

University of Asia Pacific
Department of Civil Engineering
Mid Semester Examination, Fall 2024
Program: B.Sc. in Civil Engineering
1st Year 2nd Semester

Course Title: English Composition and Communication

Course Code: HSS 103

Time: 1 hour

Credit Hour: 3.00

Full Marks: 20

Answer all the questions

QUESTION 1 [05 MARKS]

The following paragraph contains 10 grammatical errors (3 article-related errors, 4 preposition-related errors, and 3 pronoun-related errors). **Rewrite the excerpt by correcting the errors and underline the corrections you've made in your script.**

[5]

Andrew has been working as an software engineer for 2022 and he designs and constructs software projects such as task monitoring, inventory systems and analysis. He graduated from a University of Pennsylvania. Him works with app developers and contractors to ensure that plans are executed accurately and within budget. Their need a strong understanding of math and physics along for complex problem solving skills. Andrew also collaborates with clients to understand their needs and specifications. In Saturday, he is supposed to start an utility-based project. Its very unique in nature. On only 25 years old, he has made quite a good reputation for himself.

QUESTION 2 [05 MARKS]

Change the tense of the following into the past. Underline the changes you're making.

[5]

Following the same routine every day, Lina makes breakfast early in the morning. The smell of freshly cooked egg spreads throughout her house. After having breakfast, she jogs in the park for an hour. After that, she meets her best friend at a café to drink coffee and talk about their day. Lina bicycles on some mornings before going back home. She admires the bicyclists who whiz past her speedily. In the afternoons, she writes poetry in her journal and eats a sandwich. Then she dozes for half an hour.

QUESTION 3 [10 MARKS]

You are Adil Rahman. Recently, you visited a newly opened restaurant, "Zaika", Road 11/A, Dhanmondi, Dhaka-1250, after seeing positive reviews about it. However, your experience at the restaurant was unsatisfactory. Now write a letter to the customer service manager of the restaurant to complain about their service and food quality.

[10]

University of Asia Pacific
Department of Civil Engineering
Mid Semester Examination, Fall 2024
Program: B.Sc. in Civil Engineering
1st Year 2nd Semester

Course Title: Mathematics-II (Self-Study)

Course Code: MTH 103

Time: 1.00 Hour

Credit Hour: 3.00

Full Marks: 60

Answer any three questions including 'Question 1' and 'Question 2'.

QUESTION 1 [20 MARKS]

- a) Define Direction cosine. Find the ratio in which XY plane divides the line joining (2, 1, -3) and (1, 3, 2). Also find the coordinates of that point. [10]
- b) Write the relation between direction cosine and direction ratio. Find the angle between lines AB and BC. Where A(-11, 8, 4), B(-1, -7, -1) and C(9, -2, 4). [10]

QUESTION 2 [20 MARKS]

- a) Find the equation of plane which is passing through (2, 1, 3), (-1, -2, 4), (4, 2, 1). [10]
Also find the perpendicular distance from the point (1, 1, -1) to this plane.
- b) Find the equation of plane which is passing through (1, 1, 2) and perpendicular to two planes $2x - 2y - 4z - 6 = 0$, $3x + y + 6z - 4 = 0$. [10]

QUESTION 3 [20 MARKS]

- a) Define the followings: [15]
Vector, Sense, Position vector, Unit vector, Null vector, Parallel vector, Equal vector, Opposite vector, Co-planer vector, Like vector.
- b) Find the volume of the parallelepiped whose edges are given by $\vec{A} = 2\hat{i} - 3\hat{j}$, [05]
 $\vec{B} = \hat{i} + \hat{j} - \hat{k}$ and $\vec{C} = 3\hat{i} - \hat{k}$.

OR

QUESTION 4 [20 MARKS]

- a) Discuss about scalar triple product also write down its property. [10]
- b) Find the sine of the angle between vectors $\vec{a} = \hat{i} + 2\hat{j} + 3\hat{k}$, $\vec{b} = 3\hat{i} - 4\hat{j} + 2\hat{k}$. [10]

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1st Year 2nd Semester

Course Title: Mathematics-II
Time: 1 hour

Credit Hour: 3.00

Course Code: MTH 103
Full Marks: 60

There are four questions. Answer any three including QUESTION 1 and QUESTION 2.

QUESTION 1 [20 MARKS]

- a. Define direction cosines of a line. If P and Q are $(2, 3, -6)$ and $(3, -4, -6)$, respectively, and O be the origin then calculate the direction cosines of OP and OQ . [10]
- b. Compute the length of the shortest distance between the lines [10]
- $$\frac{x-3}{1} = \frac{y-5}{-2} = \frac{z-7}{1}; \frac{x+1}{7} = \frac{y+1}{-6} = \frac{z+1}{1}.$$

QUESTION 2 [20 MARKS]

- a. Derive the equation of the plane which is passing through the intersection of planes $x - 2y + 3z + 4 = 0$, $2x - 3y + 4z - 1 = 0$ and is perpendicular to $3x - y + 2z - 1 = 0$. [10]
- b. Obtain the equation of the plane which is parallel to the plane $4x - 4y + 7z - 3 = 0$ and a distance 4 units from the point $(4, 1, -2)$. [10]

QUESTION 3 [20 MARKS]

- a. Transfer the equation of the curve $x^2 + y^2 - 2xy + 2x - 4y + 3 = 0$ after rotating the axes through a suitable angle. [10]
- b. Find the volume of a parallelepiped whose edges are represented by $\vec{a} = \hat{i} - 2\hat{j} - 3\hat{k}$, $\vec{b} = 2\hat{i} + \hat{j} - \hat{k}$, $\vec{c} = \hat{i} + 3\hat{j} - 2\hat{k}$. [10]

OR

QUESTION 4 [20 MARKS]

- a. Transform the equation $3x^2 + 2xy + 3y^2 - 4x + 5y - 6 = 0$ by rotating the axes to eliminate the xy term through angle 45° . [10]
- b. Compute the *sine* of the angle between vectors $\vec{a} = 3\hat{i} - 5\hat{j} + \hat{k}$ and $\vec{b} = 2\hat{i} - 4\hat{j} - 7\hat{k}$. [10]

University of Asia Pacific
Department of Civil Engineering
Mid Semester Examination, Fall 2024
Program: B.Sc. in Civil Engineering
1st Year 2nd Semester

Course Title: Physics II
Time: 1 hour

Credit Hour: 3.00

Course Code: PHY 103
Full Marks: 60

There are four questions. Answer **any three** including **QUESTION 1** and **QUESTION 2**.

QUESTION 1 [20 MARKS]

- a. Describe the properties of electric lines of force. Deduce Coulomb's law from Gauss law of electrostatics. [15]
- b. Electric field and electric potential due to a point charge in air are 50 NC^{-1} and 25 JC^{-1} respectively. Calculate the value of point charge. [05]

QUESTION 2 [20 MARKS]

- a. Define capacitance of a capacitor. Derive an expression of capacitance of a parallel plate capacitor. [15]
- b. A parallel plate capacitor consists of two plates, each with an area of 200 cm^2 , separated by a 0.4 cm air gap. Calculate its capacitance. If the capacitor is connected across a 500 V source, calculate the amount of energy stored in it. [05]

QUESTION 3 [20 MARKS]

- a. Derive the expression of magnetic induction due to a long solenoid and hence find out self-inductance per unit length of the solenoid. [15]
- b. A solenoid is 2 m long and 3 cm in diameter. It has 5 layers of windings of 850 turns each and carries a current of 5 A . Calculate the magnetic induction at its center along its axis and the magnetic flux for a cross section of the solenoid at its center. [05]

OR

QUESTION 4 [20 MARKS]

- a. Explain hysteresis loop of ferromagnetic materials with proper diagram. [15]
- b. A solenoid of length 1 m and 0.05 m diameter has 500 turns. If a current of 2 A passes through the coil, calculate the coefficient of self-induction of the coil and the magnetic flux linked with the coil. [05]

University of Asia Pacific
Department of Civil Engineering
Mid Semester Examination, Fall 2024
Program: B.Sc. in Civil Engineering
(Old-Self-Study)

Course Title: Chemistry

Time: 1 hour

Credit Hour: 3.00

Course Code: CHEM 111

Full Marks: 60

There are four questions. Answer **any three** including **QUESTION 1** and **QUESTION 2**.

QUESTION 1 [20 MARKS]

- a. Define quantum numbers. Calculate the value of l , m and number of electrons of the orbitals when $n = 3$. [12]
- b. Calculate the wavelength of the photon emitted during the transition of the electron from the $n_i = 5$ state to the $n_f = 2$ state in the hydrogen atom. [Rydberg Constant, $R_H = 109676 \text{ cm}^{-1}$.] [8]

QUESTION 2 [20 MARKS]

- a. Define colligative properties. State Raoult's law and derive Raoult's law from the lowering of vapour pressure. [2+10]
- b. The boiling point of a solution containing 0.20 g of a substance X in 20.00 g of ether is 0.17 K higher than that of pure ether. Calculate the molecular mass of X. [Boiling point constant of ether per 1 Kg is 2.16 K] [8]

QUESTION 3 [20 MARKS]

- a. Draw the molecular orbital diagram of NO. Comment on its bond order and magnetism. [12]
- b. Show the hybridization of carbon in the following organic molecules and draw their structures: CH_4 , C_2H_4 , C_2H_2 . [8]

OR

QUESTION 4 [20 MARKS]

- a. Explain the bond angle and geometry of CH_4 , NH_3 , and H_2O based on VSEPR model. [12]
- b. Lithium (Li) and Magnesium (Mg) exhibit many similar chemical properties despite being in different periods and groups in the periodic table- explain. [8]

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Department of Civil Engineering
Mid Semester Examination, Fall 2024
Program: B.Sc. in Civil Engineering
1st Year 2nd Semester

Course Title: Surveying
Time: 1 hour

Credit Hour: 3.00

Course Code: CE 105
Full Marks: 60

Answer all the questions

QUESTION 1 [12 MARKS]

- a. Explain the types of Levelling. [3]
- b. Describe the reasons for variation in Magnetic Declination. [4]
- c. Explain Graphical Method with figure. [5]

QUESTION 2 [8 MARKS]

While conducting a close traverse, the following observations in **Table 1** below were obtained and closing error was also found. Calculate the length and bearing of closing error in the traverse survey.

Table 1

Line	Length (m)	Bearing
AB	468	88° 42'
BC	267	197° 37'
CD	453	58° 54'
DA'	534	311° 19'

QUESTION 3 [16 MARKS]

The following consecutive readings were taken with a level and 5 m leveling staff on a continuously sloping ground at a common interval of 14 meters: 4.889, 3.647, 2.341, 1.983, 0.971, 4.784, 3.227, 2.390, 1.248, 0.672. The reduced level of the first point was 653.38 m. Calculate the reduced level of all other points by the **Rise and Fall Method** and the gradient of the line by joining the first and the last points.

QUESTION 4 [12 MARKS]

The following Fore Bearings (F.B.) and Back Bearings (B.B.) in **Table 2** were observed [7+5]
while traversing with a compass:

Table 2

Line	Fore Bearings (F.B.)	Back Bearings (B.B.)
AB	133°01'	311°45'
BC	347°42'	169°08'
CD	354°47'	174°47'
DE	58°57'	238°39'
EA	348°18'	168°26'

- Figure out the stations affected by local attraction and correct the observed magnetic bearings of the given lines.
- Calculate the corrected true bearings of these lines assuming the magnetic declination at that place as 39' W.

QUESTION 5 [12 MARKS]

Explain the characteristics of the contour lines in **Fig. a**, **Fig. b**, **Fig. c**, and **Fig. d**.

[4×3]

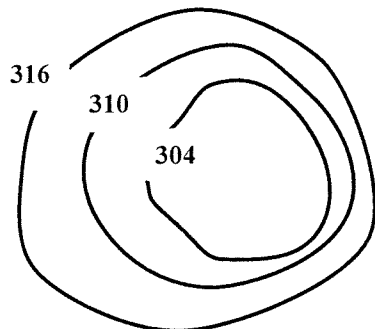


Fig. a

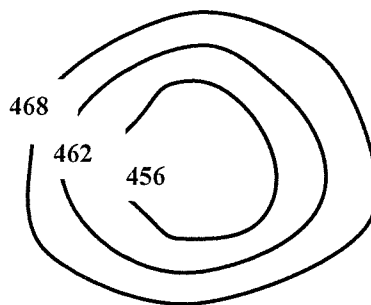


Fig. b

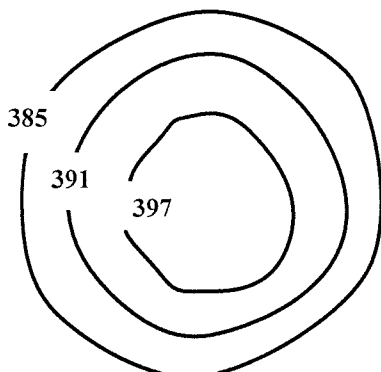


Fig. c

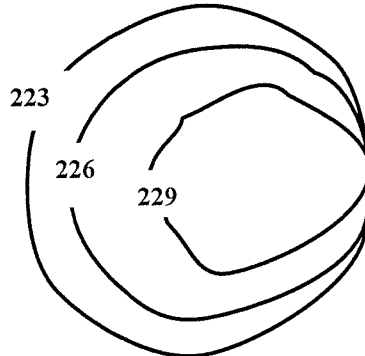


Fig. d

University of Asia Pacific
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Mid Semester Examination Fall 2024
Program: B. Sc. Engineering (Civil)

Course Title: Engineering Mechanics II
 Time: 1 hour

Credit Hours: 3.0

Course Code: CE 103
 Full Marks: 30

ANSWER ALL THE QUESTIONS

QUESTION 1 [10 Marks]

A horizontal force Q is acting on block A while it rests on block B as shown in **Fig. 1**.

Given: Unit weight of block A = 20 kN/m^3 , width of block = 1 m

- If $Q = 0 \text{ lb}$, calculate the minimum co-efficient of friction required between block A and B to prevent downward motion of block A. [4]
- Calculate Q that causes block A to be on the verge of moving upward, if the co-efficient of static friction between A and B is 0.33 . [6]

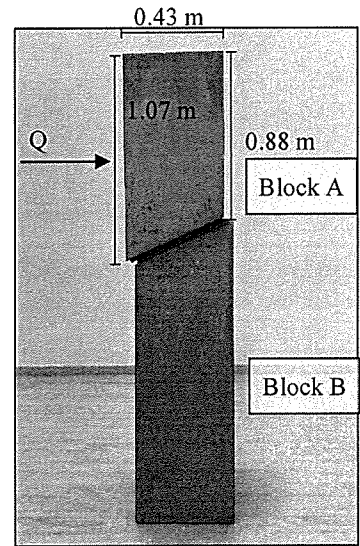


Fig. 1

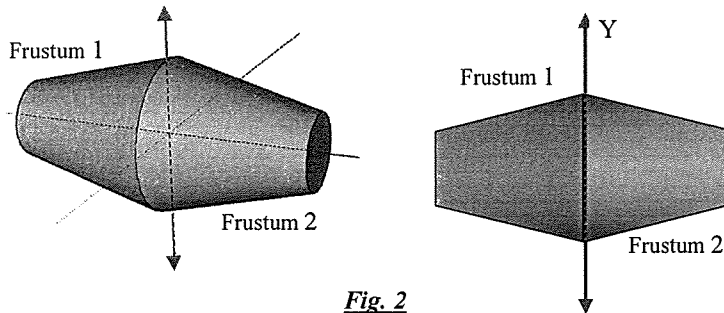


Fig. 2

QUESTION 2 [12 Marks]

The composite object shown in **Fig. 2** is made up of two solid frustums (as defined in the table).

Calculate the Moment of inertia of the object with respect to the Y axis shown in the figure. [12]

Object	Radius	Height	Unit weight
Frustum 1	6''(top)	1'	80 lb/ft ³
	1''(bottom)		
Frustum 2	6''(top)	1'	60 lb/ft ³
	1''(bottom)		

QUESTION 3 [8 Marks]

- Calculate the stopping distance for an automobile going at a constant initial speed of 95 km/h and a human reaction time of 0.40 second for acceleration $a = -3 \text{ ms}^{-2}$. If human reaction time is 1 second , what can be the maximum initial speed for the calculated stopping distance assuming $a = -3 \text{ ms}^{-2}$? [4]
- The position of a particle is given by $s = (2t^2 - 8t + 6)$ in meters where t is in seconds. Calculate the time when velocity of the particle is 10 ms^{-1} starting from rest at $t = 0$. [4]