Scheme of Valuation/Answer Key

(Scheme of evaluation (marks in brackets) and answers of problems/key)

APJ ABDUL KALAM TECHNOLOGICAL UNIVERSITY

SIXTH SEMESTER B.TECH DEGREE EXAMINATION, MAY 2019

Course Code: CE304

Course Name: DESIGN OF CONCRETE STRUCTURES - II

Max. Marks: 100 Duration: 3 Hours

PART A

Answer any two full questions, each carries 15 marks. Marks

1	a)	Factored load and finding values of Pu/fck bD and Mu/fck b D^2 $\frac{P_u}{f_{ck}bD} = \frac{1050x10^3}{20x300x600} = 0.291$ $\frac{M_u}{f_{ck}D^2} = \frac{225x10^6}{20x300x600^2} = 0.104$ (3) $\frac{d'}{D} = \frac{50}{600} = 0.083 = 0.1$ f_y=250MPa; Reinforcement equally on 2 sides; Chart 28 or reinforcement equally on 4 sides Chart 40, Finding *p/fck*, and *As* (2) Diameter and no. of bars **(1)** Design of lateral ties and spacing **(2)** Detailed cross section **(2)**	(10)
	b)	Calculation of additional moments- $M_{ax} = \frac{P_u D}{2000}\left\{\frac{l_{ex}}{D}\right\}^2$ $M_{ay} = \frac{P_u b}{2000}\left\{\frac{l_{ey}}{b}\right\}^2$ - (reduction factor – optional)— (2) Modified Initial moments = 0.4M_{a1}+0.6M_{a2} Calculate moment due to minimum eccentricity and comparing with modified actual moments- greater value to be taken as initial moments for adding with the additional moments (2) Checking the section for axial load and biaxial bending (1)	(5)

2	a)	Check for slenderness ratio **- 1** Check for min eccentricity **- 1** Trial reinforcement and uniaxial moment capacities about x- and y- axes **- 4** Finding Puz and α n **- 3** Checking interaction equation **- 3** Design of lateral ties and spacing **- 2** Detailing **- 1** Alternate Solution Check for slenderness ratio **- 1** Check for min eccentricity **- 1** Trial reinforcement and uniaxial moment capacities about x- and y- axes **- 4** Puz from Chart 63 (3) For given Pu/Puz and Muy/Muy1, calculate Permissible Mux / Mux1 from Chart 64 (3) Design of lateral ties and spacing **- 2** Detailing **- 1**	(15)
3	a)	Total Load on footing including self weight = 2200kN **(1)** Calculation of base area and upward pressure **(3)** Thickness of footing based on one way shear **(3)** Check for two way shear **(2)** Design of flexural reinforcement (both directions) **(3)** Check for Development length **(1)** Detailing **(2)**	15
PART B			
Answer any two full questions, each carries 15 marks.			
4	a)	Assuming value of $\phi = 30^0$ Depth of foundation $D_f = \frac{p}{\gamma}\left(\frac{1-\sin\phi}{1+\sin\phi}\right)^2 = 1.2m$ (1) Proportioning the retaining wall with figure **(3)** F.O.S against overturning $= \frac{0.9M_R}{M_o} > 1.4$ (2)	(15)

		F.O.S against sliding $= \frac{0.9\mu\sum W}{P_a} > 1.4$ (2) Upward soil pressure diagram and check (1) Design and detail the heel slab - **3** Design and detail the toe slab - **3**	
5	a)	Circumstances - **2** design procedure - **4** Detailing- **4**	(10)
	b)	Calculation of radius of sphere from span and rise (1) Meridional stress = $\frac{wR(1-\cos\theta)}{t\sin^2\theta} = \frac{wR}{t(1+\cos\theta)}$ Hoop stress= $\frac{wR(\cos^2\theta+\cos\theta-1)}{t(1+\cos\theta)}$ If stresses are minimal, nominal reinforcement to be provided (3) Design of ring beam based on stress on equivalent area (1)	5
6	a)	Load calculation (w kN/m^2) (2) For fixed edges, At Centre, $M_r = \frac{wr^2}{16}$ $M_\theta = \frac{wr^2}{16}$ At edges, $M_r = -\frac{wr^2}{8}$ $M_\theta = 0$ (2) Check for depth (1) Reinforcement at centre **(3)** Reinforcement at edge- **(3)** Check for shear (1) Detailing (3)	15
PART C			
Answer any two full questions, each carries20 marks.			
7	a)	Volume= 500m^3 Height and diameter of tank (3)	(20)

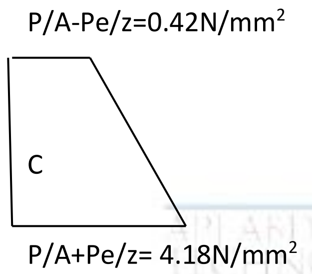
		As per IS 3370 (2), minimum strength of concrete for water tanks is M25. So, this can be mentioned and stresses for M25 can be adopted for the design. Either fixed or hinged base can be assumed. Assuming suitable thickness of wall, calculate H^2/Dt Hoop tension = coefficient(wHR) (2) Moment= coefficient(wH^3) (2) Shear= coefficient (wH^2) (2) Design of horizontal rings based on Hoop tension (3) Design of vertical reinforcement based on moment (3) Check for shear stress (1) Design of base slab (As it is resting on ground, nominal thickness and minimum reinforcement can be provided (2) Detailing with haunches (2)	
8	a)	Listing – **3** Immediate Losses include i. Elastic Shortening of Concrete ii. Slip at anchorages iii. Friction between tendon and tendon duct, and wobble Effect 2. Time Dependent Losses include i. Creep and Shrinkage of concrete ii. Relaxation of prestressing steel Explanation – **2**	(5)
	b)	Loss due to friction = $f_0(\mu\alpha + kx) = 102.7\text{N/mm}^2$ **(5)** Loss due to slip= $\frac{\delta}{L}E_s$ =70 N/mm^2 (5) Total loss – 172.7 N/mm^2 Percentage loss – 17.2% **(2)** Final force =f A=496.38 kN (3)	15
9	a)	Explanation - **4**	4

	b)	Why high strength concrete – **3** Why high strength steel - **3**	6
	c)	P=700(Π/4 x 12 x 12)4=316.5kN (1)	10

e=275-200=75mm

P/A= 2.3N/mm^2 Pe/z=1.88N/mm^2 (2)

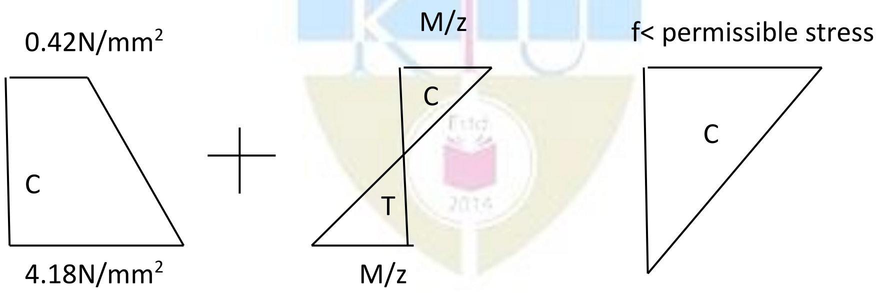
Assuming moment due to self weight to be negligible, stress diagram at transfer of prestress is



(2)

Let M be the total BM including that due to self weight

For no tension to be developed in the section, net stress at bottom = 0



4.18-M/z = 0

M= 52.63 kNm (inclusive of moment due to self weight). (3)

Since the span of the beam is not mentioned, BM due to dead load can't be calculated.

Check: stress at top = 0.42+ 4.18 = 4.6 N/mm^2 < permissible compressive stress for concrete. (2)

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