

STRUCTURAL ANALYSIS – I
CEC – 401

Full Marks – 30

Time – 1.5 Hours

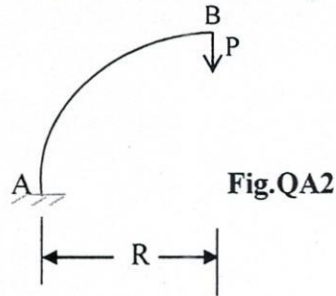
PART-A

Figures in the margin indicate full marks

QA) Solve *any three* problems from the following questions and pick up the correct answer from the bottom list:
5 x 3 = 15

QA1 A cantilever of span L is propped at the free end. A point load W is acting vertically downward at a distance ' a ' from fixed end. If the free end and the fixed end are at the same level, then the prop reaction is given by (use Moment Area Method).....

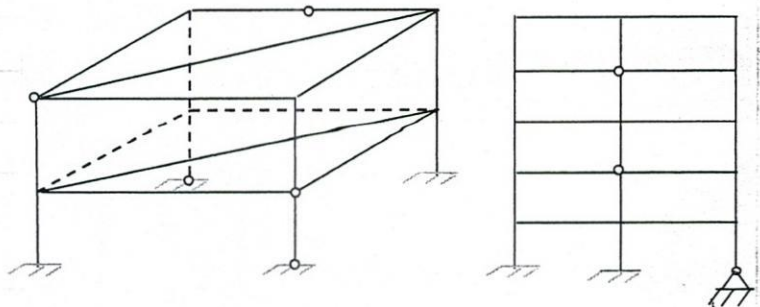
QA2 A quadrant of a circle of radius ' R ' has one of its ends fixed while the other end is free as shown in Fig.QA2. The free end is pulled down by a horizontal force ' P '. The total horizontal movement of the free end B are given by (use Minimum Energy Principle)...



QA3 A cantilever beam AB of span ' L ' and flexural rigidity EI is subjected to a uniformly distributed load ' ω ' per unit length. The slope and deflection at the free end of the beam due to bending is given by (Use Conjugate beam method).....

QA4 The static & kinematic indeterminacies (both extensible & inextensible members) of the frames shown Fig.QA4 is given by.....

Fig.QA4



List of wrong and right answers (randomly oriented):

$\omega L^3/6EI$; $\omega L^4/8EI$; $\omega L^2/6EI$; $\omega L^3/8EI$; $\omega L^4/12EI$; 33; 30; 51; 81; 79; 52; 21; 23;
50; 52 27; 25; $PR^3/2EI$; $PR^3\pi/2EI$; $PR^3/3EI$; $PR^2\pi/2EI$; $Wa(3L-a)/2L^3$; $Wa^2(3L-a)/2L^3$;
 $Wa^2(3L-a)/2L^2$; $Wa^3(3L-a)/2L^3$

Part B

Answer QB1 and QB2 and any two from the rest

QB1 Draw Influence lines qualitatively for the following and provide values at salient sections. 2+
1+
1

- (i) The reactions at A and B
- (ii) The shearing force at the section D
- (iii) The bending moment at the section D

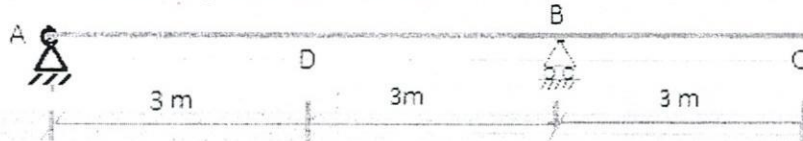


Fig. QB1

QB2 A linear elastic structure is loaded at 4 coordinates locations such that $\{F\}^T = \{+150, -100, +200, -50\}$ kN and the corresponding displacements at these coordinates are $\{10, -6, 9, 3\}$ mm. If in a separate loading condition in which F_3 alone acts the observed deflections are $\{2, 3, -5, 0\}$ mm, find out the value of F_3 . 3

QB3 A train of four concentrated loads crosses a simply supported girder of 18 metre span with 30 kN load leading. Determine the maximum bending moment at 6 m from left support. 4

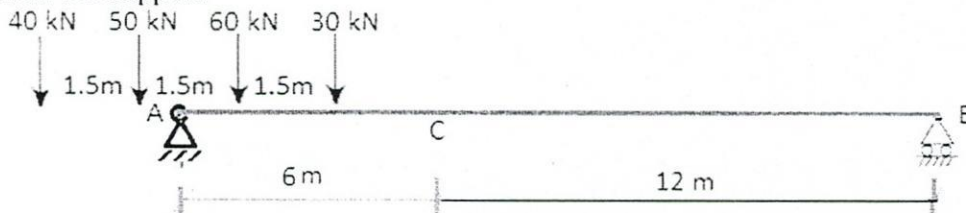


Fig. QB3

QB4 Refer question QB3 and Fig. QB3 where a train of four concentrated loads crosses a simply supported girder of 18 metre span with 30 kN load leading. Determine the absolute maximum bending moment anywhere in the girder. 4

QB5 Draw the influence line for the force in member GB of the truss shown in Fig. 4

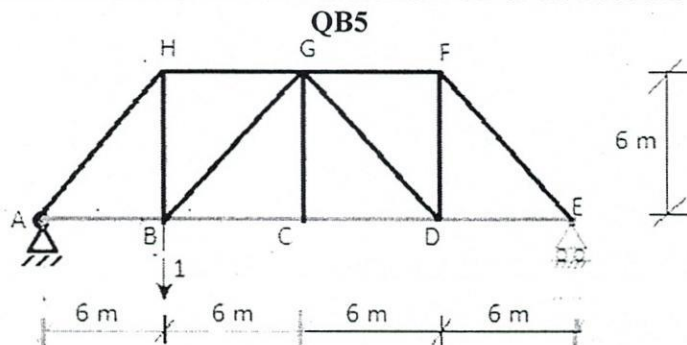


Fig. QB5

NATIONAL INSTITUTE OF TECHNOLOGY DURGAPUR**Even Semester End-term Examination, 2021-22****Course Code:** CEC 402

Full Marks: 30

Course Name: Design of Concrete Structures

Time: 90 Minutes

Question Paper No.: NITdgp.ce/CEC 402/2022.04/01

Date of Exam: 26/04/2022

Instructions: Answer all the questions.

Materials to be supplied: Graph paper shall be supplied, if required.

*Answer to the point and brief**Use of IS Code is permitted.**Use Combination M25 & Fe415*

Show details/sections of reinforcements compulsorily

Assume any suitable data, if not supplied

Ques No.	Body of the Question	Marks	Mapped CO
1	A hall measures 16m x 4.5m. The floor slab is supported on outer peripheral 250 thick brick masonry walls and seven intermediate RC beams having clear span = 4.5m placed @2.0 m c/c. The beams are in turn supported on masonry walls. Assume live load of 3.0 kN/m ² . Answer any five		
a)	Draw a neat sketch of the hall Roof plan & section along longitudinal direction of the hall.	3	CO1
b)	Can the mid-section of the Intermediate beam be designed as flanged beam, justify	3	CO2
c)	Calculate the load on the Roof slab of the Hall.	3	CO1
d)	Draw BMD and SFD for a strip (one meter wide) along longitudinal direction of the hall.	3	CO3
e)	Design the strip /slab following LSM.	3	CO3
f)	Draw / Show details of reinforcements with curtailments in plan and section.	3	CO3

Ques No.	Body of the Question	Marks	Mapped CO
2	a) Explain different types of Foundations for civil engineering structures.	2	CO2
	b) Explain one way shear and two way shear for a footing with a neat sketch.	2	CO2
	The above hall (Ques.-1) is a single storey RCC frame structure with 10 nos of Column 500x300 and RC Roof. GFL is 750 above GL. Clear height of the Hall is 6m. Assume a tie beam at 100 below GL, depth of foundation 1.2 m below GL.		
	c) Calculate the load for a corner column at GL.	4	CO1
	d) Calculate an appropriate area of an isolated footing assuming net SBC of soil as 15 ton/m ² and the thickness of foundation.	4	CO3
	e) Design the reinforcement for the same and draw rebar layout in plan and section.	3	CO3

Course Outcomes

CO1: Apply knowledge of solid mechanics for design solutions.

CO2: Understand basic design philosophies applicable to concrete structures

CO3: Formulate, analyze, and design basic components of Civil Engineering Reinforced Concrete structures

NATIONAL INSTITUTE OF TECHNOLOGY DURGAPUR

Even Semester End-term Examination, 2021-22

Course Code: CEC403

Course Name: Surveying

Question Paper No.: NITDGP/CEC403/

Full Marks: 30

Time: 90 Minutes

Date of Exam: 27/04/2022

Instructions: Answer all questions.

Q. No.	Questions	Marks	Mapped CO																		
1	What do you understand by the terms Precision and Accuracy in Surveying? Write short note on determination of distances by using passometer, pedometer, odometer, and perambulator.	1 4 x 1 = 4	CO1																		
2	State the basic features of Gunter's chain, revenue chain, and engineers chain. Explain reciprocal ranging.	3 2	CO2																		
3	Write a note on normal tension. Write short notes on base line; check line and tie line. What does traverse surveying mean?	1 3 1	CO2																		
4	The distance between two stations was measured with a 20m chain and was found to be 2000m. The same distance was measured with a 30m chain and was found to be 1990m. The 20m chain was 0.075m too short. What was the error in the 30m chain?	5	CO4																		
5	A 20m chain was tested before the commencement of the day's work and found to be correct. After chaining 1000m, the chain was found to be 0.1m too long. At the end of the day's work, after chaining a total distance of 2000m the chain was found to be 0.2m too long. What was the true distance chained?	5	CO4																		
6	The following bearings were observed on a closed traverse. Calculate the interior angles and correct them for observational errors. Taking the bearing of BC as correct, find the corrected bearings of the remaining sides of the traverse. <table border="1"><thead><tr><th>Line</th><th>Fore bearing</th><th>Back bearing</th></tr></thead><tbody><tr><td>AB</td><td>191°15'00"</td><td>10°15'00"</td></tr><tr><td>BC</td><td>120°45'00"</td><td>300°45'00"</td></tr><tr><td>CD</td><td>349°05'00"</td><td>169°00'00"</td></tr><tr><td>DE</td><td>339°35'00"</td><td>160°40'00"</td></tr><tr><td>EA</td><td>296°00'00"</td><td>115°00'00"</td></tr></tbody></table>	Line	Fore bearing	Back bearing	AB	191°15'00"	10°15'00"	BC	120°45'00"	300°45'00"	CD	349°05'00"	169°00'00"	DE	339°35'00"	160°40'00"	EA	296°00'00"	115°00'00"	5	CO4
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CO1: Learn basic principles of surveying and handling of various surveying instruments.

CO2: Learn to conduct engineering surveys.

CO3: Data entry in field books and level books.

CO4: Make and interpret maps.

CO5: Compute area and volumes

NATIONAL INSTITUTE OF TECHNOLOGY DURGAPUR**Even Semester End-term Examination, 2021-22****Course Code:** CEC601

Full Marks: 30

Course Name: Water Resource Engineering

Time: 1½ Hours

Question Paper No.: NITDGP/CEC601/1

Date of Exam: 18/04/2022

Instructions: Answer **any six** questions from Q.1 to Q.9 and **any two** questions from Q.10 to Q.12.

Question No.	Body of the Question	Marks	Mapped CO																						
1	What do you understand by bed load & suspended load of sediments?	3	CO3																						
2	What do you understand by a weir & a barrage? Show with sketches.	3	CO3																						
3	What do you understand by the following? (a) Culturable commanded area (b) Intensity of irrigation (c) Consumptive use of water.	3	CO3																						
4	What do you understand by a carrier canal & a feeder canal? Which one of them may represent the other?	3	CO3																						
5	What is difference between silt excluders & silt ejectors?	3	CO3																						
6	What is the difference between branch canals & distributary canals? Which of them will have a higher value of duty?	3	CO3																						
7	State the functions of different elements of river training works.	3	CO3																						
8	Derive a relation between duty (in ha/cumec), delta (in m) & base period (in days).	3	CO3																						
9	Show how a hydrograph is moderated by the provision of a reservoir.	3	CO2																						
10	A masonry dam 7m high is 1.5m wide at the top & 4.5m wide at the bottom, with vertical water face. Determine the normal stresses at the toe & heel for reservoir full conditions. Take $p = 2.4$ & $c = 1$, where the notations have their usual meanings.	6	CO3																						
11	<p>The following information is available regarding the relationship between trap efficiency & capacity inflow ratio.</p> <table><tr><td>Capacity inflow ratio</td><td>0.1</td><td>0.2</td><td>0.3</td><td>0.4</td><td>0.5</td><td>0.6</td><td>0.7</td><td>0.8</td><td>0.9</td><td>1.0</td></tr><tr><td>Trap efficiency, %</td><td>87</td><td>93</td><td>95</td><td>95.5</td><td>96</td><td>96.5</td><td>97</td><td>97</td><td>97</td><td>97.5</td></tr></table> <p>A reservoir has an initial reservoir capacity of 40 million m^3. If the average annual flood inflow is 50 million m^3 & the average annual sediment inflow is 3,00,000 ton, find the number of years during which the first 50% of the capacity shall be filled up. Assume that 25% of the capacity is filled up in the first interval. Assume a specific weight of the sediment as 1.2 gm/cc.</p>	Capacity inflow ratio	0.1	0.2	0.3	0.4	0.5	0.6	0.7	0.8	0.9	1.0	Trap efficiency, %	87	93	95	95.5	96	96.5	97	97	97	97.5	6	CO2
Capacity inflow ratio	0.1	0.2	0.3	0.4	0.5	0.6	0.7	0.8	0.9	1.0															
Trap efficiency, %	87	93	95	95.5	96	96.5	97	97	97	97.5															

Course Outcomes

CO1: Understanding of occurrence, distribution, storage & transmission of water in different form in the space, on the surface and below the surface of the earth.

CO2: Understanding of tempo-spatial collection of data and preparation of hydro-meteorological information system.

CO3: Learning importance, requirement, method & infrastructure for imparting irrigation water to crop, development & conservation of water for its economic & efficient use.

12	Design a channel for $Q = 50$ cumecs in non-alluvial soil having maximum permissible velocity of 0.9m/s . The available bed slope is 1 in 4500. Assume Manning's $N = 0.025$. Provide a trapezoidal section of the channel with side slopes 1:1.	6	CO3
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NITDGP/BTECH/Reg/Even/2021-22

Full Marks: 30

Time: 90 Minutes

Date of Exam: 19/04/2022

Materials to be supplied: Graph paper shall be supplied, if required.

1

- CO1: Calculate shear strength of soil
- CO2: Determine the earth pressures on foundations and retaining structures
- CO3: Analyse stability of finite and infinite soil & rock slopes
- CO4: Calculate the bearing capacity of soils and foundation settlements

P. T. O.

	<p>(vi) A 30-cm diameter friction pile is embedded 10 m into a homogeneous consolidation deposit. Unit adhesion developed between clay and pile shaft is 4 t/m^2 and adhesion factor is 0.7. The safe load for factor of safety 2.5 will be</p> <p>a) 21.50 t b) 11.57 t c) 10.55 t d) 6.35 t</p>	2	CO4
	<p>(vii) The settlement of a group of friction piles as compared to that of a single pile is</p> <p>a) Same b) Less c) More d) None of the above</p>	1	CO4
	<p>(viii) The bearing capacity of a strip footing on a saturated clay is 120 kN/m^2. The bearing capacity of a circular footing (diameter = width) will be</p> <p>a) More than 120 kN/m^2 b) Equal to 120 kN/m^2 c) Less than 120 kN/m^2 d) Any of the above</p>	1	CO4
	<p>(ix) The gross bearing capacity of a footing is 450 kN/m^2. If the footing is 1.5 m wide at a depth of 1 m in clayey soil with unit weight of 20 kN/m^3, then the net bearing capacity (in kN/m^2) will be</p> <p>a) 400 b) 430 c) 435 d) 440</p>	1	CO4
2	<p>An embankment 10 m deep is to be made with a soil having cohesion 40 kN/m^2 and angle of internal friction 18°, bulk density 18.5 kN/m^3. Slope of the embankment is 1.5 (Horizontal): 1 (vertical). A trial slip circle has a radius of 9m and its centre is at same level as the top of the embankment. The slip circle passes through the toe. Determine the factor of safety of the slope with respect to this slip circle.</p>	10	CO3
3	<p>In a two layered cohesive soil, bored piles of 500 mm diameter are installed. The top layer has a thickness of 6m and the bottom one is of considerable depth. The shear strength of the top clay layer is 50 kN/m^2 and that of the bottom is 100 kN/m^2. Determine the length of bored pile required to carry a safe load of 400 kN, allowing a factor of safety of 2.5.</p>	10	CO4

NATIONAL INSTITUTE OF TECHNOLOGY DURGAPUR
Even Semester End-term Examination, 2021-22

Course Code: CEC603

Full Marks: 30

Course Name: Environmental Engineering

Time: 1½ Hours

Question Paper No.: NITDGP/CEC603/1

Date of Exam: 23/04/2022

Instructions: Answer **any six** questions from Q.1 to Q.8 and **any two** questions from Q.9 to Q.11.

Question No.	Body of the Question	Marks	Mapped CO
1	State the places of use of the following pipe materials for conveyance of water: (a) G.I. (b) C.I.	3	CO1
2	What do you understand by the problem of water hammer? How is it taken care of?	3	CO2
3	Where is a goose neck pipe used in respect of water supply connection to a household? Show with a neat sketch.	3	CO1
4	Describe two house plumbing systems suited for multi-storeyed buildings through sketches only.	3	CO2
5	Name the methods of prevention of pipe corrosion.	3	CO1
6	Draw a labelled sectional elevation view of spigot & socket joint used in water supply pipes.	3	CO1
7	Derive an expression for the correction factor to be applied for analyzing flow in closed pipe networks by Hardy Cross Method.	3	CO1
8	Give the flowsheet for a wastewater treatment plant that employs a single stage high rate trickling filter as the main biological unit.	3	CO2
9	The existing DO deficit of 1.2 mg/l is observed in a river with a linear flow velocity of 0.16 m/s. After discharge of a waste effluent into this river, $Y_{mixed} = 4.5$ mg/l, $K = 0.15$ /day & $R = 0.33$ /day. DO concentration initially was 8.5 mg/l. (a) What is the critical DO deficit & how far downstream will the critical deficit occur? (b) If the state regulations required a residual DO concentration of 4.0 mg/l at the critical time after discharge, would a discharge permit be issued for the effluent?	6	CO2
10	A storage reservoir is situated at a distance of 5km from a city of 2 lakh population. The total loss of head from the source to the city is not to exceed 20m. Taking the daily demand of 150 lpcd, & pumping is to be done for 12 hours only, determine the size of supply main by Darcy – Weisbach Formula, taking coeff. of friction = 0.015. Assume minor losses equal to $10.v^2/(2g)$.	6	CO3

Course Outcomes

CO1: Apply knowledge of water supply & wastewater engineering for design solutions.

CO2: Understand basic design philosophies applicable to conveyance and treatment units of water & wastewater.

CO3: Formulate, analyze, and design basic components of water supply & wastewater disposal.

11	A city has a population of 100,000. Water is to be supplied @ 140 lpcd. If the static lift of the pump is 30 m., calculate the E.H.P. of the motor. The rising main (i.e. the pipe through which water is sent from the source, through a pump, to a reservoir usually located at a higher R.L. than the source) is 400m long & has a dia. = 50cm. Assume that motor efficiency = 85%, pump efficiency = 60%, $f = 0.04$ & peak hour demand = 1.5 times the average demand.	6	CO3
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