Hall Ticket No. | | | | | | | | | | | Question Paper Code: ACE009

INSTITUTE OF AERONAUTICAL ENGINEERING

(Autonomous)

Dundigal, Hyderabad - 500 043

MODEL QUESTION PAPER

B.Tech V Semester End Examinations (Regular), November – 2019

Regulations: IARE-R16

REINFORCED CONCRETE STRUCTURES DESIGN AND DRAWING

(CIVIL ENGINEERING)

Time: 3 hours **Max. Marks: 70**

Answer ONE Question from each Unit
All Questions Carry Equal Marks
All parts of the question must be answered in one place only

UNIT–I

1. (a) Enumerate the five limit states commonly used in limit state design and state briefly how they are provided in the design. **[7M]**

   (b) A reinforced concrete beam of a rectangular section 300 mm wide by 600 mm deep is reinforced with 4 bars of 25 mm diameter at an effective depth of 550 mm. the effective span of the beam is 7m, f_y = 415 N/mm^2 and f_{ck} = 20 N/mm^2, find the uniformly distributed ultimate load on the beam. **[7M]**

2. (a) Explain the limiting moment of resistance and give the expression for the Fe 250 and Fe415 grade steel? **[7M]**

   (b) Find the moment resistance of a singly reinforced concrete beam of 200 mm width and 400 mm effective depth, reinforced with 3 bars of 16 mm dia. of Fe 415 steel. Take M20 concrete. **[7M]**

UNIT–II

3. (a) Sketch the pattern of cracking in a beam under torsional moment. Explain the term torsional stiffness. **[7M]**

   (b) A simply supported reinforced concrete beam is 250 mm wide and 500mm effective depth and is reinforced with 4-20 mm diameter as tensile steel. If the beam is subjected to a factored shear of 65 KN at the support. Find the nominal shear stress at the support. Use M20 concrete and Fe 250 steel. **[7M]**

4. (a) What do you understand by nominal shear stress? Write the formula for uniform formulae for rectangular section? **[7 M]**

(b) Design the torsional reinforcement in a rectangular beam section, 350 mm wide and 750 mm deep, subjected to an ultimate twisting moment of 140 kNm, combined with an ultimate (hogging) bending moment of 200 kNm and an ultimate shear force of 110kN. Assume M 25 concrete, Fe 415 steel and mild exposure conditions. **[7 M]**

UNIT–III

5. (a) Explain the need for corner reinforcement in two-way rectangular slabs whose corners are prevented from lifting up. **[7M]**

(b) Design a simply supported slab to cover a hall with internal dimensions 4.0 m× 6.0 m. The slab is supported on masonry walls 230 mm thick. Assume a live load of 3 kN/m2 and a finish load of 1 kN/m^2. Use M 20 concrete and Fe 415 steel. Assume that the slab corners are free to lift up. **[7M]**

6. (a) Design a simply supported RCC slab for a roof of a hall 5m x 10 m with 230 mm walls all around assume a LL of 4 KN/m^2 and finish 1 KN/m^2. Use M 25 and Fe 415 steel. **[7M]**

(b) Design a two-way slab for a room of size 4 m X 5 m with discontinuous and simply supported edges on all the sides with corners prevented from lifting to support a live load of 4kN/m^2. Use M20 grade concrete & Fe415 steel bars. **[7M]**

UNIT–IV

7 (a) Derive the expression for the ultimate load for axially loaded short column. **[7M]**

(b) Determine the longitudinal steel required for column for 400 x 600 mm carrying Pu=166 KN, factored moment M (major axis) =120 KN-m and factored M (minor axis) = 90KN-m, assume f_{ck}=15 N/mm^2 and f_y =415 N/mm^2 assume d'=60mm. **[7M]**

8 (a) Explain the step-by-step procedure for design of centrally loaded short columns. **[7M]**

(b) Design the reinforcements in a circular column of diameter 300 mm to support a service axial load of 800 kN. The column has unsupported length of 3 m and is braced against side sway. The column is reinforced with helical ties. The material to be used is M 25 grade of concrete and HYSD steel bars of grade Fe 415. **[7M]**

UNIT–V

9 (a) Explain about the following stair cases **[7M]**
(A) A stair case
(B) A dog legged stair

(b) Design an isolated footing for a square column, 450 mm × 450 mm, reinforced with 8–25 φ bars, and carrying a service load of 2300 kN. Assume soil with a safe bearing capacity of 300 kN/m^2 at a depth of 1.5 m below ground. Assume M 20 grade concrete and Fe 415 grade steel for the footing, and M 25 concrete and Fe 415 steel for the column. **[7M]**

10 (a) Design a combined rectangular footing for a two columns A and B, carrying loads of 500 and 700 kN respectively. Column A is 300 mm X 300 mm in size and column B is 400 mm X 400 mm in size. The c/c spacing of the columns is 3.4 m. The safe bearing capacity of soil may be taken as 150 kN/m^2. Use M20 grade concrete & Fe 415 steel. **[7M]**

(b) Design a footing for a 500 x 350 mm column using 20 mm bars as dowels to transmit characteristic loads of 600 KN as dead load and 400 KN as live load to a foundation with SBC = 120 KN/m2, assume M20 and Fe415. **[7M]**

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COURSE OBJECTIVES:

The course should enable the students to:

I	Identify, formulate and solve engineering problems of RC elements
II	Differentiate between working stress design and limit state design
III	Understand the importance of limit state design in reinforced concrete structures.
IV	Design of different structural members like beam, slab, column, footing and stair case.

COURSE OUTCOMES (COs):

CO 1	Describe the Concepts of RC design, material Stress–Strain curves, factors, characteristic values, Stress block parameters, Working Stress Method, Limit state analysis, design of singly, doubly reinforced T, and L beam sections.
CO 2	Understand Limit state analysis and design of section for shear and torsion, concept of bond, anchorage and development length, I.S. code provisions.
CO 3	Explore the design concept of two-way Slabs, one-way slabs, continuous slabs using I.S. coefficients, Cantilever slab/ Canopy slab.
CO 4	Design of short and long column, Axial loads, uni-axial and bi-axial bending I.S. Code provisions.
CO 5	Design footings–Isolated (square, rectangle) and Combined Footings. Design of Stair Case.

COURSE LEARNING OUTCOMES (CLOs):

ACE009.01	Describe the basic concepts of RC design.
ACE009.02	Understand the concept material Stress–Strain curves, Safety factors.
ACE009.03	Understand the concept Stress block parameters.
ACE009.04	Use the design concept of Working Stress Method.
ACE009.05	Design of singly reinforced, doubly reinforced sections.
ACE009.06	Design of, T, and L beam sections.
ACE009.07	Understand Limit state analysis and design of section for shear.
ACE009.08	Understand Limit state analysis and design of section for torsion.
ACE009.09	Concept of bond, anchorage.
ACE009.10	Concept of development length.
ACE009.11	Illustrate the deflection limits as per IS: 456–2000
ACE009.12	Understand the design concept of one-way slabs.
ACE009.13	Understand the design concept of two-way Slabs.
ACE009.14	Understand the design concept of continuous slabs.
ACE009.15	Calculate the I.S. coefficients for Cantilever slab.
ACE009.16	Calculate the I.S. coefficients for Canopy slab.
ACE009.17	Discuss the concept of short and long column
ACE009.18	Understand the concept of Axial loading.
ACE009.19	Understand the concept of uni-axial and bi-axial bending.
ACE009.20	Apply I.S. Code provisions.

ACE009.21	Design concept for isolated footing.
ACE009.22	Design concept for Combined footing.
ACE009.23	Understand the Design procedure for Stair Case.
ACE009.24	Types of stair Case.

MAPPING OF SEMESTER END EXAMINATION - COURSE OUTCOMES

SEE Question No		Course Learning Outcomes		Course Outcomes	Blooms Taxonomy Level
1	a	ACE009.01	Describe the basic concepts of RC design.	CO 1	Remember
	b	ACE009.05	Design of singly reinforced, doubly reinforced sections.	CO 1	Understand
2	a	ACE009.05	Design of singly reinforced, doubly reinforced sections.	CO 1	Understand
	b	ACE009.06	Design of T and L beam sections.	CO 1	Understand
3	a	ACE009.07	Understand Limit state analysis and design of section for shear.	CO 2	Remember
	b	ACE009.09	Concept of bond, anchorage.	CO 2	Understand
4	a	ACE009.07	Understand Limit state analysis and design of section for shear.	CO 2	Understand
	b	ACE009.10	Concept of development length.	CO 2	Understand
5	a	ACE009.12	Understand the design concept of one-way slabs.	CO 3	Understand
	b	ACE009.12	Understand the design concept of one-way slabs.	CO 3	Remember
6	a	ACE009.13	Understand the design concept of two-way Slabs.	CO 3	Remember
	b	ACE009.13	Understand the design concept of two-way Slabs.	CO 3	Understand
7	a	ACE009.17	Discuss the concept of short and long column	CO 4	Remember
	b	ACE009.18	Understand the concept of Axial loading.	CO 4	Understand
8	a	ACE009.17	Discuss the concept of short and long column	CO 4	Understand
	b	ACE009.18	Understand the concept of Axial loading.	CO 4	Understand
9	a	ACE009.21	Design concept for isolated footing.	CO 5	Remember
	b	ACE009.22	Design concept for Combined footing.	CO 5	Understand
10	a	ACE009.21	Design concept for isolated footing.	CO 5	Remember
	b	ACE009.22	Design concept for Combined footing.	CO 5	Understand

Signature of Course Coordinator **HOD, CE**