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National Institute of Technology, Hamirpur (HP)  
End Semester Examination  
CE- 311 - RCC Design

Maximum Marks: 50

Time Allowed: 3.00 Hrs

**Note:** Attempt any five questions.

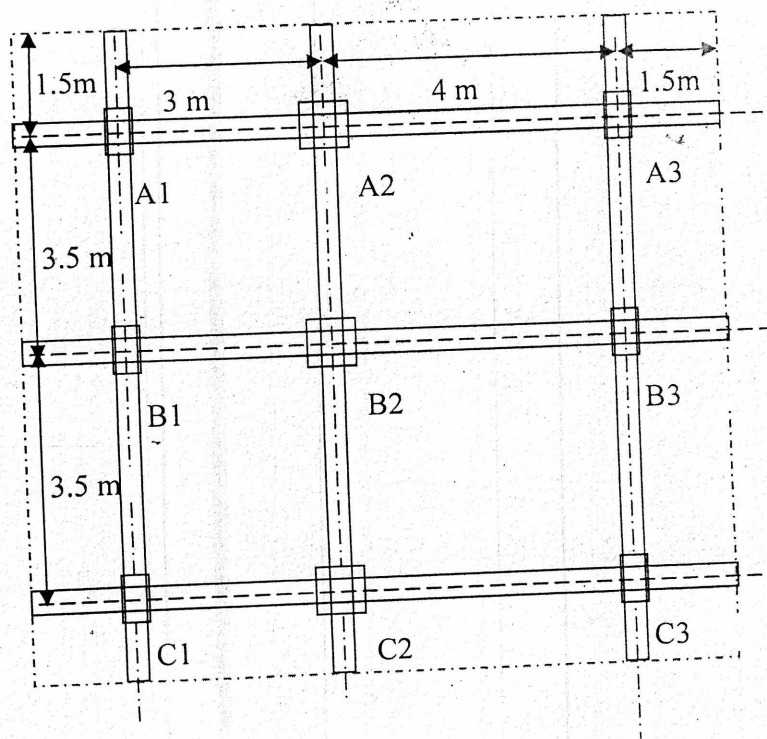
All Questions carry Equal Marks.

Use of all BIS codes as IS: 456-2000, IS 875-1987, IS:1893-2016, IS:13920-2016, SP-16 etc is allowed.

Q. 1 (a) What is the three major difference between the working stress method, ultimate load method and limit state method of design?

(b) Determine the limiting moment of resistance of a T beam RCC beam with rib having width of 300 mm, depth of 400 mm from bottom of slab to the soffit of beam. The beam is cast monolithically with a slab 100 mm thick reinforced with 8 mm diameter bars in both directions @120 mm c/c at an clear cover of 15 mm in midspan as well as supports. The span of the beams is 4.0 m in both longitudinal and transverse direction. The beam is reinforced with 6 bars of 25 mm diameter at a clear cover of 30 mm from soffit of beam. M20 grade of concrete and Fe 500 grade of steel are used in the construction.

Q. 2 The figure below shows a plan of a building at first floor with nine Columns. The size of the columns is 600 x 450 mm for corner columns and 600 mm x 600 mm for middle columns as shown. The beams are provided to support a 150 mm thick slab in both directions over the columns. The slab is projected 1.5 m on all sides of the building as shown by the dotted line. The slab is loaded with a live load of  $4.5 \text{ kN/m}^2$ . The height of the floor is 4m from the plinth level. Design the intermediate beam supported over columns A2-B2-C2. Show the reinforcement detail with the help of a longitudinal sketch and section at suitable locations.



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Q. 3 Design the slab panel lying within the columns A2-A3-B2-B3 shown in figure above. Consider the slab to carry an additional 250 mm thick waterproofing layer of Mud phuska at its top, whose unit weight is  $22 \text{ kN/m}^2$ . The live load on the slab is already stated as  $4.5 \text{ kN/m}^2$ . Design the slab using M20 grade of concrete and Fe415 Grade of steel. Sketch the reinforcement details, showing the section in both directions.

Q. 4 Design a waist slab type dog legged staircase for an office building using the following data. Height between floors is 3.9 m. Tread = 300 mm and riser = 150 mm. Width of flight = landing width = 1.8 m. The stair flight is supported on the ends of the landing slabs which are spanning parallel to the risers. The landing slabs are supported over end masonry walls 300 mm thick on both the ends. Use M20 grade of concrete and Fe 415 grade of steel. Sketch the reinforcement details.

Q. 5 Design a RCC short column under biaxial bending to carry a Factored load = 2000 kN, Factored moment,  $M_{ux}=120 \text{ kNm}$  and  $M_{uy}=110 \text{ kNm}$ . The column has effective length along x-direction = 5.5 m, along y-direction = 4.5 m. Use M 20 and Fe 415.

Q. 6 A footing is required to be designed for six columns as shown in figure. Check if individual footing can be provided for column A2. If yes, design individual footing, or otherwise design combined footing. The size of the columns is 600 x 450 mm for corner columns and 600 mm x 600 mm for middle columns as shown. The working loads on the columns along with center to center spacing are shown. The columns are subjected to different loads as shown. The safe bearing capacity of the soil is  $100 \text{ kN/sqm}$ . Determine the depth of the footing required from flexural consideration, one-way shear as well as two way shear. Also show the details of the reinforcement in the footing. Using M 20 grade of steel and Fe 415 Grade of steel.

