

**University of Asia Pacific**  
**Department of Civil Engineering**  
**Semester Final Examination Fall 2022**  
**Program: B.Sc. Engineering (Civil)**

Course Title: English Language II

Course Code: HSS 103

Time: 3 hours

Credit Hour: 3.00

Full Marks: 50

**Instructions:**

**\*Marks are indicated in the right margin.**

**\*Answer all the questions**

**Q1. Read the following passage and answer the questions that follow:**

(1) Bangladesh is a country of colorful celebrations. We celebrate our faith, life, liberty, nature, elation, and achievements round the year through a wide variety of fairs and festivals, organized with inexorable enthusiasm and intricate details. Some Bengali fairs and festivals have recorded history of over 2000 years. Festivals in Bangladesh fall into four major categories: religious festivals, national events, cultural festivals, tribal festivals. Although a few festivals are primarily meant for particular sections of the population, all the festivals have now attained universal reach throughout the country.

(2) *Basanta Utsab* is the first day of spring, celebrated in a very colorful manner throughout the country on the 1<sup>st</sup> day of Falgun, the 11<sup>th</sup> month of Bangla calendar, which falls in mid-February of Gregorian calendar. On this occasion, people wear color dresses and colorful fairs and cultural programmes organized. Women usually wear yellow *sharis* and decorate themselves with floral ornaments. Exchange of greetings and gifts is common on the Day.

(3) The Nabanna Utsab (new harvest festival) is celebrated predominantly by rural agrarian population of Bangladesh in *Poush*, the first month of winter season of the Bengali calendar. With a full barn for the winter, it is the time for the agrarian rural Bengalis to relax and engage in merriment and cultural activities. A traditional Poush Mela (traditional fair) would essentially include a *Jatrapala* (a traditional theatre), traditional dance and music concerts, along with a wide variety of rice-milk-molasses based delicacies called *pitha*.

(4) Pohela Boishakh is the first day of the Bengali calendar which falls on 14<sup>th</sup> April of Gregorian calendar. Pohela Boishakh is an integral part of Bangladesh's cultural heritage. It is closely linked with the rural life. People start this day with new hope thoroughly removing the failures and sorrows of the preceding year. Businessmen, particularly in rural areas, close their old book of accounts and open new ones and treat their customers with traditional sweets to renew the business relationship. People, dressed in colorful traditional clothes, visit their friends, relative and neighbors to exchange greetings. On this day, Fairs are arranged in many parts of the country where various agricultural products, traditional handicrafts, toys, cosmetics, as well as various kinds of food and sweets are sold. The fairs also provide entertainment with singers, dancers and traditional plays and songs. Pohela Boishakh is also celebrated in grand ways in capital Dhaka and other major cities of Bangladesh.

**A. Write a summary of the passage using 5-6 sentences:**

**B. Write 'T' for True and 'F' for False for the following statements. If False, write the correct answers:** 5×1=5

- i. Bengali fairs and festivals have no history \_\_\_\_.
- ii. Poush is the second month of winter season of the Bengali calendar \_\_\_\_.
- iii. Basanta Utsab is celebrated in mid-March \_\_\_\_.
- iv. Pohela Boishakh starts with new hope to think about the past \_\_\_\_.
- v. Pohela Boishakh is mostly celebrated in capital Dhaka \_\_\_\_.

**C. Find out synonymous words from the above passage for the following words:** 5×1=5

- i. Passion (Para-1)
- ii. Beautify (Para-2)
- iii. Fun (Para-3)
- iv. Essential (Para-4)
- v. Previous (Para-4)

**Q2: Change these active sentences to passive:** 5×1=5

- a) People speak Spanish in Argentina.
- b) The Government is planning a new road near my house.
- c) My grandfather has built this house recently.
- d) Picasso painted Guernica at that time.
- e) Someone should do the work.

**Q3: Complete the sentences using proper conditionals:** 5×1=5

- a) ... .., ice melts
- b) ... .., the plane will land soon.
- c) ... .., the test would be taken last week.
- d) ... .. I would have met him today.
- e) Had you been to the place, ... ..

**Q4:** Suppose the Managing Director asked you to prepare a report on one of your chips which has been gradually declining in popularity in the market for last six months. As the Product Promotion Officer at *GOODFOOD* beverage company, prepare a memorandum to be sent to the Managing Director informing him that the assigned job is done. 10

**Q5: Write an essay on any of the following:** 15

Life in Dhaka City  
Or,  
Blended Education

**University of Asia Pacific**  
**Department of Basic Sciences and Humanities**  
**Final Examination, Fall-2022**  
**Program: B. Sc. in Civil Engineering**

Course Code: CHEM 111

Course Title: Chemistry

Credits: 3.00

Full Marks: 150

Duration: 3 Hours

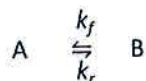
**Instructions:**

1. There are **eight (8)** questions. Answer any **six (6)** of them. All questions are of equal value. Part marks are shown in the margins.

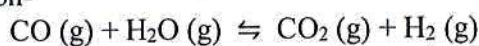
1. a. Explain the concept of hybridization with the help of hybridized state of carbon in methane. 10  
b. State the main postulates of VSEPR theory. Predict and draw the geometry of the following molecules: 6+9=15  
i) CH<sub>3</sub>Cl ii) SO<sub>2</sub> iii) SF<sub>4</sub>
2. a. Identify the compound that is more likely to be soluble in water among C<sub>4</sub>H<sub>9</sub>OH and C<sub>4</sub>H<sub>9</sub>SH? Justify your answer. 10  
b. Hydrogen peroxide is a powerful oxidizing agent used in concentrated solution in rocket fuel and in dilute solution in hair bleach. An aqueous solution of H<sub>2</sub>O<sub>2</sub> is 30.0% by mass and has a density of 1.11 g/mL. Calculate the (a) molality, (b) mole fraction of H<sub>2</sub>O<sub>2</sub>, and (c) molarity. 15
3. a. Define sol. Give comparison of lyophilic sols and lyophobic sols. 3+10=13  
b. Describe the nature of the following type of colloids a) Emulsion b) Gel c) Micelle or Associated Colloid 12
4. a. Define the rate of reaction? Identify the different factors that affect the rate of a chemical reaction. 10  
b. Write down the expression with graphical representation that shows the quantitative effect of temperature on reaction rate. The rate constant of a first order reaction is  $3.46 \times 10^{-2} \text{ s}^{-1}$  at 25°C. What is the rate constant at 77°C if the activation energy for the reaction is 50 kJ/mol? 5+10=15
5. a. Derive the integrated rate expression for zero-order reaction: A → (Product) with graphical representation and show the expression for the half-life for such reaction. 15  
b. A first-order reaction has a half-life of 26.4 seconds. How long does it take for the concentration of the reactant in the reaction to fall to one-eighth of its initial value? 10

6. a. Define reaction quotient and equilibrium constant. Explain that with the value of these two parameters, the direction of a reversible reaction can be predicted. 8

b. For the following reaction,  $A$  is the reactant, and  $B$  is the product.  $k_f$  and  $k_r$  are the rate constants for the forward and reverse reactions, respectively. Prove that the equilibrium constant,  $K$ , for the reaction is the ratio of the rate constants. 10



c. For the following reaction- 7

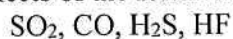


Suppose you have 1 mol of each reactant in a 50L vessel. How many moles of each substance is present in the equilibrium mixture? The equilibrium constant is 0.58.

7. a. Corrosion can be prevented by sacrificing metals-explain. 10

b. Discuss the galvanic cell formation theory of corrosion with a suitable example. 15

8. a. Identify the source and harmful effects of the following gas pollutants. 10



b. Define Eutrophication. State the impacts of Eutrophication on the environment. 15

**University of Asia Pacific**  
**Department of Basic Sciences and Humanities**  
**Final Examination, Fall-2022**  
**Program: B.Sc. Engineering (Civil)**

Course Title: Mathematics II  
Time: 3 Hours

Credit Hours: 3

Course Code: MTH 103  
Full Marks: 150

There are **EIGHT** questions. Answer **SIX** including questions **1, 2, 3 and 4**. All questions are of equal value. Figures in the right margin indicate marks.

1. (a) The acceleration of a particle at any time  $t \geq 0$  is given by 10  
 $\vec{a} = e^{-t} \hat{i} - 6(t+1) \hat{j} + 3 \sin t \hat{k}$ . If the velocity  $\vec{v}$  and displacement  $\vec{r}$  are zero at  $t = 0$ , find  $\vec{v}$  and  $\vec{r}$ .
- (b) Find the total work done in moving a particle in a force field given by 15  
 $\vec{F} = 3xy \hat{i} - 5z \hat{j} + 10x \hat{k}$  along the curve  $x = t^2 + 1, y = 2t^2, z = t^3$  from  $t = 1$  to  $t = 2$ .
2. Evaluate  $\iint \vec{A} \cdot \hat{n} \, dS$ , where  $\vec{A} = 2x \hat{i} - 3y \hat{j} + z \hat{k}$  and  $S$  is that part of the plane 25  
 $x + 2y + 2z = 6$  which is located in the second octant.
3. (a) If  $\vec{F} = x^2 z \hat{i} - 3y^2 \hat{j} + 2yz^2 \hat{k}$ , evaluate  $\iint \vec{F} \cdot \hat{n} \, dS$  where  $S$  is the surface of the 15  
cube bounded by  $x = 0, x = 2, y = 0, y = 2, z = 0, z = 2$ .
- (b) Let  $\vec{F} = 2xz \hat{i} - x \hat{j} + y^2 \hat{k}$ . Evaluate  $\iiint_V \vec{F} \, dV$  where  $V$  is the region bounded by 10  
 $x = 0, y = 0, y = 6, z = x^2, z = 4$ .
4. (a) Find the two tangent planes to the sphere  $x^2 + y^2 + z^2 - 4x + 2y - 4 = 0$  which are 10  
parallel to the plane  $2x - y + 2z = 1$ .
- (b) Identify name of the equation  $3x^2 + 4y^2 + 2z^2 - 12x - 8y + 4z + 18 = 0$  and also 15  
find the center and length of semi major axis.

5. (a) Find the equation of plane which is passing through  $(2, -3, -1)$ ,  $(1, 2, 3)$ ,  $(2, 1, -3)$ . 10  
Also find the perpendicular distance from the point  $(-5, 6, 7)$  to this plane.

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

(c) Find the angle between two planes  $2x - 2y - z + 3 = 0$  and  $5x - 4y + 3z - 15 = 0$ . 05

**OR**

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

(b) Find the equation of plane which is parallel to the plane  $2x + 3y - 2z - 4 = 0$  and a 10  
distance 3 unit from the point  $(2, -1, -2)$ .

(c) Write down the perpendicular and parallel formula for two planes. 05

7. (a) Find the ratio in which the  $xz$  plane divides the line joining  $(-1, 0, -2)$  and 10  
 $(2, -3, 2)$ . Also find the coordinates of that point.

(b) Define direction ratio. Prove that the sum of the squares of direction cosine of 15  
every line is one.

**OR**

8. (a) Find the direction cosine of the line which is equally inclined to the axes. 10

(b) Define direction cosine. If P and Q are  $(-2, 3, -1)$  and  $(-3, 2, -2)$  respectively and 15  
O be the origin, then find the direction cosines of OP and PQ. Also find the angle  
between OP and PQ.

**University of Asia Pacific**  
**Department of Civil Engineering**  
**Final Examination Fall 2022**  
**Program: B. Sc. Engineering (Civil)**

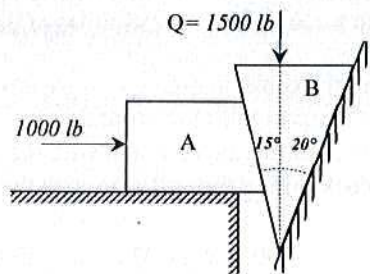
Course Title: Engineering Mechanics II  
 Time: 3 hours

Credit Hours: 3.0

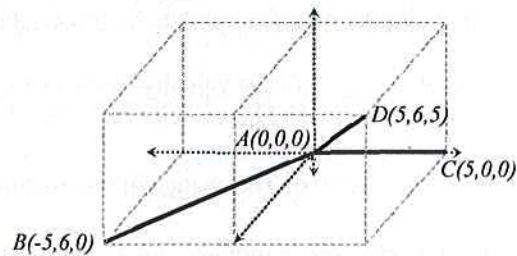
Course Code: CE 103  
 Full Marks: 100

**ANSWER ALL THE QUESTIONS**  
**[Assume any reasonable value if needed]**

1. In **Figure 1**, a resistance of 1000 lb is exerted on the block A, which in turn presses against the wedge B. Vertical force  $Q = 1500$  lb causes the wedge to be in impending motion downward. If coefficient of static friction  $\mu_s$  is the same for all contact surfaces, calculate the value of  $\mu_s$ , neglecting the weight of both A and B. 10

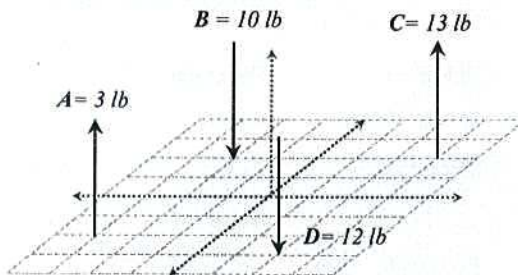


**Figure 1**

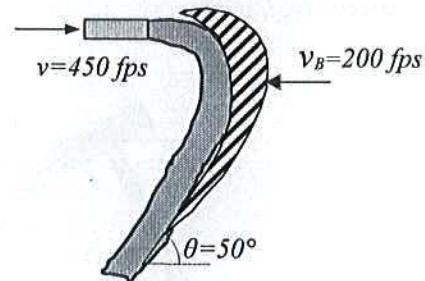


**Figure 2**

2. Calculate the resultant of the three non-coplanar concurrent forces AB, AC and AD shown in **Figure 2**. Given,  $AB = 100$  lb;  $AC = 80$  lb;  $AD = -90$  lb. 10
3. Calculate magnitude and location of the equilibrant for the non-coplanar parallel force system shown in **Figure 3**. Each small square on the grid represents  $(1' \times 1')$  area. 10



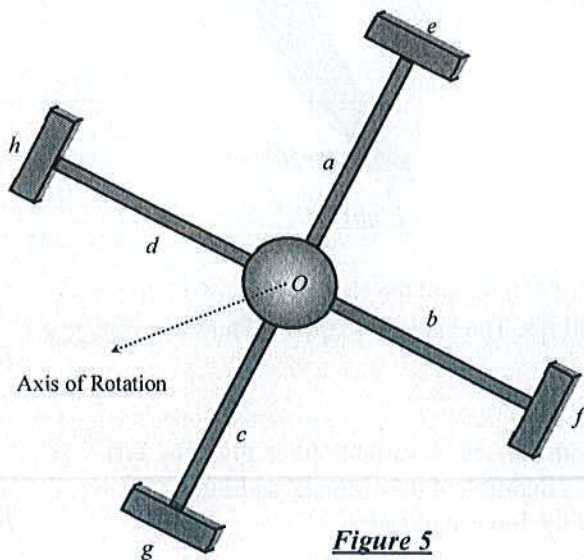
**Figure 3**



**Figure 4**

4. A jet of steam issued from a nozzle with a velocity of 450 fps and the absolute rate of 1.5 lb per sec. It enters a blade moving with a velocity of  $v_B = 200$  fps. The blade is shaped as shown in **Figure 4** and has a negligible frictional loss. Calculate the resultant force exerted on the blade. 10
5. A ball of mass 0.2 kg is initially at rest on a smooth surface. A variable force given by  $F(t) = 2t^2$  [where  $t$  is the time in seconds] acts on the ball for a duration of 0.5 seconds, causing it to move. Calculate the final velocity of the ball at the end of the force application. 10

6. A large water wheel (with a radius of 10 meters and a mass of 5000 kilograms) is used to generate electricity in a hydroelectric power plant. It starts from rest and accelerates uniformly to a rotational speed of 50 revolutions per minute in 10 seconds. The water exerts a constant torque of 2000 Newton-meters on the wheel.
- Calculate:
- The angular acceleration of the water wheel. 4
  - The work done by the water wheel during the acceleration phase. 4
  - The rotational kinetic energy of the water wheel after the acceleration phase. 5
7. A crane is lifting a 5000 kg concrete block vertically using a steel cable. The block is initially at rest on the ground, and the crane starts lifting it with an upward acceleration of  $2 \text{ m/s}^2$ . After the block has been lifted 10 meters, the cable suddenly snaps, causing the block to fall freely to the ground. Upon impact with the ground, the block rebounds with a coefficient of restitution of 0.6.
- Calculate:
- The velocity of the block just before the cable snaps. 4
  - The velocity of the block just before impact with the ground. 4
  - The impulse experienced by the block during the collision with the ground. 5
  - The change in momentum of the block during the collision with the ground. 4
8. A small race car is moving along a circular track of radius 100 meters. The car is initially at rest, but the driver accelerates it from rest with a constant tangential acceleration of  $5 \text{ m/s}^2$ . At a certain instant, the car's velocity is  $10 \text{ m/s}$ . Simultaneously, the car experiences a normal acceleration of  $3 \text{ m/s}^2$  towards the center of the track. 10
- Determine the car's angular velocity and the total acceleration at this instant.
9. Calculate moment of inertia of the composite object with respect to its axis of rotation as shown in Figure 5. 10
- The shape consists of a sphere ( $O$ ) at the center, four slender rods ( $a, b, c, d$ ) and four rectangular prisms ( $e, f, g, h$ ).



**Figure 5**

Object	Dimension		Unit weight
Sphere	Radius	6"	50 lb/ft <sup>3</sup>
Slender rods	Radius	1.5"	80 lb/ft <sup>3</sup>
	Height	2'	
Rectangular prism	Cross section	3" × 3"	60 lb/ft <sup>3</sup>
	Height	1'	



**University of Asia Pacific**  
**Department of Civil Engineering**  
**Final Examination – Fall 2022**  
**Program: B.Sc. Engineering (Civil)**

Course Title: Surveying

Course Code: CE 105

Time: 3 hours

Credit Hour: 4

Full Marks: 200

1. a) Differentiate between open and closed traverse. 05  
 b) Explain radiation and intersection methods of plane table surveying. 12  
 c) Describe the linkage of GIS to Remote Sensing. 08  
 d) Compare between photogrammetry and chain surveying. Explain the purpose of taking overlapping photographs in case of photogrammetric survey. 10+10
2. a) The following interior angles were measured with the sextant in a closed traverse. The bearing of line AB was measured as  $70^{\circ} 00'$  with the prismatic compass. Calculate the bearings of all other lines where  $\angle A=150^{\circ} 10'$ ;  $\angle B=60^{\circ} 8'$ ;  $\angle C=70^{\circ} 22'$ ;  $\angle D=79^{\circ} 20'$ . 15  
 b) In 1979, a map was plotted where a line AC was drawn to a magnetic bearing of  $7^{\circ} 45'$ . The magnetic declination at that time was  $2^{\circ}$  west. If you want to correct the map for 2023, calculate the magnetic bearing of the line if the magnetic declination in 2023 is  $10^{\circ} 15'$  west. 05
3. The following observations were obtained during conducting a closed traverse round an obstacle: 15
- | Line | Length (m) | Azimuth           |
|------|------------|-------------------|
| AB   | 650        | $88^{\circ} 30'$  |
| BC   | 770        | $20^{\circ} 20'$  |
| CD   | 618        | $288^{\circ} 30'$ |
| DE   | ?          | $220^{\circ} 0'$  |
| EA   | ?          | $140^{\circ} 10'$ |
- Calculate the missing quantities.
4. Two points A and B are opposite sides of a mountain. The tachometer was set up at C on top of the summit and the following readings were taken: 20
- | Inst. station | Height of Instrument | Staff Station | Vertical Angle    | Hair Readings       | Remarks   |
|---------------|----------------------|---------------|-------------------|---------------------|-----------|
| C             | 2.500                | A             | $-15^{\circ} 00'$ | 1.172, 2.417, 2.879 | RL of C=  |
| C             | 2.500                | B             | $-17^{\circ} 00'$ | 0.746, 1.065, 2.247 | 447.600 m |
- The tachometer is fitted with an analytic lens, the multiplying constant being 99. The staff was held normal to the line of sight. Calculate the followings:  
 i. The distance between A and B  
 ii. The slope of lines AC and AB
5. A road bend which deflects  $75^{\circ}$  is to be designed for a maximum speed of 29.2 m/sec, a maximum centrifugal ratio of 1/5, and a maximum rate to the change of acceleration of  $79920 \text{ m/min}^3$ , the curve consisting of a circular arc combined with two cubic spirals. Calculate the radius of the circular arc, the requisite length of the transition curve, the total length of the composite curve, the chainages of the beginning and end of the transition curve and of the junctions of the transition curves with the circular arc if the chainage of the P.I. is 45578 meters. 20

6. Complete the following table from an old surveying book and point out any error if found. 20

Point	B.S	I.S	F.S	Rise	Fall	R.L	Remarks
1	4.125					X	B.M
2	4.560		X	1.325		125.005	T.P
3		X			0.055		
4		X				125.350	
5	3.157		2.655				T.P
6	1.620		X		2.165		T.P
7		2.625					
8			X			122.590	T.B.M

7. Draw contour lines of 50 m, 30m, 35m and 55m. 20

50	60	55	45	35
60	30	30	35	30
55	45	36	30	45
70	40	32	38	68
45	50	30	40	30

8. A land is 900'x 500' approximately and towards the end of the longitudinal side, there is a steep slope. At a distance of 150' from the left corner of the land, there is a temple. If you are the surveyor and you need to survey the entire land and also overcome the obstacle, figure out a suitable method/ method for surveying. 20

9. The following perpendicular offsets were taken from a chain line to an irregular boundary: 20

<i>Chainage(m)</i>	0	10	25	42	60	75
<i>Offset (ft)</i>	15.5	26.2	31.8	25.6	29.0	31.5

Calculate the area between the chain line, the boundary, and the end offsets using two different methods and the percentage of difference between the obtained results. Predict the reason for such difference.