

SUBJECT: Solid Mechanics

Mid Semester Examination (2018-19)  
CODE: ~~CEEC-301~~ (CEC-301) FM = 30

TIME: 2 hrs

Attempt all questions from each group. Use a single script but do not mix the answers of Group A and Group B

**Group A**

1. a) Define a beam along with a relevant diagram. 1.5  
b) Differentiate, using suitable example(s), between a determinate beam and an indeterminate beam 1.5
2. For each of the following beams, identify the supports and find out the support reactions. Hence, draw SFD and BMD for each beam. 3x3=9
  - a) Cantilever beam of length  $L$  with concentrated clockwise moment  $M_0$  at the free end
  - b) Simply supported beam of length  $L$  with two point loads each at  $L/3$  from the supports.
  - c) Overhang beam of overall length  $3L/2$  with a single overhang of  $L/2$ . There is a udl of  $w$  per unit length on the overhang part.
3. Write short notes on: 1.5x2=3
  - a) Neutral axis of a beam cross section
  - b) Section Modulus

**Group B**

4. a) Force carrying member may experience uniform normal average stress, if the force passes through the centroid of the member cross-section - explain. 3  
b) Define 'yield point' of stress-strain diagram. 2
5. (a) Draw stress-strain diagram with all salient points in case of mild steel specimen tested in laboratory. 3  
(b) What do you mean by 'resilience'. 2
6. State of stress inside a structure is as follows:  
 $\sigma_x = 10 \text{ MPa}$ ,  $\sigma_y = -20 \text{ MPa}$  and  $\tau_{xy} = 15 \text{ MPa}$ . Find out the principal stresses and maximum shear stress as well as the angle of principal planes and maximum shear plane for this state of stress. Show each result on a separate element. 5

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27/8/18

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27/8/18

Department of Civil Engineering, National Institute of Technology Durgapur  
MANUSCRIPT FOR THE SUBJECT AND EXAMINATION DETAILED UNDER

NAME OF THE EXAMINATION ..... **B. TECH / Mid-Semester**.....

SEMESTER ..... **III rd**..... SESSION ..... **2018-19**.....

SUBJECT NAME ... **FLUID MECHANICS**

SUBJECT CODE ..... **CEC 302**.....

TIME ..... **TWO HOURS**

FULL MARKS ..... **30**

Answer ..... **any three**.... Questions

Question No.	Questions	Marks
1 (a)	Define centre of pressure and total pressure on an immersed surface. Prove that the centre of pressure of fully submerged plane lamina is always below or at the centroid of the lamina.	4
(b)	An isosceles triangular plate of base 4 metres and altitude 4 metres is immersed vertically in fluid of specific gravity 0.9. The base of the triangle is touching the free surface of the fluid horizontally and rest of its portion is within the fluid. Determine the resultant hydrostatic force on one side of the plate and the centre of pressure of the plate.	6
2	A solid cone floats in water with its apex downwards. Determine the least apex angle of cone for stable equilibrium. The specific gravity of the material of cone is 0.70.	10
3	The velocity vector in an incompressible flow is given by $V = (6xt + yz^2)\mathbf{i} + (3t + xy^2)\mathbf{j} + (xy - 2xyz - 6tz)\mathbf{k}$ (i) Verify whether the continuity equation is satisfied. (ii) Determine the acceleration vector at point A(1,1,1) at t=1.0.	10
4 (a)	Derive Euler's equation for the frictionless flow along a streamline of an incompressible fluid.	5
(b)	A horizontal venturimeter with inlet diameter 200 mm and throat diameter 100 mm is used to measure the flow of oil of sp. gr. 0.8. The discharge of oil through venturimeter is 60 litres per sec. Find the reading of the oil-mercury differential manometer. Take $C_d = 0.98$ .	5
5	Derive the formula to be used and solve the following problem: A vertical cylindrical tank of diameter 4 m contains water upto a height of 5 m. The tank is provided with an orifice of diameter 0.5 m at the bottom. Find the time taken by water (i) to fall from 5 m to 2 m and (ii) for completely emptying the tank. Take $C_d = 0.6$ .	10

*Purnendu Ray*  
Paper Setter: Purnendu Ray

## Building Construction & Concrete Technology

Time: 02 Hours

CEC-303

Full Marks: 60 (Weightage: 30)

**Answer any SIX questions.**  
**No codes and books are allowed.**

**Q.01).** Discuss any five factors necessary for consideration in planning a building.  $2 \times 5 = 10$

**Q.02).** Discuss the salient features of any five spread foundations with neat sketches.

 $2 \times 5 = 10$  $2 \times 5 = 10$ 

**Q.03).** Differentiate between the following:

(a) Detached building & annexe building,

(b) Set-back line & building line,

(c) Built-up area & covered area,

(d) Balcony & porch,

(e) Room height & head room.

**Q.04).** (a) When do we have to go for a deep foundation?

(b) Discuss the merits & demerits of pre-cast & cast-in-situ R.C.C. piles.

(c) Define & discuss the importance of F.A.R.

 $2 + (2 \times 3) + 2 = 10$ 

**Q.05).** What are the different component of Cement? Write down the role of the components during the application of the cement. Define heat of hydration, setting time and hardening of cement. What is the difference between Quick setting and Rapid hardening cement?

 $1 + 5 + 3 + 1 + 1 = 10$ 

**Q.06).** Define the fineness modulus of aggregate. Classify the sand with the help of fineness modulus. What do you mean by bulking of sand? Write short note on "Concrete with sea water". What do you mean by Flakiness of aggregate? Write down the different functions of admixture.

 $1 + 1.5 + 2 + 2 + 1.5 + 2 = 10$ 

**Q.07).** Calculate the modulus of elasticity and flexural strength of M40 grade of concrete. In an aggregate abrasion test, initial weight of aggregate is 500gms and after 1000 revolutions, the weight of aggregate reduced to 490gms. Calculate the hardness of the aggregate. Further, calculate the fineness modulus of the aggregate with the following details:

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		

 $2 + 2 + 6 = 10$ 

**Q.08).** Answer any 10 questions (write correct words/value only)

 $10 \times 1 = 10$ 

i). The tendency of an aggregate is to split along: a). texture, b). flexure, c). fracture, d). cleavage.

- ii). Good quality sand is never obtained from a). river, b). sea, c). stone dust, d). desert.
- iii). The commonly used raw material for cement is a). slate, b). sand stone, c). lime stone, d). bauxite.
- iv). The total quantity of  $C_3S$  and  $C_2S$  in percentage is.....
- v). Aggregates are nothing but cooled .....
- vi). Demarcation size of coarse and fine aggregate is.....
- vii). The elongation index is not applicable to sizes smaller than .....
- viii). The pH value of construction water is.....
- ix). Generally, one bag of cement means .....kg of cement.
- x). Best shape of coarse aggregate is a). Round, b). Angular, c). Flakey, d). Irregular
- xi). In concrete cube test, the standard size of cube is a). 15 cm x 15 cm x 15 cm, b). 15 cm x 15 cm x 10 cm c).25 cm x 10 cm x 10 cm d). c).10 cm x 10 cm x 10 cm.
- xii). Device which is used to find out normal consistency of cement is a). Le – Chatelier, b). Permeability apparatus c). Vicat apparatus d). None.