University of Asia Pacific

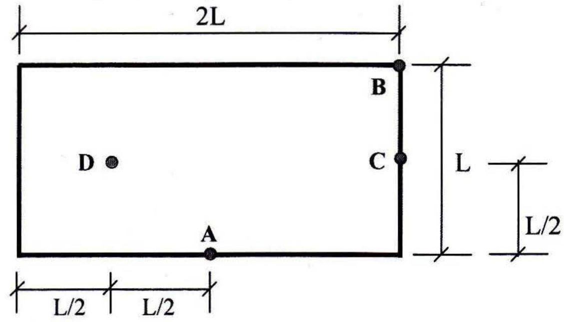
Department of Civil Engineering
Midterm Examination Spring 2018

Course # : CE-203 | Course Title: Engineering Geology & Geomorphology
Full Marks: 60 (3 X 20 = 60) | Time: 1 hour

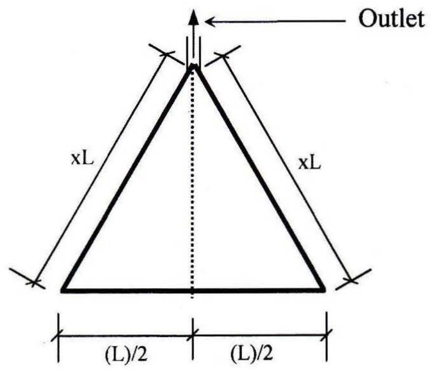
Answer to all questions.

1a)	What is geomorphology? Distinguish between sediment and sedimentary rock.	2 + 3
1b)	Write down the thicknesses (no sketch required) of different parts of lithosphere.	4
1c)	What is metamorphism? Show four examples of metamorphic rocks that are generated from sedimentary rocks due to metamorphism.	1+4
1d)	Classify (mention names only) physical and chemical weathering processes. Discuss, in brief, any one of each process.	3+3
2a)	Mention the ways runoff is dependent on precipitation and basin characteristics.	6
2b)	Identify the distinctions between infiltration and percolation.	3
2c)	What is diastraphism? Draw neat sketches of oblique fault and Horst.	2+4
2d)	Classify folds (mention names only). With the aid of a typical fold geometry show different features of tock structures.	5
3a)	For the cases of the following basin, analyze and identify the ones for maximum and minimum runoffs. Justify your answer.	8

Case 1: Outlet is at A; Case 2: Outlet is at B; Case 3: Outlet is at C. Case 4: Outlet is at D.



3b)	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.	12



University of Asia Pacific
Department of Civil Engineering
Mid Semester Examination Spring 2018
Program: B.Sc. Engineering (Civil)

Course Title: Numerical Analysis and Computer Programming — Course Code: CE 205

Time- 1 hour — Full marks: 40

(Answer any FOUR from the following FIVE questions)

1. Evaluate numerically the following integral using Trapezoidal and Simpson's rule with 4 panels or n= 4. Compare both the results. Explain which method is more accurate. (10)

$$I = \int_2^5 \frac{\sqrt{1+x^3}}{x^2}\,dx$$

2. **a)** What is the difference between Jacobi method and Gauss-Seidel method in solving linear system of equations? State the criteria that must be satisfied for the application of these methods. (04)

b) Solve the following system of linear equations using the Jacobi method. Assume the initial values are x = 0, y = 0 and z = 0. Perform 3 iterations. (06)

$$5x + 2y + z = 8$$
$$2x + 5y + 2z = 1$$
$$x + 3y - 5z = 25$$

3. **(a)** Use the iterative method to determine a real root of the equation $e^x - 3x = 0$. Perform up to 5 iterations. (05)

(b) Determine a positive root of the equation $2x^3 - 3x - 6 = 0$ by Newton-Raphson method. Correct up to five decimal places. Use initial approximation 1.5. (05)

4. Solve the following differential equation to calculate $y\,(1)$ by Euler's method, assuming $y(0) = 1$. Use step length 0.25 (10)

$$\frac{dy}{dx} = \frac{2x+5}{y^2}$$

5. Solve the following differential equation to calculate $y\,(0.4)$ by fourth-order Runge-Kutta method assuming $y(0) = 0$. Use step length 0.2. (10)

$$\frac{dy}{dx} = x^2 + y^2$$

University of Asia Pacific
Department of Civil Engineering
Mid Semester Examination Spring 2018 (Set 1)

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

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

(Points on the right within parentheses indicate full marks)

1. Fig. 1(a) shows a pile group (with six 10′-diameter piles) separated 60° from each other and supporting a bridge-pier. Fig. 1(b) shows the plan dimensions of the pile group and horizontal force P = 10,000 kip applied on it, while Fig. 1(c) shows a new pile group with an additional 10′-diameter pile at center.

   Consider stresses due to direct shear and torsional shear to calculate the maximum pile shear force for the pile group shown in

   (i) Fig. 1(b), (ii) Fig. 1(c). (5+5)

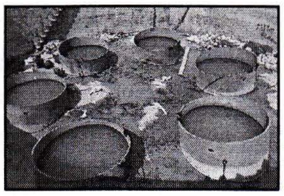


Fig. 1(a)

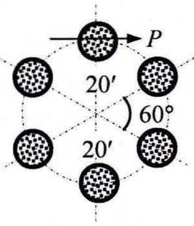


Fig. 1(b)

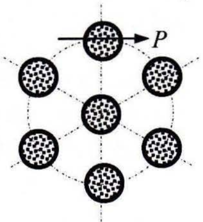


Fig. 1(c)

2. Fig. 2 shows the failure surface when torsional moment is applied on a brittle material (chalk), resulting in shear stress $\tau_{xy} = \tau_0$.

   (i) Determine angles θ_1, θ_2 of principal plane and compare it with Fig. 2 (5)

   (ii) Use the yield criteria suggested by (a) Rankine, (b) Von Mises to calculate the applied shear stress (τ_0) required to cause failure of the material if its yield strength Y = 2 MPa. (5)

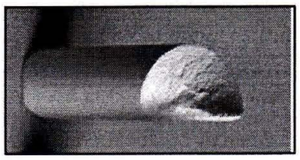


Fig. 2

3. Fig. 3(a) shows a goal-post *abocd* [with cross-section shown in Fig. 3(b)], where the goal-bar *boc* is supported on posts *ab* and *dc* through internal hinges *b* and *c*.

   The combined weight of the structure and its supporting soil-footing is 500 lbs.

   A penalty-kick by Messi applies a force F on it at an angle 12° with the horizontal (x-axis).

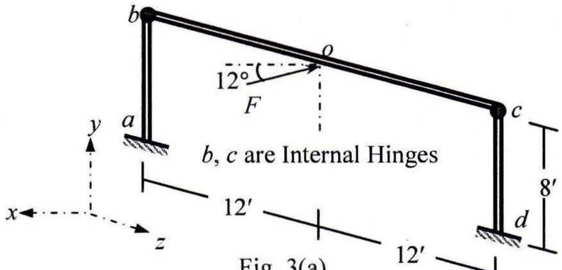


Fig. 3(a)

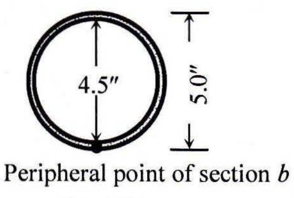


Fig. 3(b)

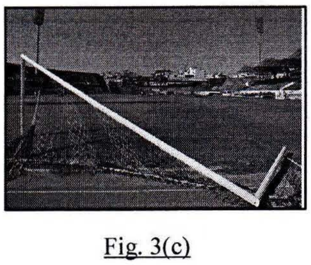


Fig. 3(c)

   (i) Calculate the force F required to uproot *ab* at *a* [as in Fig. 3(c)]; i.e. cause zero normal stress (6)

   (ii) For the force F calculated in (i), draw the Mohr's circle of stresses at the peripheral point of section *b* [shown in Fig. 3(b)]. (4)

4. Calculate the equivalent polar moments of inertia (J_{eq}) for the three cross-sections shown in Fig. 4(a)~(c) by centerline dimensions [Given: Wall thickness = 0.10″ throughout]. (4+3+3)

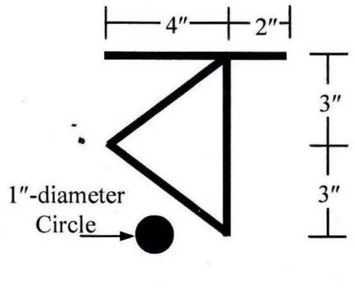


Fig. 4(a)

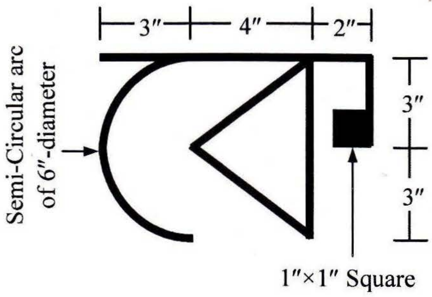


Fig. 4(b)

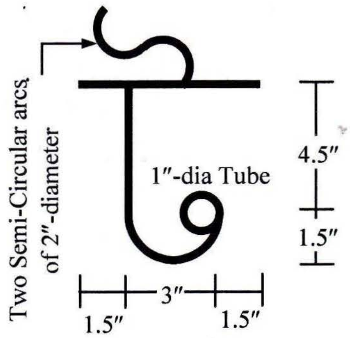


Fig. 4(c)

List of Useful Formulae for CE 213

* Torsional Rotation $\phi_B - \phi_A = \int(T/J_{eq}G)\,dx$, and $= (TL/J_{eq}G)$, if T, J_{eq} and G are constants

Section	Torsional Shear Stress	J_{eq}
Solid Circular	$\tau = Tc/J$	$\pi d^4/32$
Thin-walled	$\tau = T/(2A\,t)$	$4A^2/(\int ds/t)$
Rectangular	$\tau = T/(\alpha bt^2)$	βbt^3

b/t	1.0	1.5	2.0	3.0	6.0	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

* Normal Stress (along x-axis) due to Biaxial Bending (about y- and z-axis): $\sigma_x(y, z) = M_z\,y/I_z + M_y\,z/I_y$
* Normal Stress (along x-axis) due to Combined Axial Force (along x-axis) and Biaxial Bending (about y- and z-axis): $\sigma_x(y, z) = P/A + M_z\,y/I_z + M_y\,z/I_y$
* Corner points of the kern of a Rectangular Area are (b/6, 0), (0, h/6), (–b/6, 0), (0, –h/6)

* Maximum shear stress on a Helical spring: $\tau_{max} = \tau_{direct} + \tau_{torsion} = P/A + Tr/J = P/A\,(1 + 2R/r)$
* Stiffness of a Helical spring is $k = Gd^4/(64R^3N)$

* $\sigma_{xx}' = (\sigma_{xx} + \sigma_{yy})/2 + \{(\sigma_{xx} - \sigma_{yy})/2\}\cos 2\theta + (\tau_{xy})\sin 2\theta = (\sigma_{xx} + \sigma_{yy})/2 + \sqrt{[\{(\sigma_{xx} - \sigma_{yy})/2\}^2 + (\tau_{xy})^2]}\cos(2\theta-\alpha)$
  $\tau_{xy}' = -\{(\sigma_{xx} - \sigma_{yy})/2\}\sin 2\theta + (\tau_{xy})\cos 2\theta = \tau_{xy}' = -\sqrt{[\{(\sigma_{xx} - \sigma_{yy})/2\}^2 + (\tau_{xy})^2]}\sin(2\theta-\alpha)$
  where $\tan\alpha = 2\,\tau_{xy}/(\sigma_{xx} - \sigma_{yy})$
* $\sigma_{xx(max)} = (\sigma_{xx} + \sigma_{yy})/2 + \sqrt{[\{(\sigma_{xx} - \sigma_{yy})/2\}^2 + (\tau_{xy})^2]}$; when $\theta = \alpha/2$, $\alpha/2 + 180°$
  $\sigma_{xx(min)} = (\sigma_{xx} + \sigma_{yy})/2 - \sqrt{[\{(\sigma_{xx} - \sigma_{yy})/2\}^2 + (\tau_{xy})^2]}$; when $\theta = \alpha/2 \pm 90°$
* $\tau_{xy(max)} = \sqrt{[\{(\sigma_{xx}-\sigma_{yy})/2\}^2 + (\tau_{xy})^2]}$; when $\theta = \alpha/2 - 45°$, $\alpha/2 + 135°$
  $\tau_{xy(min)} = -\sqrt{[\{(\sigma_{xx}-\sigma_{yy})/2\}^2 + (\tau_{xy})^2]}$; when $\theta = \alpha/2 + 45°$, $\alpha/2 - 135°$

* Mohr's Circle of Stresses: Center $(a, 0) = [(\sigma_{xx} + \sigma_{yy})/2, 0]$ and radius $R = \sqrt{[\{(\sigma_{xx} - \sigma_{yy})/2\}^2 + (\tau_{xy})^2]}$

* For Yielding to take place
  - Maximum Normal Stress Theory (Rankine): $|\sigma_1| \geq Y$, or $|\sigma_2| \geq Y$.
  - Maximum Normal Strain Theory (St. Venant): $|\sigma_1 - \nu\sigma_2| \geq Y$, or $|\sigma_2 -, \nu\sigma_1| \geq Y$.
  - Maximum Shear Stress Theory (Tresca): $|\sigma_1 - \sigma_2| \geq Y$, $|\sigma_1| \geq Y$, or $|\sigma_2| \geq Y$
  - Maximum Distortion-Energy Theory (Von Mises): $\sigma_1^2 + \sigma_2^2 - \sigma_1\sigma_2 \geq Y^2$

University of Asia Pacific
Department of Civil Engineering
Mid Semester Examination Spring 2018 (Set 2)

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

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

(Points on the right within parentheses indicate full marks)

1. Calculate the equivalent polar moments of inertia (J_{eq}) for the three cross-sections shown in Fig. 1(a)~(c) by centerline dimensions [Given: Wall thickness = 0.10″ throughout]. (4+3+3)

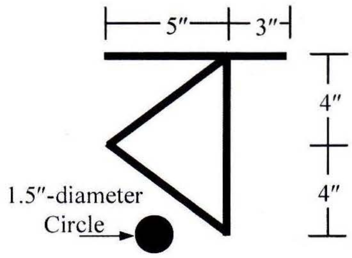


Fig. 4(a)

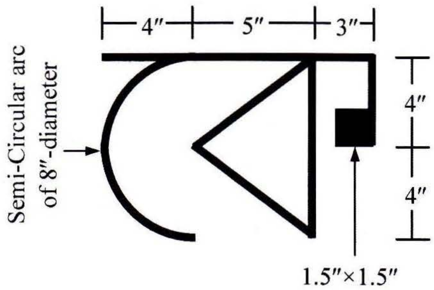


Fig. 4(b)

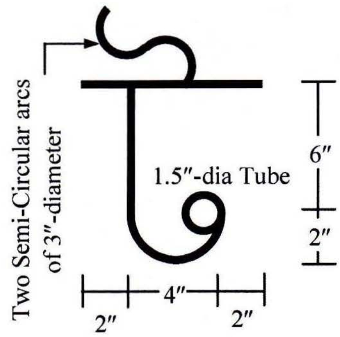


Fig. 4(c)

1. Fig. 2(a) shows a pile group (with six 3m-diameter piles) separated 60° from each other and supporting a bridge-pier. Fig. 2(b) shows the plan dimensions of the pile group and horizontal force P = 50,000 kN applied on it, while Fig. 2(c) shows a new pile group with an additional 3m-diameter pile at center.

   Consider stresses due to direct shear and torsional shear to calculate the maximum pile shear force for the pile group shown in

   (i) Fig. 2(b), (ii) Fig. 2(c). (5+5)

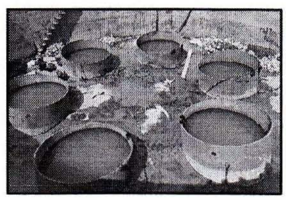


Fig. 2(a)

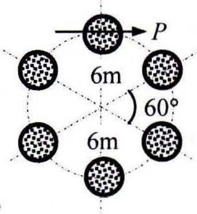


Fig. 2(b)

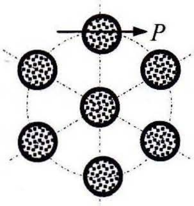


Fig. 2(c)

3. Fig. 3 shows the failure surface when torsional moment is applied on a brittle material (chalk), resulting in shear stress $\tau_{xy} = \tau_0$.
   (i) Determine angles θ_1, θ_2 of principal plane and compare it with Fig. 3 (5)
   (ii) Use the yield criteria suggested by (a) Rankine, (b) Von Mises to calculate the applied shear stress (τ_0) required to cause failure of the material if its yield strength Y = 300 psi. (5)

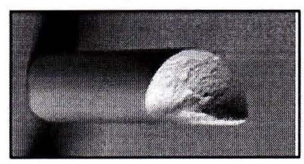


Fig. 3

4. Fig. 4(a) shows a goal-post *abocd* [with cross-section shown in Fig. 4(b)], where the goal-bar *boc* is supported on posts *ab* and *dc* through internal hinges *b* and *c*.

   The combined weight of the structure and its supporting soil-footing is 2 kN.

   A penalty-kick by Neymar applies a force F on it at an angle 12° with the horizontal (x-axis).

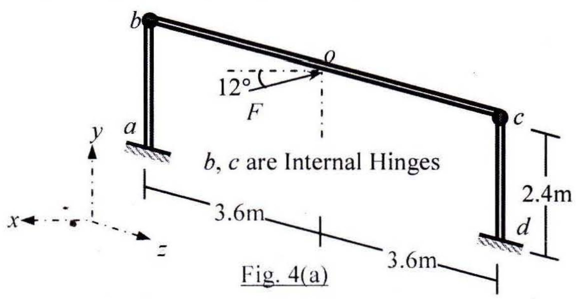
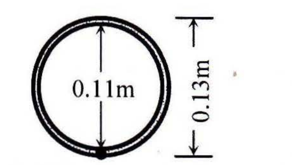


Fig. 4(a)



Peripheral point of section *b*

Fig. 4(b)

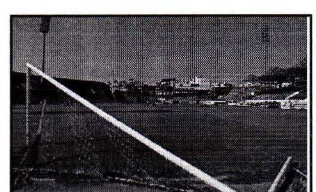


Fig. 4(c)

   (i) Calculate the force F required to uproot *ab* at *a* [as in Fig. 4(c)]; i.e. cause zero normal stress (6)
   (ii) For the force F calculated in (i), draw the Mohr's circle of stresses at the peripheral point of section *b* [shown in Fig. 4(b)]. (4)

List of Useful Formulae for CE 213

* Torsional Rotation $\phi_B - \phi_A = \int(T/J_{eq}G)\,dx$, and $= (TL/J_{eq}G)$, if T, J_{eq} and G are constants

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b/t	1.0	1.5	2.0	3.0	6.0	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

* Normal Stress (along x-axis) due to Biaxial Bending (about y- and z-axis): $\sigma_x(y, z) = M_z\, y/I_z + M_y\, z/I_y$
* Normal Stress (along x-axis) due to Combined Axial Force (along x-axis) and Biaxial Bending (about y- and z-axis): $\sigma_x(y, z) = P/A + M_z\, y/I_z + M_y\, z/I_y$
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* $\sigma_{xx}' = (\sigma_{xx} + \sigma_{yy})/2 + \{(\sigma_{xx} - \sigma_{yy})/2\}\cos 2\theta + (\tau_{xy})\sin 2\theta = (\sigma_{xx} + \sigma_{yy})/2 + \sqrt{[\{(\sigma_{xx} - \sigma_{yy})/2\}^2 + (\tau_{xy})^2]}\cos(2\theta - \alpha)$
  $\tau_{xy}' = -\{(\sigma_{xx} - \sigma_{yy})/2\}\sin 2\theta + (\tau_{xy})\cos 2\theta = \tau_{xy}' = -\sqrt{[\{(\sigma_{xx} - \sigma_{yy})/2\}^2 + (\tau_{xy})^2]}\sin(2\theta - \alpha)$
  where $\tan\alpha = 2\,\tau_{xy}/(\sigma_{xx} - \sigma_{yy})$
* $\sigma_{xx(max)} = (\sigma_{xx} + \sigma_{yy})/2 + \sqrt{[\{(\sigma_{xx} - \sigma_{yy})/2\}^2 + (\tau_{xy})^2]}$; when $\theta = \alpha/2,\ \alpha/2 + 180°$
  $\sigma_{xx(min)} = (\sigma_{xx} + \sigma_{yy})/2 - \sqrt{[\{(\sigma_{xx} - \sigma_{yy})/2\}^2 + (\tau_{xy})^2]}$; when $\theta = \alpha/2 \pm 90°$
* $\tau_{xy(max)} = \sqrt{[\{(\sigma_{xx} - \sigma_{yy})/2\}^2 + (\tau_{xy})^2]}$; when $\theta = \alpha/2 - 45°,\ \alpha/2 + 135°$
  $\tau_{xy(min)} = -\sqrt{[\{(\sigma_{xx} - \sigma_{yy})/2\}^2 + (\tau_{xy})^2]}$; when $\theta = \alpha/2 + 45°,\ \alpha/2 - 135°$
* Mohr's Circle of Stresses: Center $(a, 0) = [(\sigma_{xx} + \sigma_{yy})/2,\ 0]$ and radius $R = \sqrt{[\{(\sigma_{xx} - \sigma_{yy})/2\}^2 + (\tau_{xy})^2]}$
* For Yielding to take place
  - Maximum Normal Stress Theory (Rankine): $|\sigma_1| \geq Y$, or $|\sigma_2| \geq Y$.
  - Maximum Normal Strain Theory (St. Venant): $|\sigma_1 - \nu\sigma_2| \geq Y$, or $|\sigma_2 - \nu\sigma_1| \geq Y$.
  - Maximum Shear Stress Theory (Tresca): $|\sigma_1 - \sigma_2| \geq Y$, $|\sigma_1| \geq Y$, or $|\sigma_2| \geq Y$
  - Maximum Distortion-Energy Theory (Von Mises): $\sigma_1^2 + \sigma_2^2 - \sigma_1\sigma_2 \geq Y^2$

University of Asia Pacific
Department of Civil Engineering
Mid Semester Examination Spring 2018
Program: B.Sc. Engineering (Civil)

Course Title: Fluid Mechanics — Course Code: CE 221

Time- 1 hour — Full marks: 30

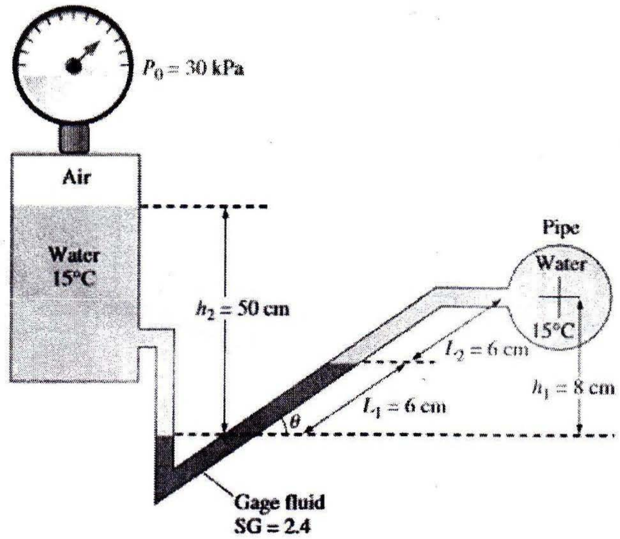
Answer any 3 (three) among the 4 (four) questions.

Marks Distribution (10*3=30)

Assume any missing values

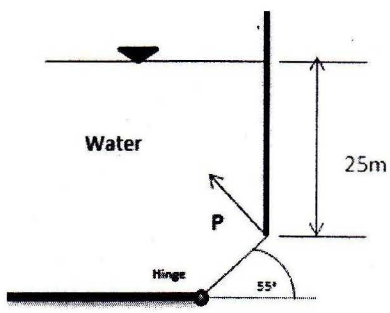
1. (a) Derive the formula for Newton's equation of viscosity with neat sketch. [4]

   (b) The Pressure of water flowing through a pipe is measured by the arrangement shown in Figure 01. For the values given, calculate the pressure in the pipe. [6]



[Figure 1] [Question 1(b)]

2. (a) A rectangular gate (width=5 m, length=10 m) has its top edge 25 m below the water surface. It is on a 55° angle and its bottom edge is hinged as shown in figure. What force P is needed to just open the gate? [5]



[Figure 2] [Question 2(a)]

(b) Prove mathematically that center of pressure and center of gravity is not same for a submerged plane surface. In which cases it becomes identical? [4+1]

3. (a) Discuss general types of fluid flow with their characteristics and mathematical expression. [3]
   (b) Given the velocity field $V=(4+xy+2t)i+6x^3j+(3xt^2+z)k$. Find the acceleration of fluid particle as a function of x ,y, z and t. [4]
   (c) Define the i) path line; ii) Stream line; and iii) streak line [3]

4. (a) "No two stream lines can ever cross one another." Explain the statement. [2]
   (b) Which one is the most elementary device for measuring the pressure? Discuss the reasons behind its limited use. [1+2]
   (c) Calculate the barometric reading with Kerosene in order to find the atmospheric pressure. The density of Kerosene is given to be 850 kg/m^3,atmospheric pressure at sea level is 101325 N/m. [3]
   (d) Differentiate between hydrodynamics and hydraulics. [2]

University of Asia Pacific
Department of Civil Engineering
Mid Examination Spring - 2018
Program: B.Sc in Civil Engineering

Course Title: Principles of Economics — Course Code: ECN 201

Time: 1 hour — Full Marks: 20

(Answer all of the following questions.)

1. Specify whether the following relationships are direct or inverse:

(a) The drop in the price of compact discs reduces the quantity purchased of caste tapes. (1)

(b) The rise in the average salary of computer programmers increases the number of people seeking a career in computer programming. (1)

(c) The fall in the price of wheat fertilizer increases the amount of wheat planted by farmers. (1)

(d) An increase in the income tax rate paid by households reduces the amount of consumption spending in the economy. (1)

2. Discuss oligopoly market structure using examples from Bangladeshi perspective. (4)

3. Production possibilities schedule of laptops and smart phones:

Laptops (Units)	Smart phones (Units)
20	0
18	1
12	2
0	3

(a) Draw the production possibilities curve putting smart phones on the horizontal axis and laptops on the vertical axis. (1)

(b) What is the opportunity cost of producing 1st smart phone? (1)

(c) What is the opportunity cost of producing 2nd smart phone? (1)

(d) What is the opportunity cost of producing 3rd smart phone? (1)

4. A photocopy shop can produce its daily output of 35,000 copies with either of two processes. Process A uses 6 workers and 4 photocopy machines. Process B uses 4 workers and 3 photocopy machines. . Process C uses 8 workers and 4 photocopy machines.

(a) If each worker's daily wage is TK. 130 and the daily rental of a photocopy machine is TK. 30, will the shop owner choose Process A or B or C? (4)

(b) Besides the costs of labor and capital, the owner daily pays TK. 850 in building rent. What is the shop's daily explicit cost? (1)

(c) If the shop's price per photocopy is TK. 4.50, what is the daily accounting profit? (1)

(d) The owner estimates that he could earn TK. 700 a day if he managed another shop instead of his own shop. What are the shop's daily implicit costs? What are the shop's daily economic costs? (1)

(e) What is the shop's daily economic profit? (1)

University of Asia Pacific
Department of Basic Sciences & Humanities
Mid Examination, Spring-2018
Program: B.Sc. in Civil Engineering

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

There are **Four** Questions. Answer any **Three.** All questions are of equal value. Figures in the right margin indicate marks.

1. (a) Find the differential equation of $xy = ae^x + be^{-x} + x^2$ and also write down the order and degree of this differential equation. **10**

(b) Define Cauchy-Euler equation and solve **10**

$$x^2\frac{d^2y}{dx^2} - 6x\frac{dy}{dx} + 6y = 0$$

2. (a) Define Bernoulli's equation and solve $t^2\frac{dy}{dt} + y^2 = ty$ **10**

(b) Solve: **5+5**

(i) $(D^3 + 3D^2 + 3D + 1)y = e^{-x}$

(ii) $(D^3 + a^2D)y = sinax$

3. (a) Solve: $p^2 + 2pycotx - y^2 = 0$ **8**

(b) Solve: **12**

(i) $\left(1 + e^{\frac{x}{y}}\right)dx + e^{\frac{x}{y}}\left(1 - \frac{x}{y}\right)dy = 0$

(ii) $(x^2 + y^2)dx + (x^2 - xy)dy = 0$

4. (a) Suppose the salt was entering the tank at the rate $10\ lb/min$ and leaving the tank at the rate $\frac{A}{300}\ lb/min$, where $A(t)$ is the amount of salt in the tank at time t. If $70\ lb$ of salt was dissolved in the initially , how much salt would be in the tank after 2 *hour* and after a long time. **10**

(b) Solve: $(D^3 - D^2 - 6D)y = 1 + x^2$ **10**