GANPAT UNIVERSITY

B. Tech. Semester: 5th Civil Engineering

Regular Examination Nov – Dec 2015

2CI504: ELEMENT OF STRUCTURAL DESIGN

Time: 3 Hours   Total Marks: 70

Instructions: (1) This Question paper has two sections. Attempt each section in separate answer book.

(2) Figures on right indicate marks.

(3) Be precise and to the point in answering the descriptive questions.

(4) CODE IS: 800-2007, IS 456-2000, IS 808-1989 and Scientific Calculator is allowed.

Section - I

Q – 1 (a) An isolated T beam of span 6m has following data: 06
Flange width available = 1000 mm
Depth of Slab = 100 mm
Effective depth of T Beam = 520mm
Breadth of web = 250 mm
Area of Steel = 6-28mm dia.
Determine ultimate moment of resistance of section if M20 and mild steel bar.

(b) Design an R.C.C slab of size 5mx6m, simply supported on four edges with   06
corners are not held down. The slab is carrying a load of 4kN/m^2 including floor finish. Use M20 and Fe415. Checks are not required.

OR

Q – 1 (a) A short column 250 mm X 400 mm is reinforced with 4-20 mm diameter   06
bars. Find the ultimate load carrying capacity of the column. Use M20 and Fe 415. Also find the spacing and diameter of lateral ties.

(b) A singly reinforced R.C.C beam 230 mm wide and effective depth 400mm   06
is reinforced with 4 bars of 16 mm diameter. Find out the depth of neutral axis, limiting depth of neutral axis, lever arm, total tension, total compression and specify type of beam. Use M20 and Fe 415.

Q – 2 (a) An R.C.C doubly beam 400 mm x 600 mm effective depth is carrying a   08
factored moment of 450 kNm. Determine the area of steel required if M20 and Fe415 are used. Take fsc = 342 N/mm^2.

(b) Write short note on various loads on the structure.   04

OR

Q – 2 (a) Design an R.C.C slab with a clear span of 3.0m×6.5m supported on the   08
sides over a 30cm thick wall and is carrying a live load of 6kN/m^2. Use M20 and Fe415.

(b) What are the various limit states? Explain briefly all of them.   04

Q – 3 Design an isolated square footing for a square column is 450 mm X 450 mm   11
for axial load of 800 kN. Safe bearing capacity of soil is 150 kN/m^2. Use M20 and Fe 250.

Q – 4 **(a)** Two plates of 8 mm thickness are connected by single - bolted Single cover butt joint using 16 mm bolts at 50 mm pitch. Calculate the efficiency of the joint. Use Fe 410 plate and 4.6 grade bolts. 03

(b) A Single unequal angle 100 x 75 x 10 mm is connected to 10 mm thick gusset plate at the ends with six no. of 16mm diameter bolts to transfer tension 250kN. Assume 4.6 grade bolts and Fe 410 steel with fy=250MPa, p =50mm & e =30 mm. Determine the net section rupture strength of the angle section 09
(a) If shorter leg is connected to gusset plate.
(b) If longer leg is connected to the gusset plate.

OR

Q – 4 **(a)** Determine bolt value of 18 mm diameter 8.8 grades HSFG bolts connecting two plates 10 mm thick and 160 mm wide. Grade of plate is 400Mpa. Also design the lap joint if it is subjected to tension load of 200kN. 09

(b) Design a tension member to carry a factored load of 300kN. Use single angle with 6mm fillet weld for the connection to gusset plate. Length of the member is 3m. Take fy =250kN, fu= 400MPa. 03

Q – 5 **(a)** Determine the Compressive strength of a single angle strut ISA 100 x 75 x 10 mm with the length of member 1.5m. The ends of the members is hinged. Use fy=250MPa. Assume that the load is applied through one leg when, 09
a) It is connected by 1 bolt at each end
b) It is connected by 2 bolt at each end

(b) Two plates 100 mm x 10 mm and 80 mm x 10 mm are connected in a lap joint by means of end fillet field weld. Design welded joint to transmit full strength of the plate. Steel used is Fe410 03

OR

Q – 5 **(a)** A Double angle discontinuous strut consists of 2 ISA 80 x 80 x 6 mm placed on the same side of gusset plate and take bolted. The length of the member is 3m, between the intersections. Determine the compression capacity of the member. Assume grade Fe410 steel with fy = 250MPa. Strut is fixed at both the end. 09

(b) Two plates 200 mm x 10 mm and 150 mm x 10 mm are connected in a lap joint using site welding. Design welded joint to transmit full strength of the plate. Steel used is Fe410. 03

Q – 6 **(a)** Define following terms: 05
a) Limit state of collapse
b) Limit state of serviceability
c) Over reinforced section
d) Depth of neutral axis
e) Lever arm

(b) A diagonal member of truss is an ISA 75x75x8mm welded in field to a gusset plate 10mm thick. The grade of steel used for angle is Fe410. Design the joint to the full strength of angle 06
a. If field weld is provide along length of member
b. If field weld is provide along all sides of the member

END OF PAPER