectangular cross section 350mmx450mm effective depth is subjected to bending moment of 40kN.m, shear force of 25kN and torsion 15kN.m at the section. Design the beam assuming effective cover as 50mm.	A
4	An RCC beam of 200 mm wide, 500 mm deep is reinforced with 2-12 mm dia bars at top and 2-16 mm dia bars at bottom, with an effective cover of 40mm. Using M20 concrete and Fe 415 steel, Determine resistance of the beam in pure tension.	A

ASSIGNMENT 6: SHEAR DESIGN AND DEVELOPMENT LENGTH

	Shear Design of beam	
1	A simply supported RCC beam 250mm wide, 400mm effective depth is subjected to Ultimate Shear Vu of 150kN at supports. Tensile reinforcement at supports is 0.5%. Design shear stirrups near supports and also design nominal shear reinforcement at mid span for M15 concrete and Fe250 steel for stirrups.	
2	An R. C. C. beam has cross section of 230 X 500mm deep is reinforced by 4-16mm bars in tension zone. If it is loaded by factored shear force of 500kN, design for the appropriate vertical shear reinforcement with 8mm dia. bars.	C
3	A Simply R.C.C. beam of 300 mm X 500 mm overall size has 4 nos. 20 mm diameter bars of Fe-415 at an effective cover of 30 mm. The beam is subjected to Shear Force of 150 kN. Design the shear reinforcement. Use M-20 grade concrete & 8 mm diameter stirrups of Fe-250.	A
4	A simply supported R. C. C. beam with clear span of 5m, support width 230mm, size of 230 wide and 420mm deep, tension bars as 4nos. of 16mm dia. bars and clear cover of 25mm. If it is loaded by an all inclusive factored udl of 60kN/m, design the shear reinforcement near support only using 2 legged 6mm. mild steel stirrups.	C
5	A simply supported normal T- beam of 4.5 m clear span is loaded with characteristic load of 40 KN/m. it is reinforced with 4 no. 20 mm diameter bars at support. The section of the beam is 230 mm wide and 560 mm effective depth. Design the shear reinforcement at support. Use M20 and Fe415.	A
6	A RC beam 250X450 mm effective is reinforced with 4 Nos-20 mm diameter of Fe-415. The beam carries factored shear force of 200 KN. Find spacing of 8 mm diameter -2 legged – Fe-250 stirrups. Use M20.	
	Development Length	
1	A cantilever RC beam of 1m span is projected from column of 400mm width. The cantilever beam is provided with 2 bars of 25 mm diameter of Fe 415.Effective cover is 50mm. Determine the anchorage length.M20 concrete.  	C
2	A simply supported reinforced concrete beam of size 300 x 500 mm effective is reinforced with 4 bars of 16 mm dia HYSD steel of grade Fe-415. Determine the anchorage length of the bars at the simply supported end if it is subjected to a factored shear force of 350 kN at the centre of 300 mm wide masonry support. Concrete M20	A

ASSIGNMENT 7: SLAB DESIGN

1	Distinguish clearly between One way and Two way slab	A
2	What is meant by Aspect Ratio. State the limits of the same for One way and two way slabs. Also show the sharing of the loads on the adjacent beams of both the slabs by sketch.	A
3	Design a simply supported one way slab 3m x 7m supported on 200 mm wide beams. The slab carries a 2 kN/m2 live load and 1.2 kN/m2 finish load. Use M20 concrete and Fe415 steel. Check criteria for deflection and development length.	C
4	Design a simply supported one way R. C. C. slab with clear span of 3m X 7m. Assume the live (Imposed) load as 4kN/m2 and floor finish load as 1kN/m2.	A
5	Design a one way simply supported slab for a room of 3.3 m X 9.6 m. the slab is resting on 230 mm thick wall. Take L.L= 2.5 KN/m2. Use M-20 grade concrete and Fe-415 steel. Check the slab for deflection. Show reinforcement details with a neat sketch.	
6	Design a two way slab continuous over all four sides having span of 3m X 4.5m. Assume the live (Imposed) load as 2.5kN/m2 and floor finish load as 0.75kN/m2.	C
7	Design a Reinforced Concrete slab for a room 6mx5m. The slab is to be cast monolithically over beams with corners held down. The width of supporting beams 230mm. Slab carries superimposed load of 3kN/m2. Use M20 and Fe415.	C
8	An R. C. C. slab of spans 4mx6m has only one long edge continuous and all other edges discontinuous. The slab is 130mm thick. It is loaded by live load of 4kN/m2 and floor finish load of 1kN/m2. Design main steel at bottom of 4m span and check for deflection assuming support width of 230mm.	A
9	Design a simply supported RCC slab having clear span 4 m X 4 m rested on the 230 mm thick brick wall, subjected to lie load of 3 KN/m2 and floor finish 1 KN/m2 for the corners held down condition. Provide detailed sketches. Checks are not required. Use M20 and Fe 415.	
10	Design a two way simply supported slab for a room of 3.3m X 3.3m. the slab is resting on 230 mm thick wall. Take L.L= 2.5 Kn/m2, F.F. = 1.0 KN/m 2. Use M-20 and Fe-415. Corners are not held down. Show reinforcement details with neat sketches.	

ASSIGNMENT 8: COLUMN DESIGN

1	Enumerate the difference between short and slender columns. State the code specifications for: a) minimum eccentricity for design of columns; b) longitudinal reinforcement; c) lateral ties.	A
2	What is difference in behavior of short and long compression members?	A
3	Design a short rectangular column to carry an axial load of 455KN. Take M20 grade of concrete and Fe415 grade of steel. Apply the check for the eccentricity. Unsupported length of column is 3m.	C
4	Calculate the area of steel required for a short RCC column 400mmx450mm to carry an axial load of 1100kN. Use fck=20MPa and Fe415 grade of steel.	A
5	An R.C.C. short column of size 400 mm x 500 mm is carrying a factored load of 3000 kN. Design the column assuming $e_{min} < 0.05D$. Use M25 concrete and Fe415 steel	
6	A short column of 300 mm x 500 mm size is subjected to an axial factored load of 2000 kN and factored moments M_{ux} = 80 kNm and M_{uy} = 60 kNm. Determine the main reinforcement only in the column if the moment due to minimum eccentricity is less than the applied loads. Use M20 – Fe 415 and 28 mm diameter bar.	
7	Design and detail RCC square column section to carry ultimate axial load 1800 kN. The effective length of column is 2.5m	
8	Design a circular column of diameter 400 mm subjected to a load of 1150 kN. The column is 3 m long and is effectively held in position at both ends but not restrained against rotation. Use M25 concrete and Fe415 steel.	A

ASSIGNMENT 9: FOOTING DESIGN

1	Explain one way shear check and two way shear check for footing design.	A
2	Write the design steps for the RC combined footing.	A
3	Sketch reinforcement detail of a rectangular combined footing to be provided for two columns. Draw plan, longitudinal and cross section	A
4	Design an isolated sloped footing for the column of size 300mmx400mm reinforced with 8 bars of 16mm diameter carrying an ultimate load of 1000kN. The safe bearing capacity of soil is 180kN/m2. Assume effective cover for bottom steel is 60mm.	C
5	Design an isolated sloped footing for the column of size 300mmx500mm reinforced with 6 bars of 20mm diameter carrying an ultimate load of 900kN. The bearing capacity of soil is 260kN/m2. Use M20 and Fe415. Effective cover for bottom steel is 60mm.	A
6	Design and detail isolated footing for an axially loaded column 400 x 400 mm in c/s and carrying 1500 kN working load. Take SBC of soil as 200 kN/m^2	
7	Design a square footing of uniform thickness for an axially loaded column of 500 mm x 500 mm size. The safe bearing capacity of soil is 180 kN/m^2. Load on column is 900 kN.	

ASSIGNMENT 1 : INTRODUCTION

1	Discuss advantages and disadvantages of structural steel.	A
2	What is the difference between Mild steel and HYSD steel. Also state the few characteristics of both types of steel.	A

ASSIGNMENT 2 : BOLTED CONNECTION

1	Draw neat and clean figures for beam to beam connection and beam to column connection in steel design.	A
2	State advantages and disadvantages of bolted and welded connection.	A
3	Two plates 80 mm wide and 12 mm and 20 mm thick are connected by lap joint to resist design tensile load of 70 KN. Design a lap joint using M16 bolts of grade 4.6 and grade 410 plates and calculate the efficiency of joint.	A
4	Design a lap joint to connect two plates 300mm wide and 16mm thick using 20mm diameter bolts of grade 4.6. The applied load is 375 kN.	A
5	Deign lap joint to connect two plates 100x16 mm and 100x12mm to transfer 100 kN axial factored load. Use single row of 4.6 grade bolts. Plates are of steel grade 410.	A
6	Design the bolted connection to transmit an axial force equals to the strength of the plate. Here two plates of size 200 X 12 mm of grade 410 are to be connected by 22 mm diameter bolt by using butt joint. Assume grade of bolt is 4.6.	A
7	Two steel plates 200x8 mm of grade 410 are to be connected by 20 mm bolts of grade 4.6 using butt joint. Design the connection to transmit a pull equal to the strength of the plate.	A
8	A member of steel roof truss consists of two angles ISA 75x75x6 mm placed back to back on either side of 8mm thick gusset plate. The member carries ultimate tensile load of 200 kN. Determine no. of 16mm diameter, 4.6 grade ordinary bolts required for the joint. Take F_u as 410 MPa.	
9	A member of steel roof truss consist of two angle section ISA 90 X 90 X 6 mm placed back to back on either side of 8 mm thick gusset plate. The member carries an ultimate tensile load of 190 Kn. Design the connection if diameter of bolts provided is 20 mm of product grade 5.6. Ultimate tensile stress in the plate is 410 Mpa.	A

ASSIGNMENT 3 : WELDED CONNECTION

1	What are the advantages and disadvantages of welding connection.	A
2	Explain types of welding with neat sketches. Explain various notation of welding.	A
3	Design a fillet weld to connect ISA 65 X 45 X 8 mm with 12 mm thick gusset plate. The member carries a tensile load of 100 kN.	A
4	An ISA 125 X 75 X 8 mm is to be connected with8 mm thick gusset plate with its longer leg connected by 4 mm size weld to transfer an axial pull of 120 KN. Design the welded connection and show the details by sketch. Assume steel grade Fe 410.Provide weld on side and end of member.	A
5	Two plates of width 200 mm and thickness 100 mm are required to be designed, using welded connection for 100 % efficiency. Use slot's welds if required.	A
6	A tie member consists of ISMC 250 is connected to either side of the gusset plate of 12 mm thick. Design the welded joint to develop full strength of the tie plate if the overlap is limited to 400 mm.	A
7	An angle of section 100 X 100 X 8 mm is to be connected to gusset plate by 6 mm fillet weld on sides and at the end of the member. The member is carrying tensile load of 120 kN. Design the welded connection. Assume steel grade Fe 410 and field welding.	A
8	A beam ISMB 400 is connected to the flange of a column ISHB 300. The beam is transferring a factored end reaction of 250 KN and factored moment of 25 KN-m. Design a suitable welded connection with fillet weld on both the sided and at the top and bottom of the beam.	A

ASSIGNMENT 4 : TENSION MEMBER

1	What do you mean by "LUG ANGLE"?	A
2	A single equal-leg angle 100X75X10mm is connected to a gusset plate of 10mm thick at the ends with 6 bolts of 20mm diameter in a single line at a gauge distance of 60mm to transfer tensile force. Determine the design tensile strength of the angle. Assume edge distance as 40mm & pitch for the bolts as 50mm.	A
3	Determine the tensile strength of a roof truss diagonal 100 x 75 x 6 mm having fy = 250 MPa connected to gusset plate by 4 mm welds of 140 mm long at top and 310 mm long at bottom. The longer edge of 100 mm was connected to plate of 8mm thickness.	A
4	Design a tension member to carry a factored load of 230 KN. Use single unequal angle with 4 mm fillet weld for the connection to gusset plate. Length of member is 3m. Take Fy 250 MPa and Fu 410 MPa.	A
5	Design a tie member of roof truss subjected to working loads of 80 KN (DL) and 120 KN (LL). Use double angle connected back to back on either side of gusset 8 mm thick. Use bolted connection. Fy = 250 MPa and Fu = 410 MPa for both member and bolt material.	A
6	Design a tension member to carry a factored load of 300 kN. Use single unequal angle with 6 mm fillet weld for the connection to gusset plate. Length of member is 3.0 m.	
7	Design a tension member to carry a factored load of 260 KN. Use single unequal angle section with 6 mm fillet weld used to connect to the gusset plate of thickness 8 mm. Assume length of the member 3.5 m and fu for plate is 410 Mpa.	A

ASSIGNMENT 5 : COMPRESSION MEMBER

1	Explain the failure modes of steel section column.	A
2	Determine axial compressive load carrying capacity of a 2.3m long single angle strut ISA 75 X 50 X 8mm. The longer leg is connected to the gusset plate with two bolts at each end. Assume hinged condition and the load is applied concentrically to the angle. Take f_y = 250 MPa.	A
3	Compute the compressive strength of an angle section ISA 90 x 90 x 8 mm. The angle is loaded by one leg and is fixed. When it is connected by two bolts at each end.	A
4	A double angle discontinuous strut consists of 2- ISA 80 X 80 X 6 mm placed on the same side of the gusset plate of 10 mm thickness and tack bolted. The length of the member is 3.2 m between the intersections. Determine the compressive strength of the member. Assume Fu 410 MPa and Fy 250 MPa. Strut is hinged at both the ends.	A
5	A truss member is analyzed and found that following loads are acting on it. 1) Dead Load = 100kN (compression) and 2) Live Load = 75kN (compression). If the length of the member is 2.25m between the connections and is connected to the 10mm thick gusset plate, design the member comprising of 2 equal angle sections. Assume that the member is connected to gusset plate by more than 2 nos. of bolts.	
6	Determine the design axial load on the column section ISMB 350 having 3.0 m, hinged at both ends. Take fy = 250 MPa.	A
7	A compound column comprising of 2-ISMC 300 placed back to back at a distance of 160 mm has actual length 4.2 m with both ends effectively held in position and restrained against rotation. Find load carrying capacity of the column. Take fy = 250 MPa. Assume the column is laced.	
8	A steel column is loaded by a working load of 600kN. The height of column is 4.5 m with both ends fixed. It is braced in order to prevent buckling about the weaker axis at a half the length of the column.	A
9	A column section ISHB 250@ 500.3 N/m is carrying a factored load of 600 KN. design a suitable column splice. use 16 Φ 4.6 grade bolts and steel of grade Fe 410.	A
10	Calculate the design load carrying capacity of a compound column consisting of ISHB 250 @ 51 kg/m with one cover plate of 320 x 20 mm on each flange. The length of column is 4 m. Assume that its one end is fixed and other end is hinged.	A

ASSIGNMENT 6 : LACING & BATTENING

1	Draw the neat sketch of lacing systems, battening systems and slab base foundation for steel columns.	A
2	A built up column with 2 ISMC 350, back to back, at spacing of 150 mm, is carrying an axial load of 1000 kN. Length of column is 9 m. It is held in position both ends but not restrained in direction. Design a suitable double lacing system.	A
3	Design battening system for a built up column of 2 ISLC 250 placed at 140 mm back to back. The column is carrying factored axial load of 1200 kN and 6 m length. The both ends of the column are effectively held in position and restrained against rotation.	
	FOOTING DESIGN	
1	A steel column ISMB 600 is loaded by the factored axial compressive load 550 KN. Design the suitable slab base for the column if it is resting on the concrete of grade M30.	A
2	Design a slab base footing for built up column consisting of two ISLC 350 backto back separated by a distance of 180 mm and carrying factored load of 1400kN. Concrete grade M15 and steel Fe410, Bearing capacity of soil 250 kN/m2.	

ASSIGNMENT 7 : FLEXURAL DESIGN FOR BEAM

1	Discuss the procedure for the design of steel member subjected to both axial compressive force and bending moment.	A
2	Design a simply supported beam of span 7m carrying R.C.C. slab capable of providing lateral restraint to the top compression flange. The beam is subjected to total u.d.l. of 100 kN dead load excluding self weight plus 150 kN imposed load. In addition, the beam carries a point load at mid span made up of 50 kN dead load and 50 kN imposed load.	
3	Design a simply supported beam of span 6m, laterally unrestrained. The beam carries a working DL = 15 Kn/m and LL = 10 kN/m. use Fe 410 grade steel. The beam is laterally restrained by a cross beam framing at mid span.	A

ASSIGNMENT 8 : BEAM COLUMN AND TORSIONAL DESIGN

1	A column fixed at bottom and hinged at top is subjected to beam reaction of 400 kN (factored) at an eccentricity of 120 mm from the major axis of the section. Design the column. Consider length of column is 4m.	A
2	A cantilever beam of span 3.0 m is subjected to a load of 40 kN at an eccentricity of 30 mm. Design the beam.	