Ref. No.: Ex/Arch/CE/T/315/2024

Bachelor of Architecture, Third Year First Semester Examination, 2024

DESIGN OF STRUCTURES – I

Full Marks – 100 **Time: 3 Hrs.**

- **Answer Question No. 1 and any FOUR from the rest.**
- The use of the following IS Codes is allowed in the examination hall: IS-456:2000, SP-16, IS:800:2007, IS:808-1989, IS:4923-2017, IS:1161-2014

---

1. Answer all questions - **(10 x 2 = 20)**

(A) What are the main ingredients of the Reinforced Cement Concrete?

(B) What are the basic material property values of RCC? (Density, E, μ, G, α etc.)

(C) Explain the difference between One-way Slabs and Two-way Slabs.

(D) What is the Effective Depth of a Concrete Beam?
How it is calculated for a rectangular cross-section with given reinforcement?

(E) What is a Clear Cover of a Concrete Section? Why it is provided?

(F) What is the difference between a short column and a long column?

(G) What is the Effective Length of a Column or Compression Member?

(H) What are the material property values of the Structural Steel?

(I) What are the different section classes of a Steel cross-section?
On which criteria this section classification is done?

(J) What is the Effective Slenderness Ratio of a Steel Member?
What are the limiting values of the same as per the code provisions?

2. Design a one-way RC Slab from the flexural perspective only for a rectangular panel size of 6m. X 2m., with all the edges simply supported to support a Live Load of 3.0 kN/m^2. Use M-20 grade concrete and Fe-415 grade reinforcement steel. Assume any other data as required and mention them specifically in the answer sheet. Also, draw a neat sketch to show the cross-section and the long section of the slab showing the reinforcement details and appropriate covers.

3. An RCC Beam having a simply supported span of 4 meters is carrying a Live Load of 5 kN/m in addition to its self-weight. The cross-section of the beam is 300 mm wide x 500 mm total depth. Calculate the reinforcement required at the mid-span for flexure only. Use M-20 grade concrete and Fe-415 grade reinforcement steel. Assume any other data as required and mention them specifically in the

answer sheet. Draw the beam cross-section in a neat sketch showing the reinforcement details and the appropriate covers.

4. Determine the Column Size and the reinforcements to be provided in an RCC short column of length 3.3 m., rigidly connected at both ends, subjected to an axial load of 500 kN. Assume a Square Cross-Section of the Column. Use M-20 grade of concrete and Fe-415 grade of reinforcement steel. Assume any other data as required and mention them specifically in the answer sheet. Draw the Column cross-section in a neat sketch showing the reinforcement details and the appropriate covers.

5. Design a square isolated RCC footing for a square RCC column of size 400 mm X 400 mm, reinforced with 8 numbers – 20 mm diameter bars, and carrying a service load of 2000 kN. The safe bearing capacity of the soil is 300 kN/m^2 at a depth of 1.5 m below the ground. Assume M-20 grade concrete and Fe-415 grade steel for the footing. Assume any other data as required and mention them specifically in the answer sheet. Draw the Footing cross-section and plan in a neat sketch showing the reinforcement details and the appropriate covers.

6. A simply supported Steel Beam, having a span of 6 meters and having a cross-section of ISMB 300, is laterally supported along its length. The beam is subjected to its self-weight and a uniformly distributed live load of 5 kN/meter. Check the adequacy of the section for the Bending Moment. Consider 250 grade Steel. Assume any other data you require and specifically mention the same in your design.

7. A Tension Member is subjected to a tensile force of 240 kN and has a Square Hollow Section 75x75x4 (SHS 75x75x4). The length of the member is 4.5 meters. Check whether the section is safe for Tensile force. Consider Yst310 grade Steel. Assume any other data you require and specifically mention them in your design.

8. A member of a Truss of length 3.5 meters and having a Circular Hollow Section 100 (CHS 100) of thickness 3.6 mm. The member is subjected to a Compressive Load of 180 kN. Check whether the section is safe for Compression. Consider Yst310 grade Steel. Assume any other data you require and specifically mention the same in your design.