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Continuous Assessment Test – II

Programme Name & Branch: Fall-2019-20
(BCE/BCL/BEC/BEE/BEM/BME/BPI)

Course Name & Code: Fluid Mechanics (MEE1004)

Class Number: 1316, 2220 **Slot: C1+TC1**

Maximum Marks: 50 **Exam Duration: 90 mins**

Answer all questions.
(Assume suitable data, if necessary and give reason for the assumptions)

Section – A (5 ×10 = 50 marks)

1. A Horizontal venturimeter with inlet diameter 180mm and throat diameter 90mm is used to measure the flow of water. The pressure at inlet is 18.5 N/cm^2 and the vacuum pressure at the throat is 25 cm of mercury. Find the discharge of water through venturimeter. (C_d=0.97)

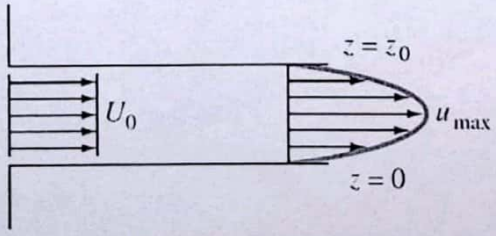
2. A pipe of 15 cm radius conveying 0.42 m^3/s of water has a right angled bend in a horizontal plane. Find the resultant force exerted on the bend if the pressure at inlet and outlet of the bend are 24.95 N/cm^2 and 22 N/cm^2.

3. The velocity components in a fluid flow are given by

   $u = \frac{y^3}{3} + 2x - x^2y$ and $v = xy^2 - 2y - x^3/3$, $w = 0$. Is the flow
   (a) steady or unsteady?
   (b) 1D, 2D or 3D?
   Show that these components represent a possible case of an irrotational flow.

4. The rate of flow of water through a horizontal pipe is 0.35 m^3/s. The diameter of the pipe which is 220 mm is suddenly enlarged to 380 mm. The pressure intensity in the smaller pipe is 13.7 N/cm^2. Is the loss is major or minor loss? What type of loss is in kind of flow? Determine:
   (i) Loss of head due to sudden enlargement,
   (ii) Pressure intensity in the large pipe,
   (iii) Power lost due to enlargement.

5. Incompressible steady flow in the inlet between parallel plates in Fig. is uniform, u = U_0 = 8 cm/s, while downstream the flow develops into the parabolic laminar profile u = az(z_0 – z), where a is a constant. If z_0 = 4 cm and the fluid is water, what is the value of u_{max} in cm/s?



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Continuous Assessment Test – II

Program Name & Branch: B Tech in Civil Engineering

Course Name & Code: Pollution Control and Monitoring-CLE2019

Class Number: 6600 & 2049 **Slot: B1** **Exam Duration: 90 mins** **Maximum Marks: 50**

Answer ALL the Questions

Section – A (10 x 3= 30 Marks)

1. (a) Calculate the minimum size of the particle that will be removed with 100 percent efficiency from a settling chamber under the following conditions. ***Data given:*** (i) Air: Horizontal velocity is 0.3 m/s; (ii) Temperature is 77°C; (iii) Particle: specific gravity is 2.0; (iv) Chamber: length is 7.5 m; and (v) height is 1.5 m; (vi) viscosity of air at 77°C is 2.1×10^{-5} kg/(m·s). (5 marks)

   (b) Estimate the wind speed at an elevation of 400 m in rough terrain, if the atmosphere is slightly unstable. Assume an anemometer at a height of 10 m above ground measures the wind speed at 2.5 m/s. (5 marks)

2. If an industrial stack is emitting CH_4, NO_x, SO_2, PM_{10} and CFC-11, enlist the possible 'direct' and 'indirect' impacts of each pollutants. Also, point out the probable environmental 'problems' and 'damages'.

3. A power plant has a 100-m stack with radius 1 m. The exhaust gases leave the stack with exit velocity of 10 m/s at a temperature of 120°C (393 K). Ambient temperature is 6°C (279 K), winds at the effective stack height are estimated to be 5 m/s, surface wind speed in 3 m/s, and it is a cloudy summer day. Estimate the effective height of this stack.

Section – B (20 x 1= 20 Marks)

4. The sugar industry wants to Implement ZLD in the premises for treating the effluent and using the recovered nutrients for their purpose.

   (a) What are the challenges for implementing the ZLD in such industry? (5 marks)

   (b) Suggest unit operations/process for achieving ZLD with flowchart and proper justification. (15 marks)

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Continuous Assessment Test – II

Programme Name & Branch: B.Tech Civil Engineering

Course Name & Code: CLE 2005 Transportation Engineering

Class Number: VL2019201003762 **Slot:** D1 **Exam Duration:** 90min. **Maximum Marks:** 50

General instruction(s): Answer all questions.

1. Answer the following questions

a Describe the method used by the engineer to obtain density of subbase layer in the field during our field visit. Use diagrams and show the principle using example. (6 marks)

b Draw the three layer system used in pavement analysis and show the two types of strains that are considered in flexible pavement design. (4 marks)

c Write how the coning of train wheels helps the movement of train in straight and curved paths. Show diagram. (4 marks)

2. Axle load survey is used to estimate vehicle damage factor (VDF) on a road. The aim of the survey is to estimate the axle equivalency factor which helps us to convert any axle type into standard axle.

A standard axle is a "single axle with dual tyres ( )" with 8160kg load or 80kN weight. For a single axle with dual tyres with a load of L kg, the equivalency factor is $(L/8160)^4$

In an axle load survey, Table 1 shows the number of single axles with dual tyres in five load groups. Calculate the average axle equivalency factor.

(8 marks)

Table 1

Load (kg)	3000	6000	9000	12000	15000
No. of axles	15	23	32	20	10

3. Flexible pavement for a four-lane divided state highway is to be designed with the following data:

Year of opening for traffic: 2022; Design life: 12 years; AADT in 2019 is 40,000. % of commercial vehicles: 6%; Compounded annual growth rate: 5%; CBR of subgrade soil: 8%; Vehicle damage factor: 2.8.

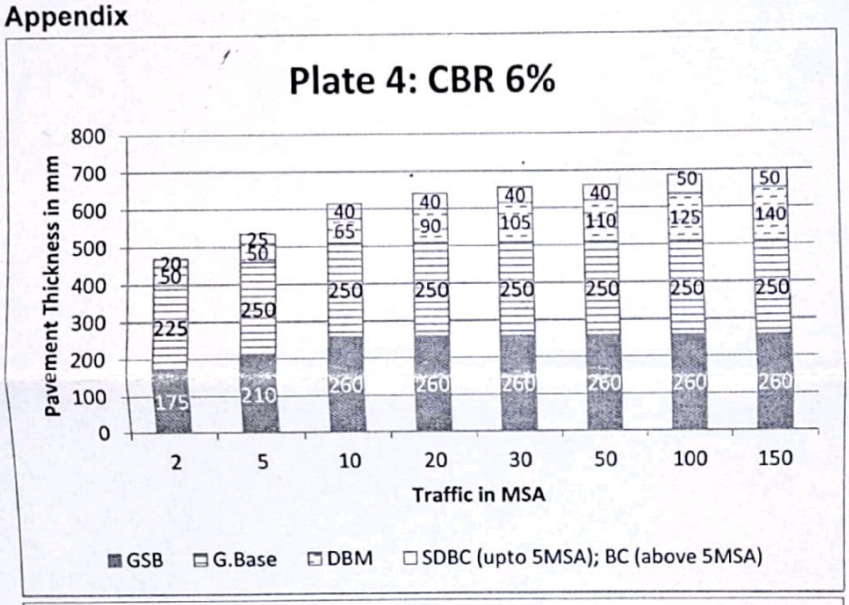
Find the pavement layers and their thicknesses form IRC charts and draw the pavement cross-section diagram (full width upto end of subgrade). Charts from IRC 37:2012 are given in Appendix. (10 marks)

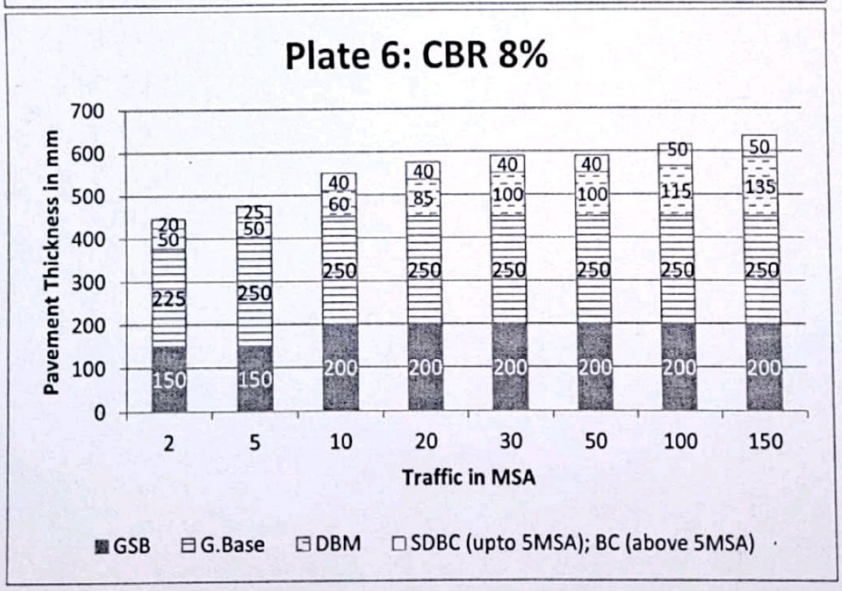
4. An BG track section is going through a 3 degree curve. It has a maximum sanctioned speed of 100 km/hr. Booked speed of the goods train to be 60km/h. (12 marks)

   a) Design the superelevation for this curve.
   b) Identify the equilibrium speed corresponding to the superelevation provided and the maximum permissible speed.
   c) Calculate the transition length to be provided.

5. A 7 degree curve branches off from a 5 degree main line curve in an opposite direction in the layout of a metre gauge yard. If the speed restriction on main line is 60 km/h, calculate the superelevation to be provided on the main line. Calculate the maximum permissible speed on the branch line at the point of divergence.(6 marks)

Appendix





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Continuous Assessment Test – II

Programme Name & Branch: B.Tech, Civil Engineering

Course Name & Code: Urban Planning, CLE 1016

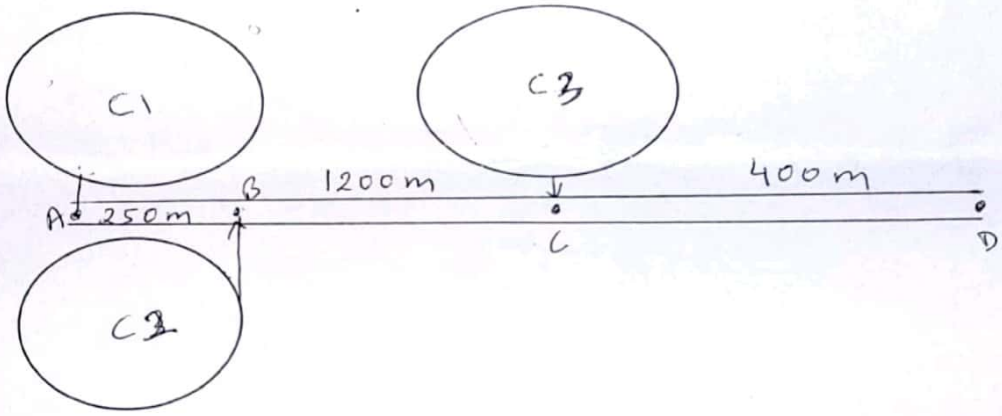
Class Number: 7407 **Slot: A1** **Exam Duration: 90 Min** **Maximum Marks: 50**

1. A new pumping plant is to be constructed for a water supply system. Either alternative A or B will provide the required flow capacity. As shown in Table 1, alternative A costs more to construct but lasts longer. Alternative B has a lower initial investment but higher O&M cost and a shorter economic life. Determine the economically optimum plan for a discounting rate of 8% and 12% respectively. [20 M]

Table 1: Cost data for the problem

Alternative	Initial investment cost (INR)	Annual O&M cost (INR)	Salvage value (INR)	Design life (years)
A	525000	26000	0	50
B	312000	48000	50000	25

2. Design a rectangular storm sewer network for the catchment shown in figure below. [20 M]



The details of the catchment are given in the table below:

Catchment ID	Area (ha)	Slope (m/m)	Length (m)	Character of the surface
C1	0.61	0.0055	276	Asphaltic
C2	2.28	0.0013	482	Grass area – fair condition – average
C3	1.51	0.008	152	Cultivated land – flat

The return period for the design can be taken as five years. The rainfall intensity can be determined using the following IDF equation:

$$i = \frac{89}{(t_c + 8.5)^{0.754}}$$

Where i is in mm/h and t_c is in minutes. Assume width of the channel (B) is two times the depth of the channel (y).

3. How does urbanization impact the local water cycle? [10 M]

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Continuous Assessment Test – I

Programme Name & Branch: B.Tech, Civil Engineering

Course Name & Code: Urban Planning, CLE 1016

Class Number: 7407 **Slot: A1** **Exam Duration: 90 Min** **Maximum Marks: 50**

1. What are the typical aims of town planning? [5 M]

2. What are the different types of data to be collected at the planning stage of urbanization? [5 M]

3. List out the principles of town planning. [5 M]

4. Explain in brief the logistic curve method for population forecasting. [5 M]

5. Write a detailed notes on various analytical tools used for analyzing data collected for urban planning. [15 M]

6. The population statistics pertaining to a town are given below. Estimate the population expected in year 2029, 2039, and 2049, using arithmetic increase method, geometric growth method, incremental increase method and decreasing rate of growth method. [15 M]

Year	1979	1989	1999	2009	2019
Population	70000	100000	150000	200000	240000

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SCHOOL OF CIVIL ENGINEERING

Continuous Assessment Test - II, October 2019

B. Tech. *(Civil Engineering)*, Fall Semester 2019–20

Class Nbr.	:	VL2019201003699		
Course Code	:	CLE1004	**Duration**	: 90 Minutes.
Course Name	:	Soil Mechanics and Foundation Engineering	**Max. Marks**	: 50
Faculty-In-Charge:		Dr. Divya Priya B	**Slot**	: E1+TE1

General instruction(s):

Assume values wherever necessary

Answer all questions

Section – A (5 x 2 = 10 Marks)

1. Under what conditions does secondary consolidation becomes important?

2. A line load of 90 kN/m run extends to a long distance. Determine the intensity of vertical stress at a point 1.5 m below the surface (i) directly under the line load, and (ii) at a distance 1 m perpendicular to the line load. Use Boussinesq's theory.

3. What type of settlement occurs in sandy soils? Why?

4. A 1000 kN load is uniformly distributed on an area 2 m X 3 m. Determine the approximate average vertical stress at 3 m depth using 2: 1 dispersion.

5. What does the Mohr circle of stress represent?

(Contd..)

Section – B (4 x 10 = 40 Marks)

1. a) Two concentrated loads 200 kN and 300 kN spaced at 5 m act on the ground surface. Find the increase in the vertical stress at a depth of 5 m below each load and also midpoint between the loads at the same depth. **[6 marks]**

   b) A layer of silty clay is 5 m thick and has an initial overburden pressure of 70 kN/m^2 at its middle. Determine the final settlement due to an increase in pressure of 80 kN/m^2 at the middle of the clay layer. The clay is over-consolidated with a preconsolidation pressure of 120 kN/m^2. The value of coefficient of recompression and compression index are 0.03 and 0.27 respectively. Take initial void ratio as 0.90. **[4 marks]**

2. A 8 m thick clay layer beneath a building is overlain by a permeable stratum and is underlain by an impervious rock settles by 120 mm in 2 years. The coefficient of consolidation for this clay layer was found to be 6×10^{-3} cm^2/s. Calculate the likely ultimate consolidation settlement and find out how long it will take to undergo 90 percent of this settlement. **[10 marks]**

3. a) Calculate the potential shear strength on a horizontal plane at a depth of 4 m below the surface in a formation of cohesionless soil when the water table is at a depth of 5 m. The soil is saturated to 40% with a void ratio of 0.60. Take G = 2.60; angle of internal friction = 25°. What will be the modified value of shear strength if the water table reaches the ground surface? **[6 marks]**

   b) What do you understand by (i) UU test (ii) CU test (iii) CD test (iv) UC test? **[4 marks]**

4. A lighthouse is constructed on a circular ring type foundation. The intensity of loading on the foundation is 200 kN/m^2. The outer diameter of the ring foundation is 16 m and the internal diameter is 13 m. Determine the vertical pressure directly below the centre of the foundation at depths of 4 m and 6m. **[10 marks]**