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

Course Title: English Composition and Communication   Course Code: HSS 103
Time: 1 Hour   Credit Hour: 3   Full Marks: 20

Instructions:
*Marks are indicated in the right margin.
*Answer all the questions.

1. The following is a paragraph containing 10 preposition-related errors. Rewrite the text correctly and underline your changes.   0.5×10 = 5

Maisha and her friends ran around of circles, chasing each other. They laughed loudly as they sat in the seesaw, laughing really loudly. One of her friends jumped about the monkey bars, looking down at the others above. Another child climbed in the slide and slid down quickly. According in Maisha's parents, children should be active and play over the playgrounds. In 6 pm. Miasha decides to go home due for Maisha's sister calling her home. Mita said goodbye to her friends and walked away to her friends.

2. Rewrite the following paragraph in past tense.   0.5×10 = 5

The dragon walks through the dark, deserted forest, alone except for its magic collar, casting a dark shadow in its path. It trudges along the winding path, its energy captivating the attention of several woodland creatures. Then, the dragon listens out for pecking noises – it feels hungry, and just fancies a woodpecker or two for its dinner. Finally, the red beast plods out of the woodland, and steps into the bright sunshine, its footsteps echoing amidst the distant hum of people in a village nearby. It stops short of the village as it does not know whether or not it is welcome.

3. You are the Operations Manager of Highlights Gadgets Ltd., Road 12/A, Malibag, Dhaka 1200. Recently, you ordered some desktops, printers and laptops from Seneca Technology Shop, Road 08/B, Banani, Dhaka-1000. Some of the desktops and printers do not function properly and some of the laptops have damaged screens. Now, write a complaint letter to the Customer Service Manager of the shop mentioning the remedial measures like compensation, refund or replacement of products.   10×1 = 10

Good Luck!

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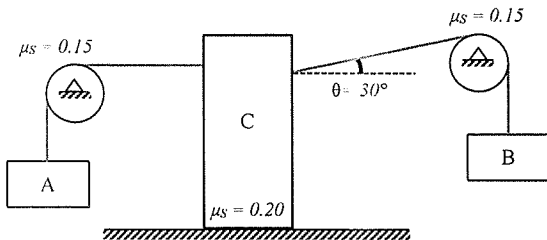Course Title: Engineering Mechanics II   Course Code: CE 103
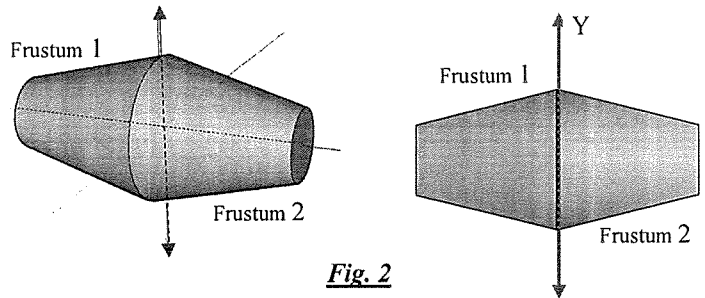Time: 1 hour   Credit Hour: 3.0   Full Marks: 30

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

1. A cylindrical block C is connected to block A and B with two rough cables as shown in **_Fig.1_**. Determine whether Block C slides or not.
[Given, W_A= 15 lb., W_B= 12 lb., W_C= 10 lb]   **[10]**


Fig.1

Fig. 2

2. A 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'	120 lb/ft³
	1'(bottom)		
Frustum 2	6"(top)	1'	70 lb/ft³
	1'(bottom)		

3. Acceleration profile of a particle is defined as shown in **_Fig. 3_**. a) Calculate velocity at t= 10 sec if initial velocity is 2 ft/s. b) Calculate distance traversed between t= 8 sec and t= 12 sec.   **[8]**

$$a= \begin{cases} if\ time \le 5, 10 \\ if\ time > 5, 10 - \sqrt{t-5} \end{cases} ft/sec^2$$

Acceleration vs Time
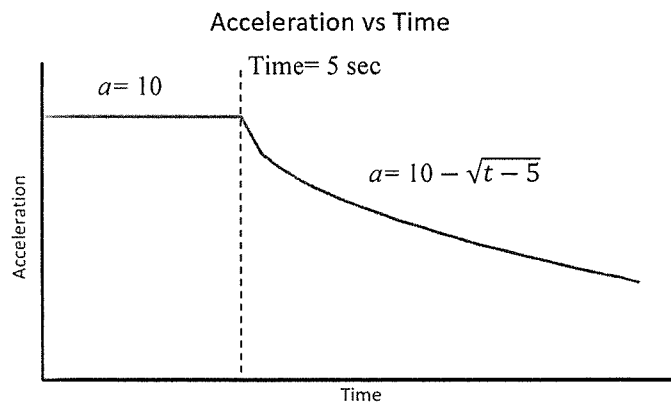
Fig. 3

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Course Title: Mathematics-II   Course Code: MTH 103
Time: 1.00 Hour   Credit Hour: 3.00   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) Check whether the lines PQ and RS are parallel, perpendicular or neither to each other where $P(0, -1, -1)$, $Q(4, 5, 1)$, $R(-4, 4, 4)$, $S(3, 9, 5)$.   **10**

   b) Prove that, the sum of the squares of direction cosines of every line is one. Then find the direction cosine of the line which is equally inclined to the axes.   **10**

2. a) Find the equation of plane which is passing through $(2, -1, -4)$ and perpendicular to two planes $3x + 4y - 5z + 6 = 0$ and $x - 2y + 2z + 1 = 0$.   **10**

   b) Find the equation of plane which is passing through the intersection of planes $4x - 2y + z - 3 = 0$, $2x - y + 3z + 1 = 0$ and is perpendicular to $3x + y - z + 7 = 0$.   **10**

3. a) Find the two tangent planes to the sphere
   $17x^2 + 17y^2 + 17z^2 - 68x + 34y - 102z + 85 = 0$ which are parallel to the plane $3x + 2y - 2z = 0$.   **10**

   b) Describe the graph of the equation $x^2 - 5y^2 - 2x - 2y - 9 = 0$.   **10**

OR

4. a) Remove the first degree term in $5x^2 + 9y^2 + 20x - 54y + 56 = 0$.   **10**

   b) Determine the equation of the curve $x^2 + y^2 - 2xy + 2x - 4y + 3 = 0$ after rotating of axes through angle $\frac{\pi}{4}$. Also identify the type of conic and describe the graph.   **10**

Course Title: Physics II   Course Code: PHY 103
Time: 1 hour   Credit Hour: 3.0   Full Marks: 60

There are **four** questions. Answer any **three including Q-1 and Q-2**. Figures in the right margin indicate marks.

1. a) State Gauss's law. [03]

    b) Derive the mathematical expression of electric field due to an infinite long [12] straight charged wire.

    c) Two charges each value of 10 C is placed on the circumference of a sphere of [05] radius 10 cm. Calculate the electric potentials at a distance 8 cm and 10 cm from center.

2. a) Describe capacitance of a capacitor. [03]

    b) Show that the energy stored per unit volume in a parallel plate capacitor is [12] $U = \frac{1}{2}\varepsilon_0 E^2$, where the symbols have their usual meaning.

    c) A plane parallel plate capacitor has circular plates of radius 10 cm separated at [05] a distance 1 mm. Calculate the electric field, electric field energy density and energy stored in the capacitor.

3. a) Describe the origin of magnetism. [03]

    b) Derive the expression of magnetic field induction due to a long solenoid. [12]

    c) A coil has an inductance of 5.0 henry and resistance of 20 ohms. If a 100 volts [05] emf is applied, calculate the energy stored in the magnetic field after the current has built up to its maximum value.

                                     OR

4. a) State Ampere's circuital law. [03]

    b) Explain Faraday's law and Lenz law, hence discuss about self-induction and [12] mutual induction.

    c) Two small spheres A and B are given charges 9 C and 16 C respectively. If the [05] distance between two spheres us 28 cm, calculate the point line joining between them, electric field due to the charges is same.

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(Self-Study)

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Course Title: Chemistry		Course Code: CHEM 111
Time: 1 hour	Credit Hour: 3.0	Full Marks: 60

There are **four** questions. Answer any **three**. Figures in the right margin indicate marks.

1. a. State Heisenberg's Uncertainty Principle. If the uncertainty in velocity of an object of 500 g mass is 7.25×10^{-23} m/s, calculate the uncertainty in position. [Planck's constant, $h = 6.626 \times 10^{-34}$ Js]   [4+8]

   b. Find the wavelength of the radiated light if the electron in a Hydrogen atom undergoes a transition from the 4th orbit to the 3rd orbit. [Rydberg constant, $R_H = 1.09678 \times 10^{-2}$ nm^{-1}]   [8]

2. a. State Raoult's Law. Discuss the main criteria for an ideal solution.   [4+8]

   b. 5.30 g Na_2CO_3 was dissolved in water to prepare 100 mL of solution. Calculate the molarity of the solution.   [8]

3. a. Discuss why methane, ammonia and water have different molecular shapes though their central atoms have the same hybridization.   [12]

   b. Write down the hybridizations of central atoms of the following molecules and predict their molecular geometry: (i) PCl_5 (ii) SF_6 [8]

4. a. Discuss the key features of Molecular Orbital Theory (MOT).   [12]

   b. Draw the molecular orbital diagram for a Nitrogen molecule (N_2) and find the bond order.   [8]

Course Title: Chemistry		Course Code: CHEM 111
Time: 1 hour	Credit Hour: 3.0	Full Marks: 60

There are four questions. Answer any three including Q-1 and Q-2. Figures in the right margin indicate marks.

1. a. Explain the autoionization of water. Show that pH + pOH = 14 at 25°C. [4+8]

   b. 10.6 g of Na_2CO_3 was dissolved in water to prepare 500 mL of solution. Calculate the normality of the solution. [Molar mass of Na_2CO_3 = 106 g/mol] [8]

2. a. Show that when the electron of a Hydrogen atom jumps from n_2 (a higher energy level) to n_1 (a lower energy level), the wave number $(\frac{1}{\lambda})$ associated with the radiated energy is given by $\frac{1}{\lambda} = R_H \left(\frac{1}{n_1^2} - \frac{1}{n_2^2}\right)$, where R_H refers to the Rydberg constant. [12]

   b. Find the highest possible wavelength in the Balmer series for the electron in a Hydrogen atom. [$R_H = 1.09678 \times 10^{-2}$ nm^{-1}] [8]

3. a. Define hybridization. Predict the hybridization of the central atoms in the following molecules, mention their molecular geometries and draw their structures: (i) PCl_5 (ii) IF_7. [2+10]

   b. Explain in the light of VSEPR theory why CH_4, NH_3 and H_2O have different molecular shapes, though their central atoms have the same hybridization. [8]

OR

4. a. Define bond order. Draw the molecular orbital diagram for an oxygen molecule (O_2), find the bond order and comment on its magnetism. [2+10]

   b. Explain why the second ionization energy of an element is generally higher than its first ionization energy. [8]

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Course Title: Surveying   Course Code: CE 105
Time: 1 hour   Credit Hour: 3.00   Full Marks: 60

[There are Total Five (05) Questions. Answer All Questions]

1. a. Differentiate between chain surveying and traverse surveying.   [05]
    b. Describe the characteristics of contours.   [05]
    c. Explain Relative Error of Closure with figure.   [02]

2. The following observations with a closing error were made while conducting a closed   [08]
    traverse round an obstacle. Calculate the length and bearing of the closing error in the
    traverse survey.

Line	Length (m)	Bearing
BC	489	105° 05′
CD	367	195° 30′
DE	298	38° 20′
EB′	506	309° 50′

3. The following Fore Bearings (F.B.) and Back Bearings (B.B.) were taken while   [8+4]
    traversing with a compass:

Line	F.B.	B.B.
AB	S 48°29′ E	N 48°15′ W
BC	N 69°44′ E	S 69°17′ W
CD	S 58°13′ E	N 58°13′ W
DA	N 58°26′ E	S 58°39′ W

Figure out the stations affected by local attraction and calculate the corrected magnetic
bearings of the given lines. Also, convert the bearings of all lines into the whole circle
bearing system.

4. The following consecutive readings were taken with a level and 4 m leveling staff on a   [16]
    continuously sloping ground at a common interval of 17 meters: 0.333, 1.258, 2.789,
    2.926, 3.128, 3.781, 0.617, 1.694, 2.644, 2.998, 3.876. The reduced level of the first point
    was 309.17 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.

5. Draw contour lines of 46 m, 47 m, 48 m and 49 m. Also, demonstrate your   [12]
    understanding on the contour shape. [**Grids are given on *Page no. 2***]