

University of Asia Pacific
Department of Civil Engineering
Mid-Term Examination Spring 2024
Program: B.Sc. in Civil Engineering

Course Title: Fluid Mechanics
Time: 1 hour

Course Code: CE 221
Credit Hour: 3.00

Full Marks: 40

Answer all the Questions. Assume any reasonable value(s) if missing.
Necessary figures are given in the page below

1. 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

2. State and derive continuity equation for fluid flow. [6]

3. A flow velocity profile is given, $u = -x$, $v = y$, $w = 0$ find out whether, the flow is [2+2+4]
a) steady or unsteady? b) Find the dimension of the flow. c) does it satisfy continuity? d) find the equation of streamline.

4. Define the following parameters of fluid flow: [6]
i) Potential energy head, ii) Absolute pressure, iii) Hydraulic grade line, iv) Head loss, v) Volume flow rate, vi) Kinetic energy head.

5. A manometer is attached to a conduit in **Figure: 1**. Find the pressure at point A. [8]

6. An 8-inch diameter horizontal pipe is attached to a reservoir as shown in **Figure: 2**. [8]
If the total head loss between the water surface in the reservoir and the discharge point is 6ft. find the velocity and flow rate of water discharging from the pipe.

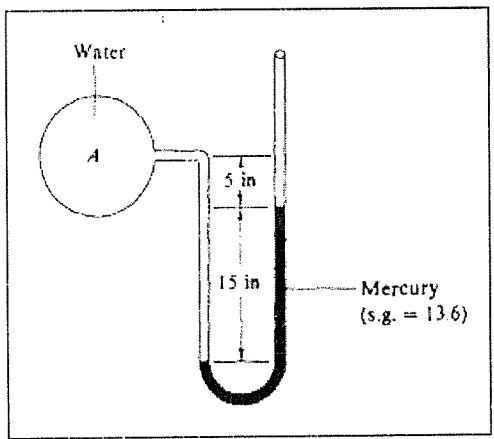


Figure: 1

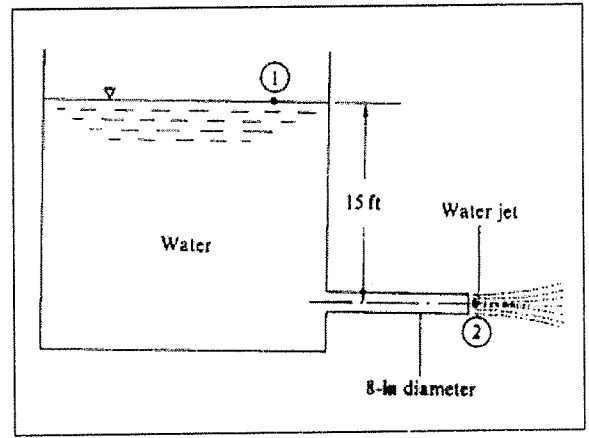


Figure: 2

University of Asia Pacific
Department of Civil Engineering
Mid-term Examination Spring-2024
Program: B.Sc. Engineering (Civil)

Course Title: Mathematics-IV
Time: 1.00 Hour

Self-Study
Credit Hour: 3.00

Course Code: MTH 203
Full Marks: 60

There are four (4) questions. Answer three (3) questions including Q1 and Q2. Figures given in the right margin indicate the marks of the respective questions.

1. a. Obtain the associated differential equations of the equation $y = A \cos ax + B \sin ax$, where A and B are arbitrary constants and a is a fixed number. 10
- b. Obtain the differential equation of all circles passing through the origin and having their centers on the x axis. 10
2. a. Identify and solve the equation $x^2(y + 1)dx + y^2(x - 1)dy = 0$ 10
- b. Verify whether the differential equation is exact or not. Also, solve the equation $(y^2 - 2xy + 6x)dx - (x^2 - 2xy + 2)dy = 0$. 10
3. a. Solve the equation $x^2 \frac{d^2y}{dx^2} - 2x \frac{dy}{dx} - 4y = 0$. 10
- b. Using integrating factor Solve $(x^2 + y^2 + 1)dx - 2xy dy = 0$ 10

OR

4. a. Identify and solve the equation $\frac{d^3y}{dx^3} + 6 \frac{d^2y}{dx^2} + 25y = 0$. 10
- b. Solve the Bernoulli's equation $x^2 \frac{dy}{dx} - 2xy = 3y^4$. 10

University of Asia Pacific
Department of Civil Engineering
Mid-Term Examination, Spring 2024
Program: B.Sc. in Civil Engineering

Course Title: Engineering Geology and Geomorphology
Time: 1 hour

Credit Hour: 3

Course Code: CE 203
Full Marks: 40

(Answer all questions)

1. Differentiate silicate minerals from non-silicate minerals in terms of their structure and formation. [5]
2. Describe briefly the formation of U-Valley. [5]
3. Explain how rocks are transformed from one type to another with the help of a neat sketch. [5+5]
4. Discuss briefly the agents of metamorphism. [10]
5. Compare between V-shaped valley and U-shaped valley. [5]
6. Discuss the process of valley deepening. [5]

University of Asia Pacific
Department of Civil Engineering
Mid-term Examination, Spring 2024
Program: B.Sc. in Civil Engineering

Course Title: Principles of Economics Credit Hour: 2.00 Course Code: ECN 201

Time: 1 hour Full Marks: 40

There are **THREE** questions. Answer any **TWO including Q-1**. All the questions are of equal value. Figures in the right margin indicate marks.

1. a. Describe the fundamental economic problems that every economy has to face. 10
- b. Explain how these problems are addressed with reference to different economic systems. 10
2. Illustrate the law of diminishing marginal utility with numerical and graphical presentations. Mathematically derive the consumer equilibrium condition ($MU_x = P_x$) for a single commodity. How would you derive a consumer's demand curve using the axiom of diminishing marginal utility? 20

OR

3. Explain the mechanism through which a commodity's equilibrium price and quantity are determined in the open market. The demand and supply functions of a commodity (say, X) are given respectively
 $Q_{dx} = 2420 - 75P_x$ and
 $Q_{sx} = 850 + 25P_x$ 20

Where, P_x is the price of the commodity. Find the equilibrium price and quantity of the commodity X. If the Government imposes 20% VAT on unit price, what would be the new equilibrium price and quantity? What is the percentage of VAT that the consumers would bear?

University of Asia Pacific
Department of Civil Engineering
Mid-Term Examination, Spring 2024
Program: B.Sc. in Civil Engineering

Course Title: Mechanics of Solids II
 Time: 1 hour

Credit Hour: 3

Course Code: CE 213
 Full Marks: 40

1. (a) Using the force method, determine support reactions for the circular stepped shaft shown in **Figure 1**.

Also,

(b) Plot the torque diagram

(c) Plot the angle of twist diagram

Given: The applied torques are $T_1 = 500$ lb-in, $T_2 = 400$ lb-in, $T_3 = 200$ lb-in (odd rolls) **OR** $T_1 = 600$ lb-in, $T_2 = 500$ lb-in, $T_3 = 300$ lb-in (even rolls).

Let, $G = 4.25 \times 10^6$ lb/in².

(Marks 10)

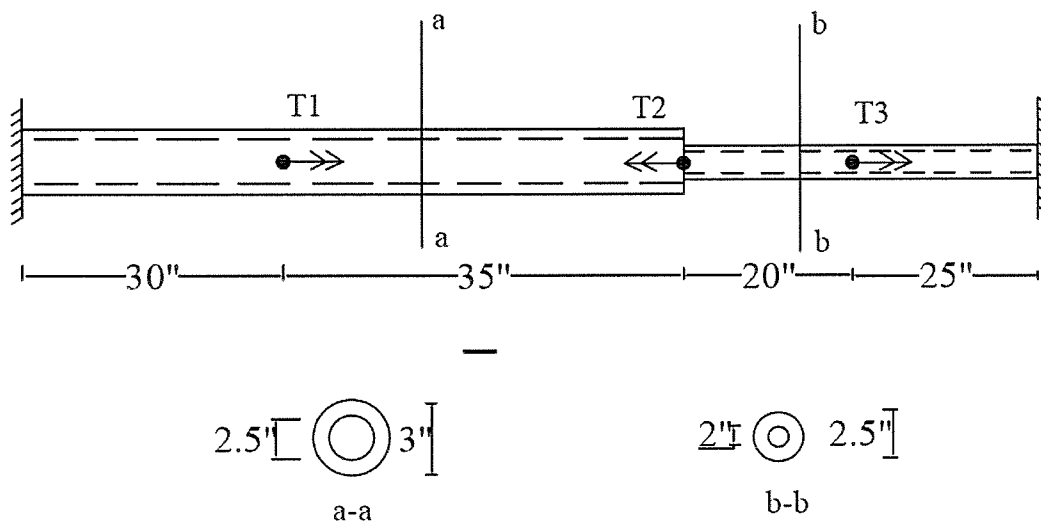


Figure 1

2. Determine the stress distribution at section ABCD for the block shown in **Figure 2**. All the dimensions are in mm. **Given:** $F = 55$ kN (even rolls) **OR** $F = 60$ kN (odd rolls). At the same section, locate the line of zero stress. Neglect the weight of the block.

(Marks 10)

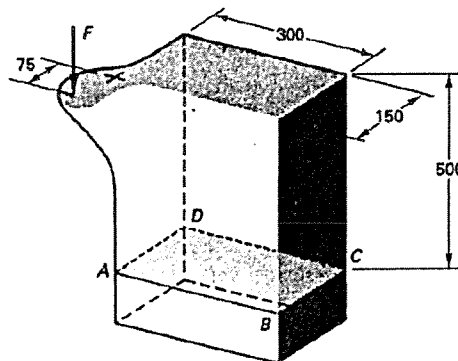


Figure 2

3. Explain how the maximum shear stress in a closely coiled helical spring is determined, considering both the direct and torsional shearing stresses. (Marks 5)
4. Using Mohr's circle of stresses,
 (a) transform the stresses shown in **Figure 3** into stresses acting on the plane at an angle of $\alpha = 22.5^\circ$ (clockwise) with the vertical axis.
 (b) Also, transform them into the
 - principal stresses and
 - maximum shear stresses and the associated normal stresses.
 (c) Show the results for both cases [in (b)] on properly oriented elements.

(Marks 15)

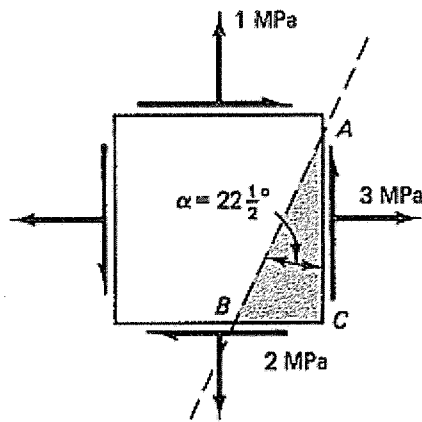


Figure 3

University of Asia Pacific
Department of Civil Engineering
Mid-term Examination, Spring-2024
Program: B.Sc. in Civil Engineering

Course Title: Applied Mathematics for Engineers

Course Code: MTH 203

Time: 1.00 Hour

Credit Hour: 3.00

Full Marks: 60

Use separate answer scripts for Part A and Part B. Figures in the right margin indicate the marks.

Answer the following questions.

Part – A

1. a. Obtain the differential equation of all spheres of radius λ , having center in the xy plane. 10
- b. Find the integral surface of the linear partial differential equation, $x(y^2 + z)p - y(x^2 + z)q = (x^2 - y^2)z$, which contains the line $x + y = 0, z = 1$. 10
2. Determine the general solution of $p(q^2 + 1) + (b - z)q = 0$. 10

OR

3. Find the complete and singular integral of $z = px + qy + pq$. 10

Part – B

4. Evaluate $\mathcal{L} \left\{ \frac{\sin 2t \cos 2t - 4t^3}{2t} \right\}$. 10
5. Express $F(t)$ in terms of Heaviside's Unit Step Function. 6
$$F(t) = \begin{cases} \sin 2t & ; 0 < t < 2\pi \\ \cos t & ; t > 2\pi \end{cases}$$
6. Find $\mathcal{L} \{t Ei(t)\}$. 6
7. Determine $\mathcal{L}^{-1} \left\{ \frac{s e^{-2s}}{3s^2 + 27} \right\}$. 8

University of Asia Pacific
Department of Civil Engineering
Mid-Term Examination, Spring 2024
Program: B.Sc. in Civil Engineering

Course Title: Numerical Analysis and Computer Programming
Time: 1 hour

Credit Hour: 3.00

Course Code: CE 205
Full Marks: 40

(Answer all of the questions. Assume any reasonable value for missing data.)

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

$$x^3 + \cos\left(\frac{x}{2}\right) - 5 = 0 \quad [10]$$

Find the root of the above equation using **Newton Rapson Method** assuming initial value $x_0 = 1$

2. In transportation engineering lab, the following data of Trip Count vs Gross Floor Area are observed. [10+20=30]

Gross Floor Area (GFA) = x

Trip Count = y

Gross Floor Area (In thousand sft)	1	2.1	3.2	4.7	5.2
Trip Count	230	350	420	530	620

- a. Determine the equation of a straight line using the tabular data.
- 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, c use **Gauss Elimination method**.