Register Number:……..

KUMARAGURU
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B.E DEGREE EXAMINATIONS: MAY 2018

(Regulation 2015)

Sixth Semester

CIVIL ENGINEERING

U15CET602: Design of Reinforced Concrete structures

(IS 456, IS 1343, IS 3370 are permitted)

COURSE OUTCOMES

CO1: Design counter fort and cantilever retaining walls.

CO2: Design underground and overhead RC water tanks for the given capacity.

CO3: Analyze and design various types of slabs using yield line theory.

CO4: Design of bridges as per IRC standards and design of flat slabs as per IS standards.

CO5: Apply the concepts of pre-stressing for structural elements analysis.

Time: Three Hours **Maximum Marks: 100**

Answer all the Questions:-

PART A (10 x 1 = 10 Marks)

1. Match list I (the element of retaining wall) with list II (behavior) and select the correct answer using the codes given below the lists. CO1 [K_4]

List I	List II
A. counter fort	i. vertical cantilever slab
B. toe slab of counter fort retaining wall	ii. continuous slab
C. heel slab of counter fort retaining wall	iii. cantilever beam
D. stem of cantilever retaining wall	iv. horizontal cantilever slab

	A	B	C	D
a)	ii	i	iii	iv
b)	iii	iv	ii	i
c)	ii	iv	iii	i
d)	iii	i	ii	iv

2. Shear key is provided in a retaining wall in order to improve its stability against CO1 [K_3]

a) overturning b) bearing

c) sliding d) settlement

3. Consider the following statements. Which of these statements are correct? CO2 [K_4]

1.While designing underground water tanks the tank full condition only to be considered.

2. The design for water retaining components is based on no crack theory.

3. The base slab of underground water tank is to be designed for net uplift exerted by the ground water, if the ground water table is above the base slab.

4.While designing the staging of an elevated water tank, only the wind force is to be considered and earthquake forces and self weight of the tank are neglected.

a) 1,3 b) 1,4
c) 1,2 d) 2,3

4. The intensity of water pressure at any depth h is equal to (taking the weight density of water as w) CO2 [K_1]
a) wh b) 0.5 wh
c) 0.75wh d) 1.5 wh

5. Assertion (A): Virtual work method gives a lower bound to the collapse load on the slab. CO3 [K_2]
Reason (R): It is essential that all possible yield line patterns have to be investigated to find the lowest value of the ultimate load.
Select the correct answer choice.
a) Both A and R are Individually true and R is the correct explanation of A
b) Both A and R are Individually true but R is not the correct explanation of A
c) A is true but R is false
d) A is false but R is true

6. If 'm' is the ultimate moment per unit length of the yield line, the total work done by all the yield lines of an isotropically reinforced square slab fixed on all edges and subjected to uniformly distributed load is CO3 [K_4]
a) 16m b) 12m
c) 8m d) 4m

7. Consider the following analysis stages of T beam bridge deck system. CO4 [K_6]
1. Referring to Pigeaud's curves
2. Analysis of longitudinal girders
3. Applying Courbon's theory to find reaction factors
4. Analysis of cross girders

The correct sequence of analysis T beam bridge deck system is
a) 2-3-4-1 b) 1-3-2-4
c) 3-4-2-1 d) 4-1-3-2

8. The minimum thickness of flat slab should be CO4 [K_1]
a) 125 mm b) 175 mm
c) 200 mm d) 250 mm

9. Assertion (A): The pre stressing force applied by steel is proportional to recoverable strain only. CO5 [K_5]
Reason (R): Loss of pre stress due to creep makes some part of elongation of steel unrecoverable.
Select the correct answer choice.
a) Both A and R are Individually true and R is the correct explanation of A
b) Both A and R are Individually true but R is not the correct explanation of A
c) A is true but R is false
d) A is false but R is true

10. The shrinkage strain used in the calculation of shrinkage loss of pre tensioned member CO5 [K_1]
a) 0.0035 b) 0.002
c) 0.0003 d) 0.0002

PART B (10 x 2 = 20 Marks)

(Answer not more than 40 words)

11.	Distinguish between the behaviour of heel slab of cantilever retaining wall and that of counter fort retaining wall.	CO1	[K_4]
12.	The factor of safety available at the base of a counter fort retaining wall against sliding is 1.2. Examine whether the wall is safe against sliding or not? Justify your answer.	CO1	[K_4]
13.	List the factors that are to be considered while designing RC water tanks.	CO2	[K_1]
14.	Compare the deflected shapes of the circular tank wall due to water pressure for fixed base and rigid base conditions.	CO2	[K_4]
15.	Draw the typical yield line pattern in the case of square slab fixed on all four edges.	CO3	[K_4]
16.	For an under-reinforced flexural member, write the general expression of yield line limit-state moment.	CO3	[K_2]
17.	Indicate the use of Pigeaud's curves in bridge analysis.	CO4	[K_2]
18.	How is the concept of one way shear employed in choosing the critical section of flat slab?	CO4	[K_3]
19.	Differentiate between axial pre stressing and eccentric pre stressing.	CO5	[K_4]
20.	List the practical applications of circular pre stressing method.	CO5	[K_3]

Answer any FIVE Questions:-

PART C (5 x 14 = 70 Marks)

(Answer not more than 300 words)

Q.No. 21 is Compulsory

21.	Design the stem and draw the detailing of reinforcement in the stem of a cantilever retaining wall to retain an earth embankment 4 m high above ground level. The density of earth is 18 kN/m^3 and its angle of repose is 30^o. The embankment is horizontal at top. The safe bearing capacity of the soil is 200 kN/m^2. Materials used in the construction are M20 grade of concrete and Fe 415 steel bars.		CO1	[K_6]
22.	Design the cylindrical wall of a circular water tank resting on the ground with a flexible base for storing 5 lakh litres of water. The depth of storage is 4m and the free board is 0.2 m. Adopt M 25 grade of concrete and Fe 415 HYSD bars.		CO2	[K_6]
23.	i) Discuss various load cases that are to be considered while analyzing the vertical walls of a rectangular underground water tank with L/B ratio greater than two.	(7)	CO2	[K_2]
	ii) Illustrate briefly, the principles involved in the analysis of staging of an over head water tank for wind forces, with sketches.	(7)	CO2	[K_3]
24.	i) List the characteristic features of yield lines that are helpful while selecting a possible yield line pattern in a typical slab.	(6)	CO3	[K_1]
	ii) Estimate the ultimate moments developed in a simply supported rectangular slab 6m x4m for a service load of 3 kN/m^2. Adopt the expression obtained from virtual work method for estimation of moments. Assume the co-efficient of orthotrophy as 0.7. Materials used in the construction of slab are M 20 grade of concrete and Fe 415 steel bars.	(8)	CO3	[K_5]

25. Illustrate the steps involved in the evaluation of dead load and live load bending moments induced in a single span RC slab bridge constructed in national highway. The loading on the two-lane carriage way of bridge may be taken as IRC class AA tracked vehicle. CO4 [K_3]

26. i) List the conditions to be satisfied by the flat slab systems for the application of the direct design method. (5) CO4 [K_1]

ii) Determine the positive and negative moments in the middle strip and column strips of an interior panel of flat slab using the following data. (9) CO4 [K_4]

Size of panel 6m x 6m; thickness of slab is 150 mm and thickness of slab drop is 200 mm; column head diameter is 1.5 m

Width of column strip = width of middle strip = drop width = 3 m

Length of drop in each direction is 2 m

Loading class 5 kN/m^2

Materials used: M 20 grade of concrete and Fe 415 HYSD steel bars.

27. i) Compare the pre-tensioning system of pre stressing with post-tensioning system of pre stressing. (6) CO5 [K_4]

ii) Calculate the stresses at the extreme fibres of the mid span section of a simply supported rectangular beam 200 mm x 300 mm overall depth which is pre stressed by means of 15 wires of 5 mm diameter located 75 mm from the bottom of the beam and 3 wires of 5 mm, 30 mm from the top. The span of the beam is 6 m and the uniformly distributed live load imposed on the beam is 6 kN/m. The pre stress in each steel wire is 850 N/mm^2. (8) CO5 [K_4]

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