NITDGP/BTech/Reg./Odd /2023-24

NATIONAL INSTITUTE OF TECHNOLOGY DURGAPUR

Odd Semester Mid-Term Examination, 2023-2024

Course Code: CEC301 Full Marks: 25

Course Name: SOLID MECHANICS Time: 90 Minutes

Instructions: Notations have their usual meanings if not mentioned otherwise.

Que-stion No.	Body of the Question	Marks	Mapped CO
	Group-A **Attempt question number 1and any one from the rest**		
1	a) Define thermal strain. b) How will you determine 'E' of a material? c) Define 'working stress.' d) Define 'stress concentration factor.' e) State the relation between E and G for elastic material.	5x1 =5	CO3
2	Derive the expression for shearing stress-deformation formulae for circular member subjected to twisting force. Mention important assumptions used for deriving the formulae.	5+2.5	CO1
3.	Draw stress-strain diagram for a mild steel specimen tested in laboratory showing all important points on the diagram. Explain each term clearly.	7.5	CO1
	Group B **Q4 is compulsory. Attempt any one from the rest**		
4.	a) What are the major characteristics of a structural component by which you identify it as a **beam**? Draw necessary figure(s). b) Identify, by name, the following supports. In each case, also show the reactions offered by each of them when they are in plane.  i) ii) iii) c) Write short notes on **any one**: i) Neutral surface and neutral axis ii) Distinction between determinate and indeterminate beams	1.5 3.0 2	CO1 CO1 CO3
5.	Draw line diagram of each of the following beams and answer the relevant questions. a) Simple supported beam of Length L having a concentrated clockwise moment M_0 at the centre. Find out the support reactions. Also determine BM and SF at L/4 distance from left support. b) Cantilever beam of length **4m** with downward *udl* **5kN/m** throughout the span. Find out the support reactions. Also determine BM and SF at the centre of the beam.	 3 3	CO2
6.	Let, a simply supported reinforced concrete beam, of length **4m** and cross section 200mm x 250mm, supports a brick wall of **200 mm** width and **1m** high. Draw the line diagram of the beam and its SFD and BMD. Given, density of RC= 25kN/m^3 and density of brick wall= 15kN/m^3.	6	CO2

- CO1: Development of skills for predicting structural behaviour of solids under different loads
- CO2: Knowledge of basics of analysis and design of structural components made of variety of materials
- CO3: Developing the requisite skill that helps in studying the advanced courses

NATIONAL INSTITUTE OF TECHNOLOGY DURGAPUR

Odd Semester Mid-Term Examination, 2023-24

Course Code: CEC302
Course Name: Fluid Mechanics

Full Marks: 25
Time: 90 Minutes

Instructions: Answer all the questions.

Question No.	Body of the Question	Marks	Mapped CO
1	Differentiate between: i) Absolute pressure and Gauge pressure ii) Simple Manometer and Differential Manometer iii) System and control volume iv) Velocity potential function and stream function v) Eulerian Approach and Lagrangian Approach	5	CO3
2	A plume of steam leaves a smokestack at x=0 and y=0. The plume lasts for three hours. The wind velocity (km/h) is v = 10i − 5j for the first 5 hours and v= 5i for the next 5 hours. Plot the steak lines of the plume at t=5 hour and t=10 hour. Also shows the Path line from t=0 to t =10 hour for a single fluid particle	5	CO1
3	A vertical Venturimeter carries a liquid of relative density 0.9. The Venturimeter has 200 mm inlet and 100 mm throat diameter. The pressure connection at the throat is 200 mm above that at the inlet. If the actual rate of flow is 50 lit/sec and the C_d= 0.98, calculate the pressure difference between inlet and throat.	5	CO2
4	i. Derive an expression for the depth of center of pressure from the free surface of a liquid of an inclined plane submerge in a liquid. ii. A mercury water manometer has a gauge difference of 0.8 m. What is the difference in pressure measured in meters of water?	4 +1	CO2
5	i. A wooden block 50cm long, 25 cm wide and 18 cm deep has its shorter axis vertical with a depth of immersion 15 cm. calculate the position of metacenter and comment on the stability of the block. ii. A steady incompressible flow is given by $u = 2x^2 + y^2, \quad v = -4xy$ What is the convective acceleration along x direction at point (1,2)?	3+2	CO1

Course Outcomes
CO1: Development of skills for predicting fluid behaviour
CO2: Knowledge of basics of fluid flow measurement and model development
CO3: Developing the requisite skill that helps in studying the advanced courses

NITDGP/BTECH/Reg/Odd/2023-24

NATIONAL INSTITUTE OF TECHNOLOGY DURGAPUR

Odd Semester Mid-Term Examination, 2023-24

Course Code: CEC303 Full Marks: 25

Course Name: Building Construction & Concrete Technology Time: 90 Minutes

Instructions: **Answer any FIVE, taking at least TWO from each group**

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

GROUP A

Q. No.	Body of the Question	Marks	Mapped CO
1	What do you understand by the following principles of building planning: Aspect, Circulation, and Flexibility? Explain with an example how "Practical Consideration" may influence the construction of a building.	3 + 2 = 5	CO2
2	State any two relevant factors to be considered in each case of planning the following types of building: Apartment houses, Assembly buildings, and Storage buildings. Then justify your selection of factors in each case.	3 + 2 = 5	CO2
3	Show with neat sketches what do you understand by the following building terminology: Set-back line, Building line, Height of a building with a pitched roof, Floor to floor height, and Headroom in a staircase.	1 x 5 = 5	CO2
4	State any five methods of improving the safe bearing pressure of soils and explain why the soil quality is expected to improve in each case.	2 + 3 = 5	CO2

GROUP B

Q. No.	Body of the Question	Marks	Mapped CO
5	What do you understand by Bogue compounds ? Write down the functions of the same.	1 + 1 x 4 = 5	CO1 & 3
6	Write short note on: a). Hardening of cement, b). Setting time of cement, c). Calcium choloride cement, d). Soundness of cement and its test, and e). Cement Fondu/Luminite.	1 x 5 = 5	CO1 & 3
7	Write short note on: a). Bulking of sand, b). Grading of aggregate, c). Fineness Modulus, d). All-in Aggregate, and e). Functions of aggregate	1 x 5 = 5	CO1 & 3
8	In an aggregate abrasion test, initial weight of aggregate is 650 gms and after 1000 revolutions, the weight of aggregate reduced to 615 gms. Calculate the hardness of the aggregate. Also, compute the aggregate's fineness modulus with the following details:	2 + 3 = 5	CO1 & 3

IS Sieve Size in mm	Retained Weight in gm	IS Sieve Size in mm	Retained Weight in gm
25.00	0000.00	10.00	3750.00
20.00	0850.00	06.30	2700.00
16.00	3750.00	04.75	0050.00
12.50	5500.00		

Course Outcomes

CO1: Acquire knowledge of selection and application of building materials

CO2: Understand the building components and planning

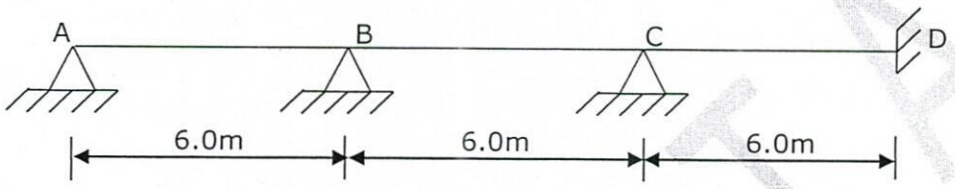
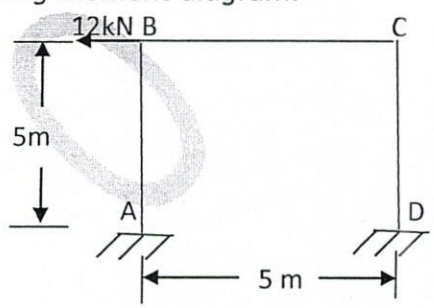
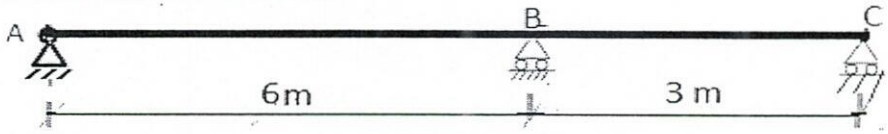
CO3: Gain an integrative idea on materials, preparation and mix design of concrete

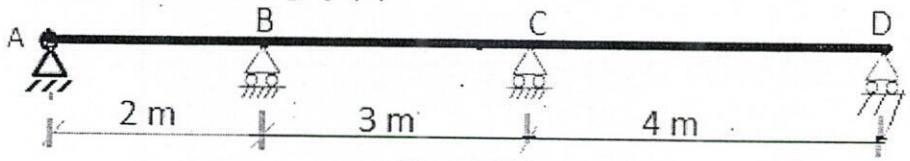
NATIONAL INSTITUTE OF TECHNOLOGY DURGAPUR
Odd Semester Mid-Term Examination, 2023-24

Course Code: CEC 501
Course Name: Structural Analysis II
Question Paper No.: NITDGP-CE-501/2023-24/MT/

Full Marks: 25
Time: 90 Minutes
Date of Exam: 11/09/2023

Instructions: ***Answer question Q4 and Q5 and any one from the rest.***
Figures in the margin indicate full marks

Qn. No.	Body of the Question	Marks	Mapped CO
1	Analyse the continuous RC beam shown in Fig.Q1 by Moment Distribution Method. The supports B and C sink 10 mm and 5 mm, respectively, and the support D rotates through an anticlockwise angle of 0.1 radians. There are no loads on the beam. Values of E and I are constant throughout the length of the beam: M30 grade of concrete and 600 mm x 400 mm cross-section. Sketch the bending moment diagram. Also, calculate the maximum fibre stress.  **Fig.Q1**	7.5	CO1
2	A propped cantilever beam AB of length L=7.0 m is fixed at support A and has a hinge support at B. It is acted upon by a concentrated load of magnitude 25 kN at C, which is at a distance of 3.0 m from A. The support B settles by 10.0 mm. Analyse the structure by the slope-deflection method and draw the shear force and bending moment diagrams. Take E = 2×10^5 MPa, I = 300 cm^4.	7.5	CO1
3	Analyse the frame shown in Question 4 (Fig.Q4) by Kani's Rotation Contribution Method. Draw the approximate deflected shape and bending moment diagram.	5+1+1.5 =7.5	CO1
4	Analyse the frame shown in Fig.Q4 of uniform flexural rigidity. Use Column Analogy Method. Draw the approximate deflected shape and bending moment diagram.  **Fig.Q4**	5+1+1.5 =7.5	CO2
5(a)	Draw Influence line diagram for vertical reaction at support B of the two span continuous beam in Fig.Q5(a). Compute the ILD ordinates at 1.5 m interval. EI is constant.  **Fig.Q5(a)**	7	CO4

5(b)	Draw Influence line diagram **qualitatively** for (i) Vertical reaction at support A, (ii) Vertical reaction at support C and (iii) Moment at B of the continuous beam in Fig.Q5(b).  **Fig.Q5(b)**	3	CO4

Course Outcomes

- CO1: Analyse indeterminate beams and frames by displacement methods (Slope deflection method, Moment distribution method, Kani's method)
- CO2: Analyse indeterminate beams and frames by force methods (Three moment Equation, column Analogy method, consistent deformation method)
- CO3: Apply matrix analysis using stiffness and flexibility methods- computer-based analysis of structure.
- CO4: Evaluate and draw the influence lines for reactions, shears, and bending moments in indeterminate beams / girders and frames.
- CO5: Apply approximate methods (Substitute Frame method, Portal and cantilever methods) to solve multi-storeyed building frames.

NATIONAL INSTITUTE OF TECHNOLOGY DURGAPUR

Odd Semester Mid-term Examination, 2023-24

Course Code: CEC 502 | Full Marks: 25
Course Name: Design of Steel Structures | Time: 90 Minutes
Question Paper No.: NITdgp.ce/CEC 502/2023.09/01 | Date of Exam: ...../09/2023

2 marks allotted for neatness and to the point, brief answer
Use of IS:800-2007 and IS:808-1989 is permitted.
Grade of steel Fe410 with fy = 250 MPa and Bolt Grade 4.6
Show details/sections compulsorily
Assume any suitable data, if not supplied

Ques No.	Body of the Question	Marks	Mapped CO
1 a)	State the difference between End distance & Edge distance Also between pitch and gauge.	1+1	CO1
b)	What is the minimum distance between the two consecutive bolts as per IS code.	1	CO1
c)	State the difference between i) hot-rolled steel and cold-formed steel. ii) brittle cladding and ductile cladding ii) leading load and accompanying load	1x3	CO2
d)	Why the drilled holes are being preferred over punched holes ? State the difference between standard hole and slotted hole for bolted connection.	1+1	CO2

Ques No.	Body of the Question	Marks	Mapped CO
2 a)	Design a welded (fillet) connection of a L75x75x8 to a 10 thick gusset plate to transfer a factored load of 300kN. Welding can be done in 2 or 3 sides of the angle leg.	15	CO3
	OR		
b)	A single unequal angle L100x75x8 is connected to a 10mm thick gusset plate through longer leg its ends with 4nos M20 bolts of grade 4.6. Evaluate design tensile capacity of the angle if Pitch=50mm, edge distance=40mm, gauge distance=60mm.	15	CO3

Course Outcomes
CO1: Apply knowledge of solid mechanics for design solutions.
CO2: Understand basic design philosophies applicable to steel structures
CO3: Formulate, analyze, and design basic components of Civil Engineering steel structures

NATIONAL INSTITUTE OF TECHNOLOGY DURGAPUR

Odd Semester Mid-Term Examination, 2023-24

Course Code:CEC503 Full Marks: 25

Course Name:SOIL MECHANICS Time: 90 Minutes

Instructions: Answer all the questions.
Materials to be supplied:Graph paper shall be supplied, if required.

Question No.	Body of the Question	Marks	Mapped CO
1.	Write short notes: (a) Hydrometer corrections (b) Quick sand condition (c) Standard Proctor Test (d) Zero air void line	8	CO2
2.	A cube of dried clay having sides 4 cm long has a mass of 110 gm. The same cube of soil, when saturated fully at unchanged volume, has mass of 135 gm. At saturated condition, draw the phase diagram showing the volumes and masses of the constituents of the soil, and determine the water content, specific gravity of soil solids, void ratio and saturated density. Consider density of water as 1 gm/cm^3.	6	CO1
3.	A granular soil deposit is 7 m deep over an impermeable layer. The ground water is 4 m below the ground surface. The deposit has a zone of capillary rise of 1.2 m with a saturation of 50%. Consider the soil as dry above the capillary zone. Plot the variation of total stress, pore water pressure and effective stress with the depth of deposit. e = 0.6 and $G_s = 2.65$.	6	CO3
4.	a) Prove that: (i) $\rho_d = \frac{(1-n_a)G_s\rho_w}{(1+wG_s)}$ (ii) $\gamma_{bulk} = \gamma_d + S_r(\gamma_{sat} - \gamma_d)$	5	CO1

Course Outcomes
CO1: Acquire knowledge of classifying the soil from Civil Engg. Aspect
CO2: Ability to conduct Experiment and Analyze the data with interpretation
CO3: Ability to analyze Soil for Soil-Structure like Dams (Earthen/Rigid)
CO4: Ability to Design Soil related Civil Engg. Structure
CO5: Understanding need of the Professional Ethics & future studies

NATIONAL INSTITUTE OF TECHNOLOGY DURGAPUR

Odd Semester Mid-Term Examination, 2022-23

Course Code: CEC503 Full Marks: 25

Course Name: SOIL MECHANICS Time: 90 Minutes

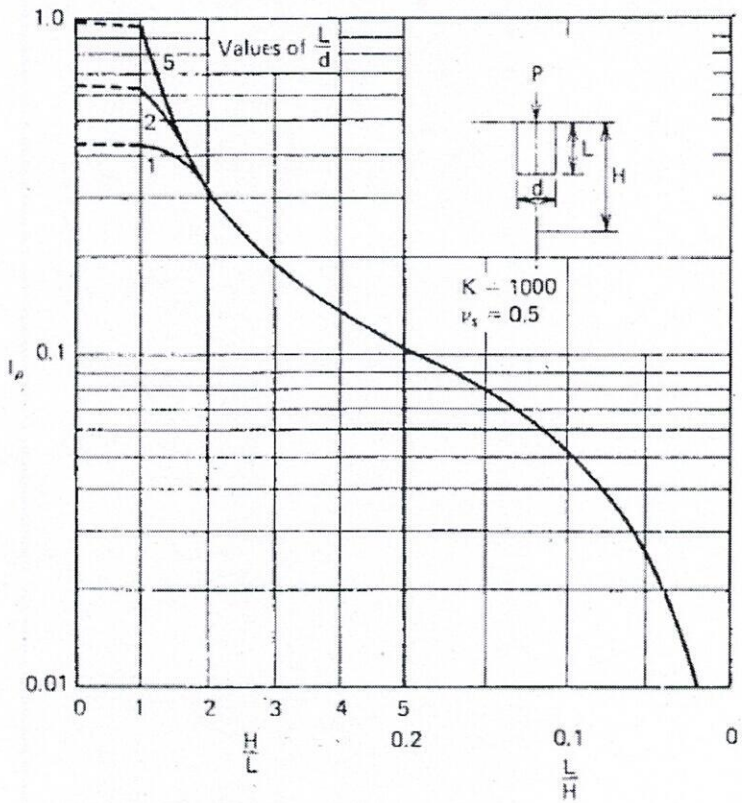


FIGURE 5.35 Influence factors for settlement beneath center of a pier.

TABLE 6.2 THEORETICAL VALUES OF SETTLEMENT RATIO R_s FRICTION PILE GROUPS, WITH RIGID CAP, IN DEEP UNIFORM SOIL MASS

No of Piles in Group		4				9				16				25			
L/d	s/d K	10	100	1000	∞	10	100	1000	∞	10	100	1000	∞	10	100	1000	∞
10	2	1.83	2.25	2.54	2.62	2.78	3.80	4.42	4.48	3.76	5.49	6.40	6.53	4.75	7.20	8.48	8.68
	5	1.40	1.73	1.88	1.90	1.83	2.49	2.82	2.85	2.26	3.25	3.74	3.82	2.68	3.98	4.70	4.75
	10	1.21	1.39	1.48	1.50	1.42	1.76	1.97	1.99	1.63	2.14	2.46	2.46	1.85	2.53	2.95	2.95
25	2	1.99	2.14	2.65	2.87	3.01	3.64	4.84	5.29	4.22	5.38	7.44	8.10	5.40	7.25	9.28	11.25
	5	1.47	1.74	2.09	2.19	1.98	2.61	3.48	3.74	2.46	3.54	4.96	5.34	2.95	4.48	6.50	7.03
	10	1.25	1.46	1.74	1.78	1.49	1.95	2.57	2.73	1.74	2.46	3.42	3.63	1.98	2.98	4.28	4.50
50	2	2.43	2.31	2.56	3.01	3.91	3.79	4.52	5.66	5.58	5.65	7.05	8.94	7.26	7.65	9.91	12.66
	5	1.73	1.81	2.10	2.44	2.46	2.75	3.51	4.29	3.16	3.72	5.11	6.37	3.88	4.74	6.64	8.67
	10	1.38	1.50	1.78	2.04	1.74	2.04	2.72	3.29	2.08	2.59	3.73	4.65	2.49	3.16	4.76	6.04
100	2	2.56	2.31	2.26	3.16	4.43	4.05	4.11	6.15	6.42	6.14	6.50	9.92	8.48	8.40	10.25	14.35
	5	1.88	1.88	2.01	2.64	2.80	2.94	3.38	4.87	3.74	4.05	4.98	7.54	4.68	5.18	6.75	10.55
	10	1.47	1.56	1.76	2.28	1.95	2.17	2.73	3.93	2.45	2.80	3.81	5.82	2.95	3.48	5.00	7.88

Course Outcomes

CO1: Understand the basis of soil-structure interaction.
CO2: Understand various soil interaction models like beams on elastic foundation (Winkler beam model), infinite beam, finite beam models.
CO3: Apply soil-structure interaction models to different type of foundations like pile, sheet pile walls (cantilever and anchored sheet pile walls).
CO4: Analyse the foundation of different civil structures with considering soil-structure interaction in static as well as dynamic conditions.

NATIONAL INSTITUTE OF TECHNOLOGY DURGAPUR
Odd Semester Mid-term Examination, 2022-23

Course Code: CEC504 Full Marks: 25

Course Name: Transportation Engineering Time: 1.5 Hours

Instructions: Answer all the questions.

Q No.	Body of the Question	Marks	Mapped CO
1	a. What is stopping sight distance required to stop a vehicle while driving on a highway? Theoretically derive the stopping sight distance expression with necessary assumptions. b. Two drivers are driving a vehicle, one is driving in upward gradient and the other one is driving in down gradient with same magnitude as the upward gradient. Both vehicles are travelling at a speed of 60 KMPH. The vehicle travelling in upward gradient requires 9 meter less distance compared to the other vehicle to stop after application of brake. Considering coefficient of friction to be 0.4 for both cases, estimate the gradient.	5 (2+3)	CO1
2	a. What is camber? What are the three major types of cambers? b. On a two-way road, the speed of the overtaken vehicle or slow-moving vehicle is 40 KMPH, whereas the overtaking vehicle just prior to overtaking operation and an oncoming vehicle were travelling at 65 KMPH. Assume reaction time to be 2.0 sec and average acceleration during overtaking operation to be 0.92 m/sec^2. Estimate the total OSD considering all necessary components with help of a neat diagram.	5 (1+4)	CO1
3	a. Derive the two major criterions to be satisfied by a vehicle travelling along a horizontal curve, if it tries to avoid both skidding and overturning. b. A highway is provided with a horizontal curve of radius 300 meter. Calculate the super elevation required to maintain a design speed of 90 KMPH. Also calculate the maximum allowable speed if super elevation is limited to 0.07 and maximum coefficient of lateral friction is 0.15. Use IRC Method and make necessary assumptions.	5	CO1
4	Calculate Equivalent Single Wheel Load (ESWL) of a dual wheel assembly carrying 2050 kg, each for pavement thickness of 15, 20 and 25 cm. Data Input: Centre to centre spacing between tyres is 30 cm and distance between adjacent wall of tyre is 12 cm. Make necessary assumptions and draw neat illustrations if necessary.	5	CO2
5	The results of an one-day axle load survey of trucks on a highway is presented in the following table. Determine the number of repetitions of a standard 80 KN axle in a year.	5	CO3

Weight in Tonnes	Number of Axles	Weight in Tonnes	Number of Axles
1-2	14	9-10	11
2-3	76	10-11	11
3-4	77	11-12	12
4-5	70	12-13	15
5-6	28	13-14	7
6-7	18	14-15	3
7-8	10	15-16	1
8-9	11		

Course Outcomes
CO1: Apply knowledge of transportation engineering for planning & design solutions.
CO2: Understand basic design philosophy applicable to components of transportation engineering.
CO3: Formulate, analyze, & design basic components of transportation engineering.