2-2

University of Asia Pacific
Department of Basic Sciences and Humanities
Mid-term Examination, Fall 2023
Program: B.Sc. in Civil Engineering

Course Title: Principles of Economics | Course Code: ECN 201
Time: 1 hour | Credit Hour: 2.00 | Full Marks: 40

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

1. $P = 100 - 2Q$

$C = 50 + 10Q^2$

a) Calculate equilibrium price and quantity. **10**

b) Explain the difference between perfect competition and monopoly market. **10**

2. Explain the effect of change in income on equilibrium price and quantity. **20**

OR

3. Explain the effect of change in input price on equilibrium price and quantity. **20**

University of Asia Pacific
Department of Basic Sciences & Humanities
Mid-Semester Examination, Fall -2023
Program: B.Sc. in Civil Engineering

Course Title: Mathematics-IV | Course Code: MTH 203
Time: 1.00 Hour | Credit: 3.00 | Full Marks: 60

There are **four questions**. Answer **three**. All questions are of equal value, indicated in the right margin.

1. a. Define order and degree of the differential equations. Obtain the associated differential equations of the equation $y = A\,e^{2x} + Bx + C$, where A, B, and C are arbitrary constants. **10**

b. Obtain the solution of the differential equation **10**

$$x^2y\,dx - (x^3 + y^3)\,dy = 0.$$

2. a. Identify and solve the equation $x^2\frac{dy}{dx} - 2xy = 3y^4$. **10**

b. Examine whether the differential equation **10**
$(x - 2\,e^y)dy + (y + x\sin x)dx = 0$ is exact or not, and also find its solution.

3. a. Identify and find the solution of $(D^4 - 2D^3 + 2D - 1)y = 0$. **10**

b. Solve the equation $(D^2 - 3D + 2)y = \sin 3x$. **10**

OR

4. a. Identify and solve the equation $\frac{d^3y}{dx^3} - 3\frac{d^2y}{dx^2} + 4\frac{dy}{dx} - 2y = 0$. **10**

b. Solve the equation $(D^3 - 2D^2 - 5D + 6)y = (e^{2x} + 3)^2$. **10**

University of Asia Pacific
Department of Civil Engineering
Midterm Examination Fall 2023

Course # : CE-203 | Course Title: Engineering Geology & Geomorphology
Full Marks: 40 | Time: 1 hour

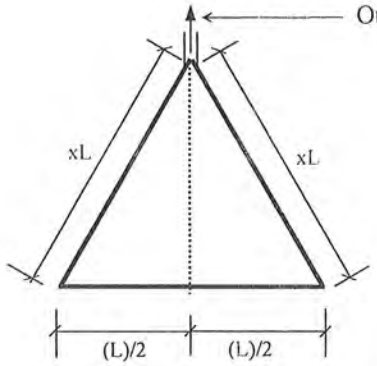
Answer to all the questions

1(a). What is metamorphism? Show three examples of metamorphic rocks that are generated from sedimentary rocks due to metamorphism. 1+3

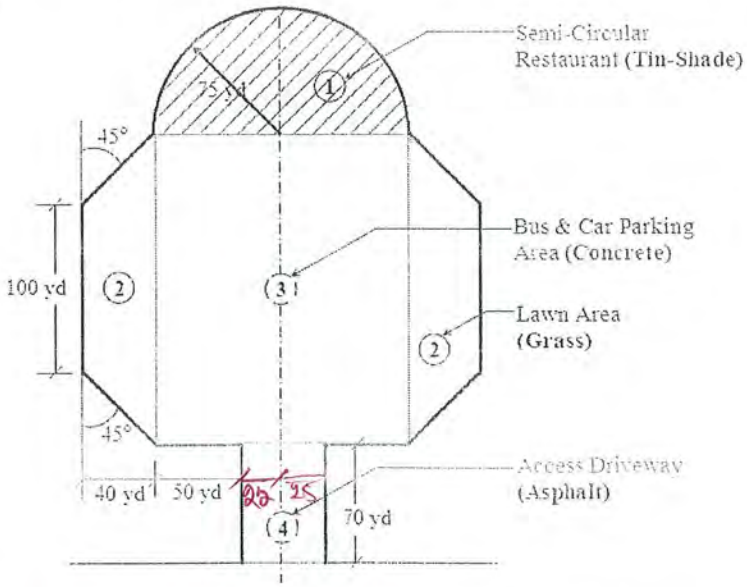
1(b). Distinguish (at least two) between sediments and sedimentary rocks. 3

1(c). Define physical and chemical weathering processes. 3

2. For the following basin, x is a constant factor. For what value of x, the flow rate (Q) will be the maximum (peak) for the basin? Also compute the FF and CC of the basin for maximum runoff. 10



3. Using the information provided, calculate the peak runoff (Q_P) in m^3/s for the following Highway Restaurant Area as bounded as shown below. Use rainfall intensity for the whole area to be 0.5 inch/hr and co-eff. of runoff for concrete, asphalt and grass as 0.8, 0.75 and 0.25, respectively. 10



4(a). Give examples of sediments and at least two examples of each type of primary rocks. 2

4(b). With the aid of a neat sketch show different parts of a typical fold geometry. 2.5

4(c). Classify (no description required) fault and draw a neat sketch of any one of them. 3.5

4(d). Draw neat sketch horst. 2

University of Asia Pacific
Department of Civil Engineering
Mid-Term Examination Fall 2023
Program: B.Sc. in Engineering (Civil)

Course Title: Numerical Analysis and Computer Programming | Course Code: CE 205
Time: 1 hour | Credit Hour: 3.00 | Full Marks: 20

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

1. In environmental engineering, the equation used to calculate the oxygen demand remaining L_t (mg/L) in a river stream after time t is expressed by

$$L_t = L_0(1-e^{-kt})$$

Where, ultimate oxygen demand L_0 = 250 mg/L, reaction rate constant k = 0.18/day, t = time. Now, use the **Regula Falsi** method to calculate the time required for the oxygen demand remaining in the river stream to drop to the level of 100mg/L. Assume that your solution lies between t = 1 day and t = 3 day. Perform 4 iterations.

[5]

2. In a geotechnical lab, the following test results are obtained through a direct shear test.

Time (min)	0.5	1	1.5	2
Shear force (lb)	11.62	12.8	14.21	16.1

a) Determine the equation of a **straight line** of the form $y = a+bx$ using the tabular data.

b) Determine the equation of a **parabola** of the form $y = a+bx+cx^2$ using the tabular data.

c) Analyze the two equations determined in question 2 (a) and 2 (b) in order to determine the more appropriate equation to predict the trendline of the given lab data.

[3+3+3=9]

3. Solve the differential equation $\frac{dy}{dx} = x^2 + y^2$ using Fourth Order Runge Kutta method to get y(0.4). Assume initial value y(0) = 0 and step size h = 0.2

[6]

University of Asia Pacific
Department of Civil Engineering
Mid-Term Examination, Fall 2023
Program: B. Sc. in Civil Engineering

Course Title: Mechanics of Solids II | Course Code: CE 213
Time: 1 hour | Credit Hour: 3 | Full Marks: 40

1. Using the force method, determine support reactions for the circular stepped shaft shown in Figure 1. The applied torques are

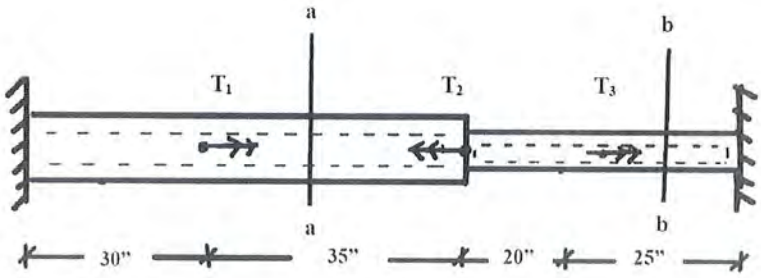
   $T_1 = 500$ lb-in, $T_2 = 400$ lb-in, $T_3 = 200$ lb-in (odd rolls)

   OR $T_1 = 600$ lb-in, $T_2 = 500$ lb-in, $T_3 = 300$ lb-in (even rolls).

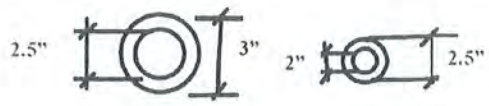
   Let, $G = 4.25 \times 10^6$ lb/in^2

   (i) Plot the torque diagram

   (ii) Plot the angle of the twist diagram. **(Marks 15)**



(a)



(b)

Figure 1

2. An agitator shaft acting as a torsional member is made by welding four rectangular bars to a circular pipe, as shown in Figure 2. The pipe is of 4 inches outside diameter and 0.5 inches in thickness; each rectangular bar is ¾ by 2 inches.

   If the maximum elastic shear stress (neglecting stress concentrations), is limited to 8 ksi (odd rolls) **OR** 12 ksi (even rolls), calculate (using Table 1) the torque T that can be applied to this member.

   (Marks 10)

Figure 2

Table 1

Table of Coefficients for Rectangular Bars

b/t	1.00	1.50	2.00	3.00	6.00	10.0	∞
α	0.208	0.231	0.246	0.267	0.299	0.312	0.333
β	0.141	0.196	0.229	0.263	0.299	0.312	0.333

3. A wooden beam of cross-section 150 × 200 mm (odd rolls) **OR** 200 × 250 mm (even rolls) shown in Figure 3 supports a uniformly distributed load (as shown) over a simple span of 3 m. The applied load acts at an angle (a) with vertical as shown in Figure.

   (i) Draw the Axial Force, Shear Force (V_y, V_z) and Bending Moment (M_y, M_z) diagrams of the beam

   (ii) Determine the angle of the inclined load with the vertical axis

   (iii) Determine the largest bending stresses (both tensile and compressive)

   (iv) Draw the normal stress distribution diagram over the cross-section.

(Marks 15)

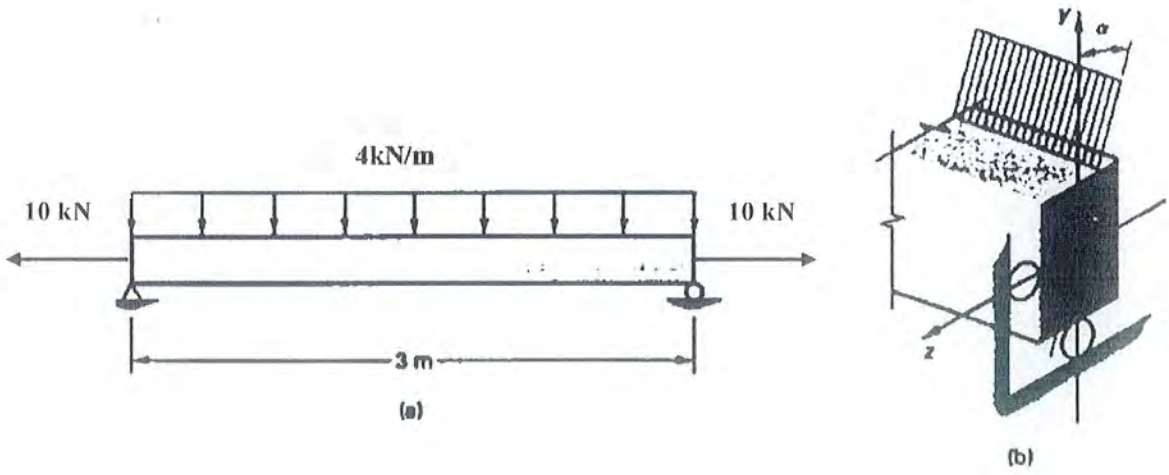


Figure 3

University of Asia Pacific
Department of Civil Engineering
Mid-Term Examination Fall 2023
Program: B.Sc. in Civil Engineering

Course Title: Fluid Mechanics | Course Code: CE 221

Time: 1 hour | Credit Hour: 3.00 | Full Marks: 40

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

1. Define and provide mathematical expression for the following fluid properties: **[5]**

i) specific weight, **ii)** specific gravity, **iii)** bulk modulus of elasticity, **iv)** specific volume, **v)** kinematic viscosity

2a. Define and briefly explain different flow type for following criterion: **[3+2]**

i) uniform flow **ii)** unsteady flow **iii)** turbulent flow

2b. Explain the relation between atmospheric pressure, absolute pressure, gauge pressure and vacuum pressure with diagram.

3. Find the slope of equipotential line and line of constant stream function. **[6]**

4. A manometer is attached to a conduit as shown in **figure: 1**. Compute the pressure at point A. **[8]**

5. Calculate the resultant force on vertical, rectangular gate in **figure:2** and locate its center of pressure. **[8]**

6. A flow velocity profile is given, $u= -2tx$, $v= t^2y$, $w=0$ find out whether, the flow is **a)** steady or unsteady? **b)** categorize the flow dimensionally. **c)** does it satisfy continuity? **d)** find the general equation of acceleration for the flow. **[8]**

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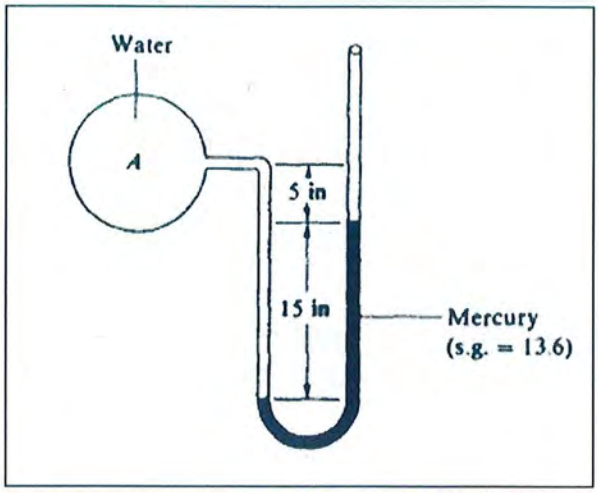

Figure: 1

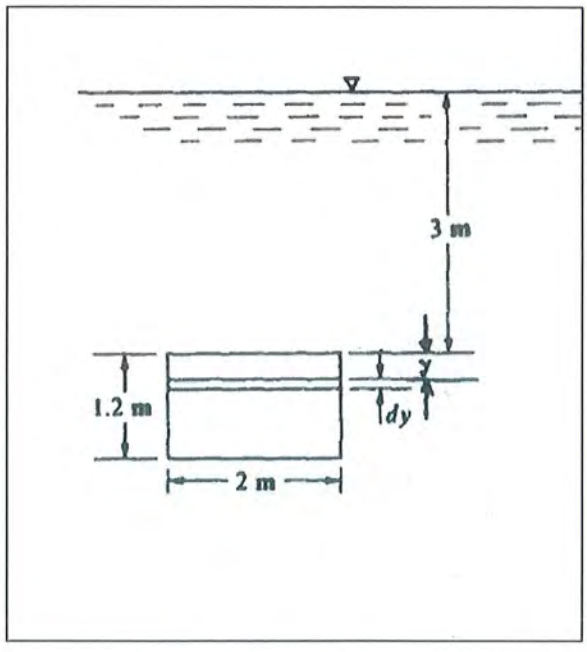

Figure: 2