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V-Sem/CIVIL/2015(W)

( 2 )

**STRUCTURAL DESIGN - I**

( Code : CET-501)

Full Marks : 70

Time : 3 hours

Answer any five questions

Figures in the right-hand margin indicate marks

IS 456-2000 and SP-16 is allowed in examination

- 1. (a) What is the value of modular ratio for M20 concrete and Fe415 steel ? 2
- (b) Find out design constants of a rectangular section by taking M15 grade of concrete and Fe415 grade of steel. 5
- (c) Find out the depth of neutral axis of a singly reinforced RC beam of 240 mm width and 450 mm effective depth. It is reinforced with 4 bars of 16 mm diameter. Use M15 concrete and Fe415 steel. Use WSM and state type of beam it is. 7

( Turn Over )

- 2. (a) Define characteristic strength of concrete. 2
- (b) Write the minimum and maximum tension and compression reinforcement for beams. Also minimum reinforcement and maximum diameter of bars for slab as per IS specification. 5
- (c) Calculate the moment of resistance and area of steel required for limiting section if width of beam is 300 mm, total depth is 700 mm and effective cover is 50 mm. Use LSM. http://www.sctevtonline.com 7
- 3. (a) Mention any two advantages of a doubly reinforced beam. 2
- (b) Write down the assumptions made for flexure in limit state of design. 5
- (c) Determine the ultimate moment capacity of a doubly reinforced beam, if width is 300 mm, overall depth is 600 mm, area of tensile reinforcement is 2060 mm<sup>2</sup> and area of compressive reinforcement is 804 mm<sup>2</sup>. Take effective cover as 50 mm for both tension and compression. Use M20 and Fe415. Use LSM. 7

V-Sem/CIVIL/2015(W)(CET-501)

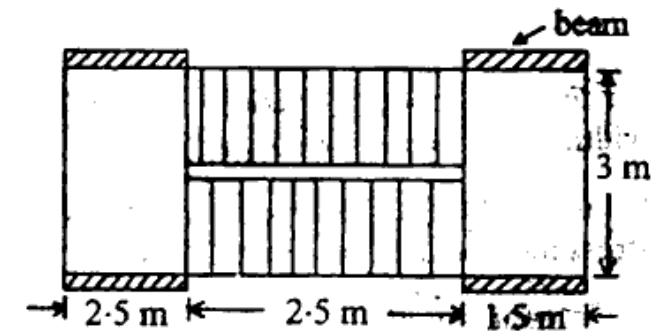
( Continued )

( 3 )

4. (a) Define development length. 2
- (b) A steel bar of 20 mm diameter of Fe415 grade is embedded in M25 concrete. Calculate its development length in tension and compression. 5
- (c) A simply supported beam (260 mm x 440 mm) reinforced with 4 numbers of 16 mm diameter bars as tension reinforcement is subjected to an inclusive load of 20 kN/m over a span of 3 m. Design suitable shear reinforcement. The materials are M20 and Fe415. 7
5. (a) Write the IS code provision for effective width of flange for an isolated T-beam. 2
- (b) Establish the comparison between working stress method and limit state method. 5
- (c) A T-beam of effective flange width of 1800 mm, thickness of slab 100 mm, width of rib 230 mm and effective depth of 500 mm is reinforced with 4 nos. 25 mm diameter bars. Calculate the factored moment of resistance if M20 and Fe415 is used. Use LSM. 7

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6. (a) Explain one way and two way slab. 2
- (b) Design a cantilever slab to carry a live load of 3 kN/m<sup>2</sup>. The overhang of slab is 1.25 m. Use M20 and Fe415. 5
- (c) Design a dog legged staircase of size as shown in figure. Take live load as 5 kN/m<sup>2</sup>, floor finish as 1 kN/m<sup>2</sup>, rise = 150 mm, tread = 250 mm. Use M25 and Fe415. Take floor height as 3.0 m. Assume any other data as per standard. 7



7. (a) What is the minimum number of bars for a circular column section? 2
- (b) A short RCC column 450 mm x 450 mm is provided with 8 bars of 16 mm diameter. If

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the effective length of column is 2.5 m, find ultimate load for the column. Use M20 and Fe415. Use LSM. 5

(c) Design a footing for the foundation of a brick wall 250 mm thick and transmitting a load of 200 kN/m of its length. The bearing capacity of soil is 160 kN/m<sup>2</sup>. Use M20 and Fe415. 7

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