INSTITUTE OF AERONAUTICAL ENGINEERING

(Autonomous)
Dundigal, Hyderabad - 500 043

CIVIL ENGINEERING

ASSIGNMENT QUESTIONS

Course Name	:	**REINFORCED CONCRETE STRUCTURES DESIGN AND DRAWING**
Course Code	:	A50121
Class	:	III-I - B. Tech
Branch	:	CIVIL ENGINEERING
Year	:	2017 – 2018
Course Faculty	:	**Ms. S.Bhagyalaxmi, Assistant Professor** **Ms. PraveenaRao, Assistant Professor**

OBJECTIVES

Civil Engineers are required to learn the fundamentals of design, analysis, and proportioning of reinforced concrete members and structures. Learn design concepts and modes of failure. Methods for analysis and design of these elements under flexure, shear, and axial loads will be examined. Learn how to make design decisions considering realistic constraints such as safety, economy and serviceability. Learn how to use the latest technology in solving structural analysis and design problems. To impart adequate knowledge on how to analyze and design reinforced concrete members and connection. To understand the mechanical properties of structural concrete. To understand the behavior of reinforced concrete elements under normal force, shear, moment and torsion. Concept of ultimate design of reinforced concrete beams, floor systems and columns are to understood. To develop an understanding of and appreciation for basic concepts in the behavior and design of reinforced concrete systems and elements. To help the student develop an intuitive feeling about structural and material wise behavior and design of reinforced concrete systems andelements.

S. No.	Question	Blooms Taxonomy Level	Course Outcomes
	UNIT-1 **DESIGN CONCEPTS, DESIGN OF BEAMS**		
1	What are the main objectives of structural design?	Understand	2
2	Explain the assumptions made in the Limit state of Flexure.	Remember	1
3	What is meant by limit state? Discuss the different ‘limit states’ to be considered in reinforced concretedesign.	Understand& remember	1
4	Show that deflection control in normal flexural members can be achieved by limiting span/effective depthratios.	Understand & remember	2

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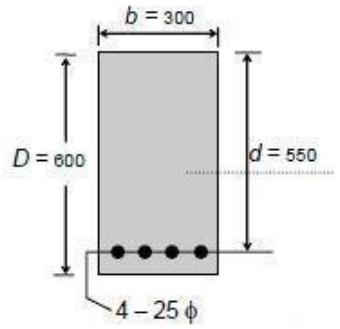
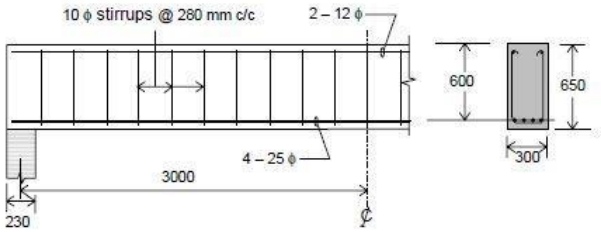
5	With the help of neat sketch derive the stress block parameters for limit state of flexure.	Understand& remember	2
6	A reinforced concrete beam of rectangular section has the cross-sectional dimensions shown in Fig. Assuming M 20 grade concrete and Fe 415 grade steel, compute (i) the cracking moment and (ii) the stresses due to an applied moment of 50 kNm.  beam section	Understand	3
7	Explain characteristic strength of materials and characteristic loads.	Understand	3
8	A rectangular reinforced concrete beam, located inside a building in a coastal town, is simply supported on two masonry walls 230 mm thick and 6m apart (centre-to-centre). The beam has to carry, in addition to its own weight, a distributed live load of 10 kN/m and a dead load of 5 kN/m. Design the beam section for maximum moment at mid-span. Assume Fe 415 steel.	Understand	3
9	A singly reinforced concrete beam is 300x450 mm deep to the centre of tension reinforcement which consists of 4 bars of 16mm diameter. If the safe stresses on concrete and steel are 7 N / mm2 and 230 N / mm2 respectively, find the moment of resistance of the section. Take M = 13.33.	Understand	3
10	Design an L beam for an office floor given the following data: Clear span: 6m Thickness of flange =150mm Service load: 4kN/m2 Spacing of beam :3m fck = 25N/mm2, fy = 415N/mm2 L beams are monolithic with columns. Width of column = 300mm. Sketch the reinforcement details.	Understand	3
UNIT – II SHEAR, BOND & TORSION			
1	What is the expression for spacing of vertical stirrups in R.C. beams for shear?	Understand	4
2	Explain, with examples, the difference between equilibrium torsion and compatibility torsion.	Understand & remember	4
3	Define ‘development length’. What is its significance?	Understand	4

S. No.	Question	Blooms Taxonomy Level	Course Outcomes
4	Under what situations do the following modes of cracking occur in reinforced concrete beams: (a) flexural cracks, (b) diagonal tension cracks, (c) flexural-shear cracks and (d) splittingcracks?	Understand & remember	5
5	What are the various remedial measures for control of cracking ?	Understand & remember	5
6	A simply supported beam of 6 m span (c/c), (shown in Fig.), is to carry a uniform dead load of 20 kN/m (including beam weight) and a uniform live load of 30 kNm. The width of the supporting wall is 230 mm. Assume M 25 concrete and Fe 415 steel.  (a)Determine the adequacy of the 10 mmφU-stirrups as shear reinforcement. (b) If the shear reinforcement is to be provided in the form of 10φ stirrups inclined at 60o to the beam axis, determine the requiredspacing. (c) If two of the tension reinforcement bars are terminated at 300 mm from the centre of the support, check the adequacy of shear strength at the bar cut-offpoint.	Understand & remember	4
7	Design a T – beam for the following data. Span = 9 m , Ends are simply supported. Spacing of the beams = 3 m Super imposed load = 4 kN / m2 Floor finish = 0.75 kN / m2 Thickness of the slab = 125 mm Weight of the wall on the beam = 15 kN / m Width of the web = 230 mm Total depth = 680 mm Use M 25 grade concrete and Fe 500 grade steel. Design the beam for shear reinforcement also. Check the design for all necessary conditions. Draw to a suitable scale: a) The longitudinal section showing the reinforcementdetails b) The cross section of the beam at salient points, showing the reinforcement	Understand & remember	4
8	A rectangular beam 230mm wide is subjected to the following at a section 1. Sagging bending moment of25kNm. 2. Shear force of20kN. 3. Torsional moment of30kNm. Use M25 and Fe-415 steel. Design a suitable section and find the reinforcement required in the section.	Understand & remember	4

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9	A rectangular beam of span 7 m (centre-to-centre of supports), resting on 300 mm wide simple supports, is to carry a uniformly distributed dead load (excluding self-weight) of 15 kN/m and a live load of 20 kN/m. Using Fe 415 steel, design the beam section at mid-span, based on first principles. Check the adequacy of the section for strength, using design aids. Also perform a check for deflection control. Assume that the beam is subjected to moderate exposureconditions.	Understand & remember	4,5
10	A doubly reinforced beam of rectangular section 300mm wide x500mm overall depth is reinforced with 4 bars of 20 mm diameter on the tension face and 2 bars of 16 mm diameter on the compression face. Assume moderate exposure condition. The beam spans over 9 m. Check the deflection control if Fe 415 steel is used. Use M25 concrete.	Understand & remember	4,5
	UNIT – III **DESIGN OF SLABS**		
1	Explain clearly the difference between one way and two way slabs.	understand	6
2	The main Reinforcement of a R.C. slab consists of 10mm bars at spacing of 10cm. if it is desired to replace 10mm bars by 12mm bars, then what is the spacing of 12mm bars?	understand	6
3	What are the limits of percentage of steel in slabs?	Remember	6
4	Torsional reinforcement is required in which type of slabs and why?	Understand & remember	6
5	What is the minimum Flexural Reinforcement in Slabs in either direction?	Understand	6
6	Determine the ultimate moment of resistance of a 150 mm thick slab, reinforced with 10 mm φ bars at 200 mm spacing located at an effective depth of 125 mm. Assume M 20 concrete and Fe 415steel.	Understand & remember	6
7	Design a one−way slab, with a clear span of 4.0 m, simply supported on 230 mm thick masonry walls, and subjected to a live load of 4 kN/m2 and a surface finish of 1 kN/m2. Assume Fe 415 steel. Assume the beam is subjected to moderate exposure conditions.	Understand & remember	6
8	Design a slab over 5m x 7m room supported on masonry walls all around with adequate restraint with corners held down. The live load on slab is 2.5 KN /m2. The slab has a bearing of 150 mm on the walls. Use M2o grade concrete. Draw the structural detailing neatly to a suitable scale.	Understand & remember	6
9	Design a reinforced concrete slab of size 5m x 4m. All the four edges are discontinuous and corners are held down. The slab has to carry a live load of 3kN/m2.And floor finish 1kN/m2.Use M20 concrete and Fe 500steel.	Understand & remember	6
10	A reinforced concrete canopy slab, designed as a cantilever, is under construction. Prior to the removal of the formwork, doubts are expressed about the safety of the structure. It is proposed to prop up the free edge of the cantilever with a beam supported on pillars. Comment on this proposal.	Understand & remember	6

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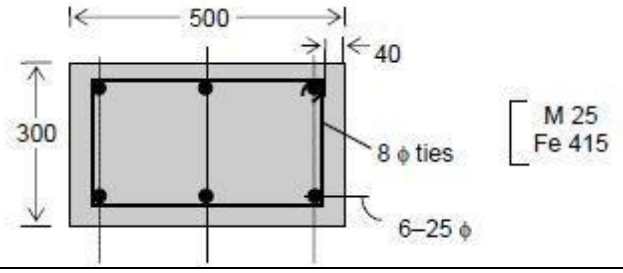
	UNIT – IV **DESIGN OF COLUMNS**		
1	What is the purpose of lateral ties in a RC column?	remember	7
2	What is the difference between load carrying capacity of a helically reinforced column and that of a tied column?	remember	7
3	What is slenderness ratio? Explain.	Understand & remember	7
4	Differentiate between short and long column.	Understand & remember	7
5	Define equivalent length of a column. Define crushing and buckling.	Understand	7
6	A short column, 600 mm × 600 mm in section, is subject to a factored axial load of 1500 kN. Determine the minimum area of longitudinal steel to be provided, assuming M 20 concrete and Fe 415steel.	Understand & remember	7
7	For the column section shown in Fig, determine the design strength components corresponding to the condition of 'balanced failure'. Assume M 25 concrete and Fe 415 steel. Consider loading eccentricity with respect to the major axis alone. Assume 8 φ ties and 40 mm clear cover. 	Understand & remember	7
8	Using the design aids given in SP : 16, design the longitudinal reinforcement in a rectangular reinforced concrete column of size 300 mm × 600 mm subjected to a factored load of 1400 kN and a factored moment of 280 kNm with respect to the major axis. Assume M 20 concrete and Fe 415steel.	Understand & remember	7
9	Design a short square column, with effective length 3.0m, capable of safely resisting the following factored load effects (under uniaxial eccentricity): (i) Pu = 1625 kN, Mu = 75kNm (ii) Pu =365 kN, Mu = 198 kNm. Assume M 25 concrete and Fe 415steel.	Understand & remember	7
10	Design a column of unsupported length 3m to carry an axial load of 2000 kN and a BM of 150kNm at service conditions. Design the column as a short column. The column is subjected to severe exposure condition and grade of steel is Fe500. Provide equal reinforcement on all the faces. Use M30 concrete. Sketch reinforcementdetails.	Understand & remember	7
	UNIT – V **DESIGN OF FOOTING, STAIR CASE**		
1	Explain about one-way and two-way shear in footings?	Remember	8

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2	What are the situations in which combined footings are preferred to isolated footings?	Remember & Understand	8
3	Under what circumstances is a trapezoidal shape preferred to a rectangular shape for a two-column combined footing?	Understand	8
4	Design a square footing for a rectangular column 300 mm × 500 mm, reinforced with 6–25 φ bars, and carrying a service load of 1250 kN. Assume soil with an allowable pressure of 200 kN/m2 at a depth of 1.25 m below ground. Assume Fe 415 grade steel for both column and footing, and M 20 grade concrete for the footing and M 25 grade concrete for the column.	Understand & remember	8
5	Explain about the following stair cases (A) A staircase (B) A dog leggedstair (C) An openstair (D) A geometricalstair	Understand	8
6	Explain about the following stair cases (A) A staircase (B) A dog leggedstair (C) An openstair (D) A geometricalstair	Understand	8
7	Design a rectangular footing for a circular column, 500 mm in diameter, reinforced with 8–25 φ bars, and carrying an axial load of 2500 kN. Assume soil with a safe bearing capacity of 300 kN/m2 at a depth of 1.5 m below ground. Assume Fe 415 grade steel for both column and footing, and M 20 grade concrete for the footing and M 30 grade concrete for the column.	Understand & remember	8
8	Design a combined footing for two columns C1 (400 mm × 400 mm with 4–25 φ bars) and C2 (500 mm × 500 mm with 4–28 φ bars) supporting axial loads P1 = 900 kN and P2 = 1600 kN respectively (under service dead and live loads). The column C1 is an exterior column whose exterior face is flush with the property line. The centre-to-centre distance between C1 and C2 is 4.5 m. The allowable soil pressure at the base of the footing, 1.5 m below ground level, is 240 kN/m2. Assume steel of grade Fe 415 in columns as well as footing, and concrete of M 30 grade in columns and M 20 grade infooting.	Understand & remember	8
9	A straight staircase is made of structurally independent tread slabs, cantilevered from a reinforced concrete wall. Given that the riser is 150 mm, tread is 300 mm, and width of flight is 1.5 m, design a typical tread slab. Apply the live loads specified in the IS Loading Code for stairs liable to be overcrowded. Use M 20 concrete and Fe 250 steel. Assume mild exposure conditions.	Understand & remember	8
10	Design the waist-slab type of the staircase of Fig. Landing slab A is supported on beams along JK and PQ, while the waist-slab	Understand & remember	8

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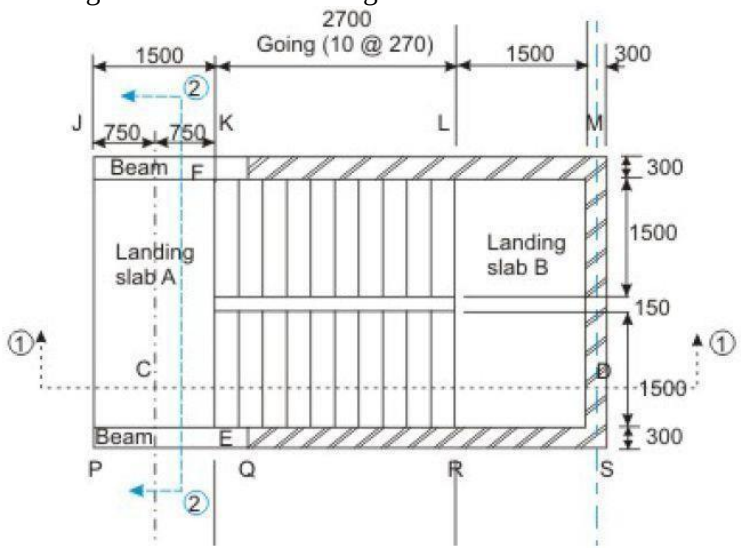
	and landing slab B are spanning longitudinally as shown in Fig.. The finish loads and live loads are 1 kN/m2 and 5 kN/m2, respectively. Use riser R = 160 mm, trade T = 270 mm, concrete grade = M 20 and steel grade = Fe415. 		

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