University of Asia Pacific
Department of Civil Engineering
Midterm Examination, Fall 2021
Program: B.Sc. Engineering (Civil)

Course Title: Principles of Economics | Course Code: ECN 201
Time: One hour | Credit Hour: Two | Full Marks: 20

(Answer any two of the following questions.)

1. (a) "When there are changes in factors other than goods own price which affect the quantity purchased --- ---." What do we call the changes? 0.5
   (b) " --- --- new technology reduces pizza costs and prices." Will the demand increase along the curve or with the shift of the curve? 0.5
   (c) "Quantity demanded tends to fall as price rises for two reasons."
   "If gasoline prices double, I have in effect less real income, so I will naturally curb my consumption of gasoline and other goods." Which affect is it? 1
   (d) Why the supply curve is upward moving? 1
   (e) Draw the curve of production possibility frontier in the graph paper with the following table. Explain the curve briefly. 7

Alternative Production Possibilities		
Possibilities	Butter (Millions of pounds)	Guns (Thousands)
A	0	15
B	1	14
C	2	12
D	3	9
E	4	5
F	5	0

2. (a) Who is the founder of microeconomics? 0.5
   (b) Which branch of economics is concerned with the behavior of individual entities such as markets, firms, and households? 0.5
   (c) Which resources form the durable goods of an economy, produced in order to produce yet other goods? Write with an example. 1
   (d) Which type of economy is most common? 0.5
   (e) Which branch of economics is concerned with the overall performance of the economy? 0.5
   (f) How government can remedy shortcomings of the market? 7

3. (a) Define economics. 1
   (b) " --- --- the government owns most of the means of production (land and capital), it also owns and directs the operations of enterprises in most industries, it is the employer of most workers and tells them how to do their jobs, and decides how the output of the society is to be divided among different goods and services." Which type of economy is it? 0.5
   (c) "Suppose that an unregulated business decides to dump chemicals in a river --- --"
   "Rather, the prices in the market place do not reflect true social priorities – the price on polluting in an unregulated environment is zero ---." What other things the true opportunity cost could include? 1

(d) Which of the three broad factors of production include natural resources like fuel, clean air, drinking water? 0.5

(e) If costs of production of a good is low, what happens with the supply? 0.5

(f) Which category of factors of production include writing software, teaching school? 0.5

(c) Describe the rise of welfare state briefly. 6

University of Asia Pacific
Department of Basic Sciences & Humanities
Mid-Semester Examination, Fall 2021
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 values, indicated in the right margin.

(1) (a) Solve the exact Differential Equation: $x\,dx + y\,dy + \frac{xdy - ydx}{x^2 + y^2} = 0$ **10**

(b) Using Integrating factor solve: $(1 - x^2)\frac{dy}{dx} + 2xy = x\sqrt{1 - x^2}$ **10**

(2) (a) Using separation of variables solve: $\frac{dy}{dx} = e^{x+y} + x^2\, e^{x^3+y}$ **10**

(b) Solve the homogeneous Differential equation: $(x^2 + y^2)\,dx + 2xy\,dy = 0$ **10**

(3) (a) Find Laplace Transform of the periodic function $f(t) = e^t, 0 < t < 2\pi$ **5**

(b) Find the inverse Laplace Transform of: **15**

(i) $\left(\frac{1}{s^4} - \frac{1}{s} + \frac{1}{s-2}\right)$ **(ii)** $\left(\frac{s}{s^2 + 2s - 3}\right)$ **(iii)** $\left(\frac{1}{(s+3)^2 - 4}\right)$

(4) Find the Laplace Transform of the followings: **20**

(i) $e^{3t}\left(9 - 4t + 10\sin\frac{t}{2}\right)$ **(ii)** $\frac{1}{t}\sin^2 t$ **(iii)** $\int_0^t \frac{1 - \cos t}{t}$ **(iv)** $(te^{2t})^n$

University of Asia Pacific
Department of Civil Engineering
Midterm Examination Fall 2021

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

Answer to all the questions

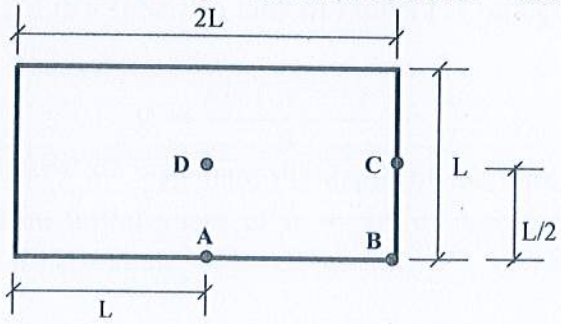
1(a). What is metamorphism? Show three examples of metamorphic rocks that are generated from sedimentary rocks due to metamorphism. 4

1(b). Distinguish (at least two) between sediments and sedimentary rocks. 4

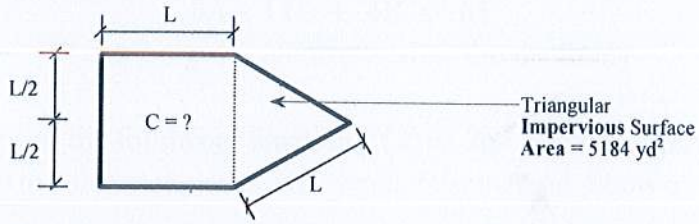
1(c). Distinguish between weathering and erosion. Classify (mention names only) physical and chemical weathering processes. 6

2. For the cases of the following basin, 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.



3. For the drainage area as shown below, calculate co-efficient of runoff (C) for Q_p = 3.072 ft^3/sec and I =25.4 mm/hour. 10



4(a). Classify folds (mention names only). With neat sketch, briefly describe basin. 4

4(b). Draw neat sketches of reverse fault and graben. 4

University of Asia Pacific
Department of Civil Engineering
Midterm Examination, Fall 2021
Program: B.Sc. Engineering (Civil)

Course Title: Numerical Methods and Computer Programming | Course Code: CE 205
Time: 1 hour | Credit Hour: 3.0 | Full Marks: 40

1. The following data have been obtained by throwing a projectile on the sky. Fit the following data to the polynomial equation: $y = A + Bx + Cx^2$ [10]

Time(s)	0	70	140	210	280	350
Speed(m/s)	0.0000	0.0853	0.2759	0.6561	1.3512	3.4560

2. The volume V of a liquid in a spherical tank of radius r is related to the depth h of the liquid by [08]

$$V = \frac{\pi h^2(3r - h)}{3}$$

If $r = 1$ m and $V = 0.75$ m^3, calculate the depth of the tank, h. Use Newton-Raphson method with an initial guess of $h = 5.5$ m. Use 6 iterations. Take 4 significant digits after the decimal.

3. Apply Gauss-Seidel method to solve the following system of equations: [08]

$$14A + 6B - 4C = 55$$
$$14B - 5C + 6A = 8$$
$$8A - 14C + 4B = 61$$

[Take 2 significant digits after the decimal]

4. Calculate the root of the following function $f(x) = 2x^3 - 6x + 7$ between -2 and -3 with accuracy up to 4 decimal places. Use regula falsi method. Show up to 5 iterations. [06]

5(a). Write a program that identify whether your student ID is an even number or not? [02]

(b). Write a program code to find out the value of shear force and bending moment at any point of a simply supported beam subjected to uniformly distributed load. Take load intensity (w) and span length of the beam (L) as inputs from the user in the following way: [06]

w (kip/ft) = last digit of your student ID + 15
L (ft) = last digit of your student ID + 20

University of Asia Pacific
Department of Civil Engineering
Midterm Examination Fall 2021
Program: B.Sc. Engineering (Civil)

Course Title: Mechanics of solids II
Time: 1-hour | Credit Hour : 3.0 | Course Code: CE 213 | Full Marks: 4 × 10

ANSWER ALL QUESTIONS. Any missing data can be assumed reasonably.

1. Calculate the equivalent polar moments of inertia (J_{eq}) for the cross sections shown in ***Fig.1(a)*** to ***Fig.1(b)*** by centerline dimensions [Given: Wall thickness=0.10" throughout].

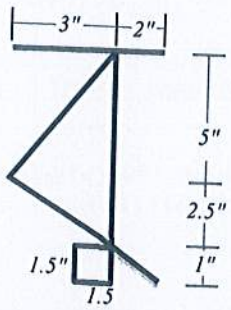


Fig.1(a)

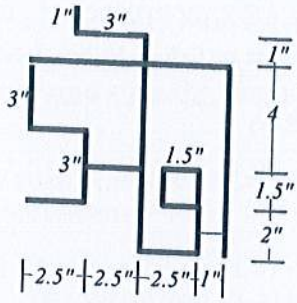


Fig.1(b)

2. Determine the Kern of the cross-section shown in ***Fig.2*** [Given: Centroid: $\bar{x}$= -1.196, $\bar{y}$=2.98, I_X=14.244 in^4, I_Y=8.532 in^4 and Wall thickness=0.10" throughout].

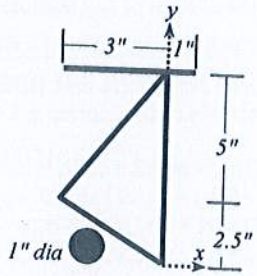


Fig.2

3. For the structure loaded as shown in ***Fig.3***, calculate the stresses (σ_x, σ_y, τ_{xy}) and the principal stresses (σ_1, σ_2) considering stress blocks at points ***a*** of section A-A.

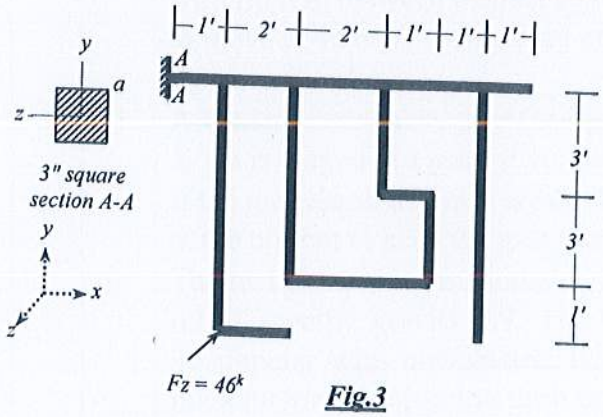


Fig.3

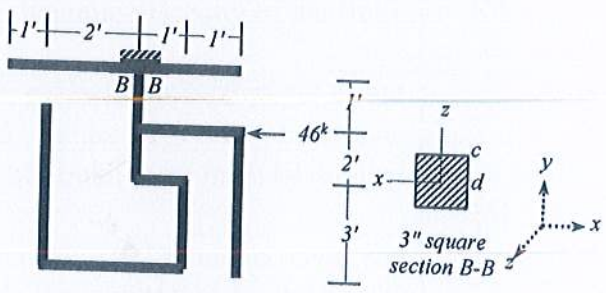


Fig.4

4. For the structure loaded as shown in ***Fig.4***, calculate the compound normal stress at point ***c*** and the compound shear stress at point ***d*** of section **B-B**.

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

* For compound section, $T_1/J_1G_1 = T_2/J_2G_2 = T_3/J_3G_3 = \ldots\ldots$
* 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): $\sigma_x(y, z) = P/A + M_z\, y/I_z + M_y\, z/I_y$
* Equation of Kern of any section: $\pm e_y\, y_{max}/I_z \pm e_z\, z_{max}/I_y \le 1/A$
* 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 $R = \sqrt{[\{(\sigma_{xx} - \sigma_{yy})/2\}^2 + (\tau_{xy})^2]}$

* To avoid yielding
  Maximum Normal Stress Theory (Rankine): $|\sigma_1| \le Y$, or $|\sigma_2| \le Y$.
  Maximum Normal Strain Theory (St. Venant): $|\sigma_1 - \nu\sigma_2| \le Y$, or $|\sigma_2 - \nu\sigma_1| \le Y$.
  Maximum Shear Stress Theory (Tresca): $|\sigma_1 - \sigma_2| \le Y$, $|\sigma_1| \le Y$, or $|\sigma_2| \le Y$
  Maximum Distortion-Energy Theory (Von Mises): $\sigma_1^2 + \sigma_2^2 - \sigma_1\sigma_2 \le Y^2$

University of Asia Pacific
Department of Civil Engineering
Midterm Examination Fall – 2021
Program: B.Sc. Engineering (Civil)

Course Title: Fluid Mechanics | Course Code: CE 221
Time: 1 hour | Credit Hour: 03 | Full Marks: 60

There are 4 questions with 15 marks for each. Please answer them accordingly.
[Assume reasonable data if and when needed]

1.	**a)**	Define and provide mathematical expressions for (i) specific weight; (2)specific volume and (3) specific gravity	**[3 X 2]**
	b)	Briefly explain buoyancy and state the characteristics of the buoyancy force.	**[1+2]**
	c)	Provide definitions for different types of flow for (1) Time; (2) Space and (3) Density as the criterion.	**[3 X2]**
2.	**a)**	Derive the mathematical expression for pressure variation in a static fluid (how pressure varies with elevation).	**[7]**
	b)	Derive the mathematical expressions for equation of continuity for steady and unsteady flow with figure.	**[8]**
3.	**a)**	A rectangular plate (3m X 3m) is 0.3mm distant from a fixed plate with fluid in between them. The rectangular plate requires 1N force to move at 40 cm/s speed. Find out the dynamic viscosity of the fluid between the plates.	**[5]**
	b)	A vertical rectangular gate (in **figure 1**; given in the next page) of 4m X 2m is hinged at a point 0.3m below the centre of gravity of the gate. If the total depth of water is 8m, what horizontal force must be applied at the bottom to keep the gate closed?	**[5]**
	c)	The two pipes in the manometer shown in **figure 2** contains water and oil of specific gravity 0.9. The liquids are connected by a U-Tube manometer with manometric liquid of specific gravity 1.25. If the manometric liquid in the limb connecting the water pipe is 3 higher than the other, find the pressure difference in two pipes.	**[5]**
4.	**(a)**	Give two examples (each) of fluid statics and kinematics in real life engineering and scientific applications with brief explanations.	**[3+3]**
	(b)	Provide and explain real life examples of how steady flow can change into unsteady flow and how unsteady flow can become steady flow?	**[3+3]**
	(c)	Why water rises in a glass tube and mercury is depressed along the walls of the tube?	**[3]**

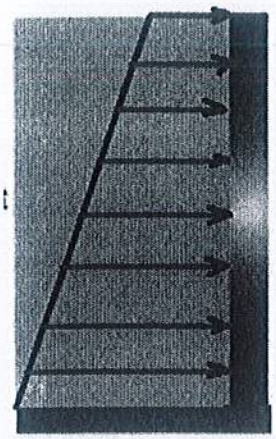


Figure 1

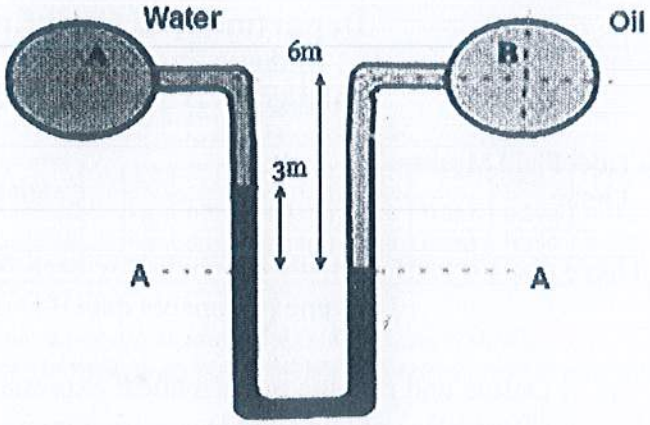


Figure 2