University of Asia Pacific
Department of Civil Engineering
Mid Semester Examination, Fall 2024
Program: B.Sc. in Civil Engineering
2nd Year 2nd Semester

Course Title: Fluid Mechanics | Course Code: CE 221
Time: 1 hour | Credit Hour: 3.00 | Full Marks: 40

Answer all the questions. Assume reasonable data for the missing values

QUESTION 1 [4 MARKS]

Define and provide mathematical expression for the following fluid properties: [4]
i) kinematic viscosity, **ii)** surface tension, **iii)** bulk modulus of elasticity, **iv)** specific volume

QUESTION 2 [6 MARKS]

State Bernoulli's energy equation and write down the limitations of it. [6]

QUESTION 3 [10 MARKS]

Define and briefly explain different flow type for following criteria:

i) time, **ii)** density, **iii)** space **iv)** velocity distribution and Reynold's number, **v)** velocity components [10]

QUESTION 4 [10 MARKS]

Oil (s.g=0.80, Q=0.60ft^3/s) is flowing from a closed tank to a nozzle at point 2 through a 6-inch diameter pipe as shown in **Figure 1**. Find out the pressure at point 1. Assume head loss is negligible. Datum is at the water surface of the reservoir. Apply Bernoulli's equation at point 1 and 2. [10]

QUESTION 5 [10 MARKS]

a. A concrete dam is shown in **Figure 2** whose width is 100m and is resisting water (γ = 9.81 kN/m^3). Find the hydrostatic force on the surface of the dam. [5]

b. Find the expression of center of pressure of a vertical circular gate with diameter, d having water table coincided with the top surface of the gate as shown in **Figure 3**. [5]

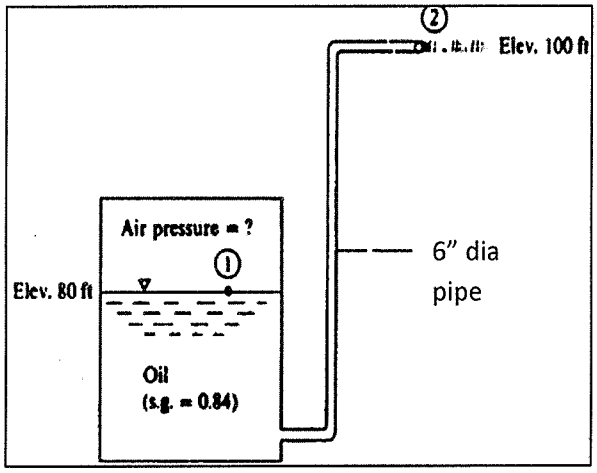

Figure: 1

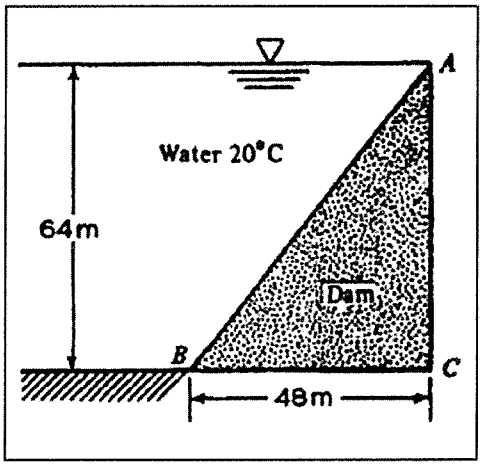

Figure: 2

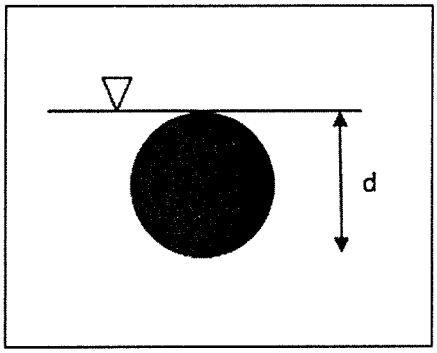

Figure: 3

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Course Title: Engineering Economics | Course Code: ECN 201

Time: 1 hour | Credit Hour: 3.00 | Full Marks: 60

Answer any THREE questions

QUESTION 1 [20 MARKS]

a. Define Economics. Distinguish between Microeconomics and Macroeconomics [8]

b. All the societies face some fundamental economic problems because of scarcity of resources. Describe these problems in your own words [12]

QUESTION 2 [20 MARKS]

a. Given the demand and supply functions for i-teen ball point pen. [8]

QDi = 1500 – 55 Pi

QSi = 750 + 20 Pi

From these two functions, construct the demand and supply schedules and plot the curves on a graph.

b. Find the equilibrium price and quantity. If the Government imposes Tk. 2 VAT on unit price, what will be the new equilibrium price and quantity? [12]

QUESTION 3 [20 MARKS]

a. Distinguish between 'change in demand' and 'change in quantity demanded'. [8]

b. Illustrate different types by elasticity of demand in Economics. Briefly explain the determinants of price elasticity of demand. [12]

QUESTION 4 [20 MARKS]

a. Define supply function. Explain the determinants of supply of a commodity in general. [8]

P.T.O

b. Derive the formula for calculating elasticity of demand. For the market demand schedule in the following **Table 1**: (i) find the price elasticity of demand for a movement from point A to point C, from point C to point A. (ii) do the same for points D and F. [12]

Table 1:

Point	A	B	C	D	F
Price, Px (Tk.)	15	12	10	8	7
Quantity, Qx	500	750	1250	1680	2000

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Course Title: Numerical Analysis and Computer Programming (OBE) Course Code: CE 205
Time: 1 hour Credit Hour: 3.00 Full Marks: 40

Answer all the questions

QUESTION 1 [10 MARKS]

While performing an experiment in geotechnical lab at UAP, students found this equation

$$x^4 + 4sin(0.5x) - 10 = 0$$

Find the root of the above equation using **Secant Method** assuming $x_0 = 1$ & $x_1 = 2$

QUESTION 2 [30 MARKS]

In transportation engineering lab, the following data of Trip Count vs Gross Floor Area are observed.
Gross Floor Area (GFA) = x
Trip Count = y

Gross Floor Area (In thousand sft)	1	3	5	7	9
Trip Count	200	350	420	540	610

a. Determine the equation of a straight line using the tabular data. [10]

b. Determine the equation of a parabola in the form of $y= a+bx+cx^2$, using the tabular data. For determination of a, b and c use **Gauss Elimination method**. [20]

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Course Title: Applied Mathematics for Engineers | Course Code: MTH 203
Time: 1 hour | Credit Hour: 3.00 | Full Marks: 60

Answer all the questions

QUESTION 1 [4 MARKS]

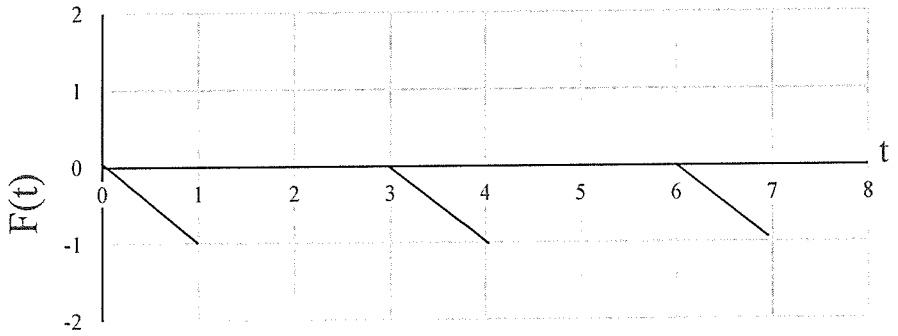
Find $L\{e^{-2t}\, Ci(t)\}$.

QUESTION 2 [10 MARKS]

Evaluate $\int_0^{\infty} \frac{e^{-2t}\,(1-\cosh t)}{t}\, dt$.

QUESTION 3 [8 MARKS]

Determine the Laplace transformation of the following periodic function.



QUESTION 4 [8 MARKS]

Determine $L^{-1}\left\{\frac{1}{s^2(s+5)}\right\}$.

QUESTION 5 [10 MARKS]

Form a PDE from $\phi(x^2+y^2+z^2, ax+by+cz) = 0$.

QUESTION 6 [10 MARKS]

Determine the general solution of the linear partial differential equation.

$$\frac{(m-n)yzp}{l} + \frac{(n-l)zxq}{m} = \frac{(l-m)xy}{n}$$

QUESTION 7 [10 MARKS]

Find the complete integral of non -linear partial differential equation $p^2z^4 = 1 - q^2z^2$.

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Course #: CE 213 — Course Title: Mechanics of Solids II

Full Marks: 40 (= 4 × 10) — Time: 1 hour

Given R_0 = Last three digits of Registration #

1. Fig. 1 shows a freedom fighter (at Gobra camp) using sten gun for the liberation war of 1971, while Fig. 2 shows a schematic view of forces acting on her left hand *abc*.


Fig. 1

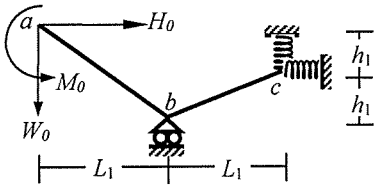

Fig. 2

At center of section *b* (just at left of support) of her hand *abc* (whose cross-section is a 0.8″-dia circle), calculate the

(i) Normal stress and shear stress

(ii) Principal stresses and direction of Principal planes

[Given: $W_0 = (3 + 0.01R_0)$ lb, $H_0 = 10W_0$, $L_1 = (1 + 0.003R_0)$ ft, $M_0 = 0.25W_0L_1$, $h_1 = 0.35L_1$].

2. Fig. 2 shows hypothetical helical spring supports (vertical and horizontal) at joint *c* of the beam *abc* described in Question 1. Assume each spring to have shear modulus = 12000 ksi, coil diameter = 0.1″, mean radius = 0.5″, number of coils = 5.

Calculate (for both springs at *c*) the

(i) Force (ii) Deflection (iii) Maximum shear stress

(iv) Principal stresses and direction of Principal planes.

3. Fig. 3(a) shows a Karate Girl applying force $F_0 = (500 + R_0)$ lb at eccentricity $e_0 = (3 + 0.03R_0)$ ft on a devil, which is modelled in Fig. 3(b) by a beam *AB* (of variable cross-sections) subjected to torsional moment $T_0 = F_0 e_0$, at point *B*.

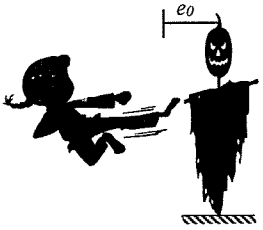

Fig. 3(a)

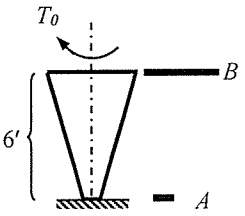

Fig. 3(b)

If the beam-section varies linearly from (1′×1″) at section *A* to (4′×1″) at section *B*, calculate the maximum torsional stress and torsional rotation of the beam *AB*, given $G = (1000 + 10R_0)$ ksi.

4. Calculate equivalent polar moments of inertia (J_{eq}) of ANY TWO of the cross-sections shown in Fig. 4(a), 4(b), 4(c) by centerline dimensions

[Given: $x = (1 + 0.01R_0)$ ft,

Wall thickness = 0.10 ft throughout].

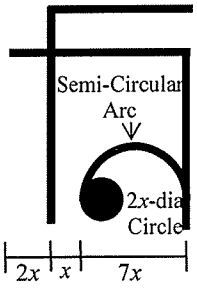

Fig. 4(a)

Fig. 4(b)

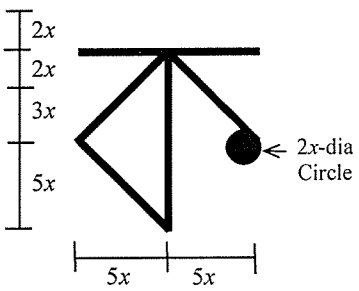

Fig. 4(c)