

**University of Asia Pacific**  
**Department of Civil Engineering**  
**Semester Final Examination Spring 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

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**Instructions:**

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

**\*Answer all the questions**

1. **Combine the following pairs into single sentences:** 10×2 = 20

- a) He went there. We know it.
- b) He could do it. I do not know how.
- c) She is laughing. Nobody knows the reason.
- d) He will come. I do not know the time.
- e) It is very simple. Even a child can do it.
- f) You met a man last night. He is a teacher.
- g) I will not go to school. I will not go to my friend's house.
- h) Do not touch the water. It is boiling.
- i) He was tired. He took a rest for a while.
- j) We visited the fair. We returned home.

2. **Rewrite the following changing the active sentences to passive or *vice versa*:**

10×1= 10

- a) I ate a piece of chocolate cake.
- b) The librarian read the book to the students.
- c) The money was stolen.
- d) They are paid on Fridays.
- e) The movie is being made in Hollywood.
- f) I washed my car three weeks ago.
- g) His hair was cut by a professional.
- h) I will introduce you to my boss this week.
- i) It would have been fixed at the weekend.
- j) The national anthem is being sung by him this time.

3. Complete the following conditional sentences:

10×1=10

- a) If I ..... you, I would tell him straightaway.
- b) If you ..... yellow and blue, you get green.
- c) If I ....., I would never have done it.
- d) Unless you ..... things easy, you'll get ill.
- e) ....., I'd have come immediately.
- f) If I ..... you, I would never have done that.
- g) Provided you..... there half an hour before it starts, you'll get straight in.
- h) Unless you ..... drinking, you'll have serious health problems.
- i) If you see him, ..... him to call me?
- j) ..... her help, I'd have been in real trouble.

4. Imagine you are the CEO of a clothing line company.

10×1=10

Now write a memo addressed to your marketing staff to change the traditional advertising plan to a digital one. Mention how this change will demand more hours out of your workers, but will increase profit in the long term.

**University of Asia Pacific**  
**Department of Basic Sciences and Humanities**  
**Final Examination, Spring-2022**  
**Program: B. Sc. in Engineering (CE)**  
**(1<sup>st</sup> year/2<sup>nd</sup> semester)**

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. Discuss the main postulates of Valence Shell Electron Pair Repulsion Theory (VSEPR). 10  
b. Predict and draw the geometry of the following; 15  
i)  $\text{IF}_5$  ii)  $\text{SF}_6$  iii)  $\text{SO}_2$  iv)  $\text{XeF}_2$  v)  $\text{ClF}_3$
2. a.  $\text{H}_2\text{O}$  is liquid at room temperature, but  $\text{H}_2\text{S}$  is a gas -justify. 10  
b. Identify the main assumptions of VBT and explain the concept of hybridization by illustrating the hybridization of carbon in ethyne. 15
3. a. Derive the integrated rate expression for the first order reaction;  $\text{A} \rightarrow (\text{Product})$  and show the expression for the half-life for such reaction. 15  
b. The conversion of cyclopropane to propene in the gas phase is a first-order reaction with a rate constant of  $6.73 \times 10^{-4} \text{ s}^{-1}$  at  $500^\circ\text{C}$ . If the initial concentration of cyclopropane was  $0.25 \text{ M}$ , what is the concentration after  $8.8 \text{ min}$ ? 10
4. a. Differentiate the order and molecularity of a reaction. 7  
b. Draw the potential energy diagram showing the activated complex during a reaction and explain the diagram. 10  
c. The rate constant of a first-order reaction is  $3.64 \times 10^{-2} \text{ s}^{-1}$  at  $298\text{K}$ . What is the rate constant at  $350\text{K}$  if activation energy is  $50.2 \text{ kJ/mol}$ ? 8
5. a. Define 'solution.' Identify the different interactions at the molecular level during the solution process. Explain the solution process at the molecular level. 10  
b. Differentiate molality and molarity. A solution is prepared by mixing  $1.00 \text{ g}$  ethanol ( $\text{C}_2\text{H}_5\text{OH}$ ) with  $100.0 \text{ g}$  water to give a final volume of  $101 \text{ mL}$ . Calculate the molarity, mole fraction, and molality of ethanol in this solution. 15

6. a. Define colloid. Differentiate Sol, Gel, and Emulsion with suitable examples. 10
- b. Explain Brownian movement and Tyndall effect of colloidal solution. 15
7. a. Define Equilibrium constant and reaction quotient. Explain that the direction of a reversible reaction can be predicted by comparing the reaction quotient with equilibrium constant. 10
- b. Write down the expression of the equilibrium constant for the following reactions: 8
- i)  $\text{H}_2\text{O} (\text{l}) \rightleftharpoons \text{H}_2\text{O} (\text{g})$
- ii)  $\text{CaCO}_3 (\text{s}) \rightleftharpoons \text{CaO} (\text{s}) + \text{CO}_2 (\text{g})$
- c. The value of  $K_p$  at 25 °C for the following reaction is  $1.9 \times 10^3 \text{ atm}^{-1}$ . Calculate the value of  $K_c$  at the same temperature. 7
- $2\text{NOCl} (\text{g}) \rightleftharpoons 2\text{NO} (\text{g}) + \text{Cl}_2 (\text{g})$
8. a. Define corrosion. Identify the factors on which the rate of corrosion depends. 10
- b. Show the rusting mechanism of iron with proper reactions at the anode and cathode. 15

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

Course Title: Co-ordinate Geometry and  
Vector Analysis

Credit Hour: 3  
Time: 3 hours

Course Code: MTH 103  
Full Marks: 150

There are **Eight** Questions. Answer any **Six**. All questions are equal value. Part marks are shown in the Margin.

- 1 (a) The acceleration of a particle at any time  $t \geq 0$  is given by 10  
$$\vec{a} = \frac{d\vec{v}}{dt} = 12 \cos 3t \hat{i} - 9 \sin 3t \hat{j} + 18t \hat{k}$$
 if the velocity  $\vec{v}$  and displacement  $\vec{r}$  are zero at  $t = 0$ , find  $\vec{v}$  and  $\vec{r}$ .
- (b) If  $\vec{A} = (2y+3)\hat{i} + xz\hat{j} + (yz-x)\hat{k}$ , evaluate  $\int_C \vec{A} \cdot d\vec{r}$  along the following paths C: 15
- $x = 2t^2, y = t, z = t^3$  from  $t = 0$  to  $t = 1$ .
  - The straight lines from  $(0,0,0)$  to  $(0,0,1)$ , then to  $(0,1,1)$ , then to  $(2,1,1)$ .
- 2 (a) If  $\vec{F} = 4xz\hat{i} - y^2\hat{j} + yz\hat{k}$ , evaluate  $\iint_S \vec{F} \cdot \hat{n} ds$  where S is the surface of the cube 10  
bounded by  $x = 0, x = 1; y = 0, y = 1; z = 0, z = 1$ .
- (b) Evaluate  $\iint_S \vec{F} \cdot \hat{n} ds$ , where  $\vec{F} = 18z\hat{i} - 12\hat{j} + 3y\hat{k}$  and S is that part of the plane 15  
 $2x + 3y + 6z = 12$  which is located zx plane.
- 3 (a) Find the ratio in which the  $zx$  plane divides the line joining  $(2, -2, -3)$  and 10  
 $(1, 3, 2)$ . Also find the coordinates of that point.
- (b) Check that joining points from  $A(5, 2, -3)$  to  $Q(6, 1, 4)$  to line joining the points 10  
from  $C(-3, 2, -1)$  to  $L(-1, -4, 13)$  is parallel or not.
- (c) The sum of the squares of direction cosines of every line is one. 05
- 4 (a) Find the equation of plane which is passing through  $(2, -4, 3)$  and parallel to 05  
 $2x + 3y + 2z + 6 = 0$ .
- (b) Find the equation of plane which is passing through  $(-3, 2, 3)$ , 10  
 $(-1, 3, 1), (1, 2, -2)$ . Also find the perpendicular distance from the point  
 $(2, -1, 2)$  to this plane.
- (c) Find the equation of plane which is passing through  $(-1, 3, 2)$  and perpendicular to 10  
two planes  $x + 2y + 2z - 5 = 0, 3x + 3y + 2z - 8 = 0$ .

- 5 (a) Find the constant  $k$  so that the planes  $x-2y+kz=0$  and  $2x+5y-z=0$  are at right angles. 05
- (b) Find the equation of plane which is parallel to the plane  $2x+3y+6z-3=0$  and a distance 4 unit from the point  $(2, 1, -1)$ . 10
- (c) Find the equation of plane which is passing through the intersection of planes  $x+2y+3z-4=0$ ,  $2x+y-z+5=0$  and is perpendicular to  $5x+3y+6z+8=0$ . 10
- 6 (a) Find the two tangent planes to the sphere  $x^2+y^2+z^2-4x+2y-4=0$  which are parallel to the plane  $x-2y+z-2=0$ . 10
- (b) Do the plane  $x-2y+2z+6=0$  touch the sphere  $x^2+y^2+z^2+2x+2z-3=0$ ? 10
- (c) Find whether the two points  $(2, 1, 1)$  and  $(-3, 3, -2)$  lie on the same side or opposite side of the plane  $x+2y-3z+2=0$ . 05
- 7 (a) State and proof Frenet Seret Formula. 15
- (b) Find the equation of plane which is passing through  $(1, 2, 3)$  and the intersection of two planes  $x+2y+3z+4=0$ ,  $4x+3y+2z+1=0$ . 10
- 8 (a) Find the equation of sphere whose center is  $(-2, 2, 3)$  and radius is 5. 05
- (b) Find the radius and center of the sphere  $x^2+y^2+z^2+2x-4y-6z+5=0$ . 05
- (c) Find the angle between two planes  $2x-y+z-6=0$  and  $x+y+2z-7=0$ . 05
- (d) Find the distance between  $(1, 2, 1)$  and origin. 05
- (e) Write the condition for which two planes will be perpendicular or parallel. 05

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

Course Title: Engineering Mechanics II  
 Time: 3 hours

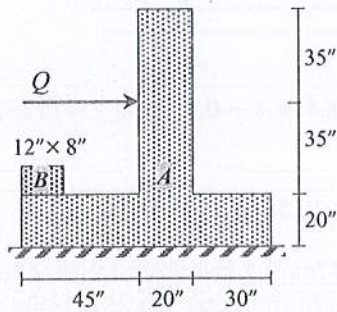
Credit Hours: 3.0

Course Code: CE 103  
 Full Marks: 100

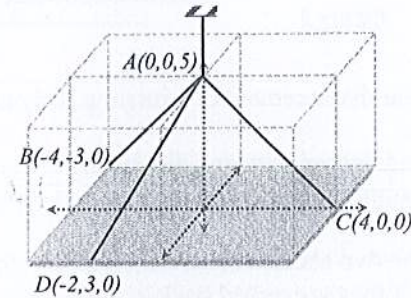
**ANSWER ALL THE QUESTIONS**

- 1 In **Figure 1**, homogeneous object A with uniform 1' width is resting on a rough surface and block B is placed on it. Unit weight of A is 145 lb/ft<sup>3</sup> and a constant Q force is applied as shown in shown in figure.
- Check whether A overturns when  $Q = 3000$  lb, if weight of B = 0.
  - Calculate Q required to overturn A if weight of B = 500 lb.

5  
5



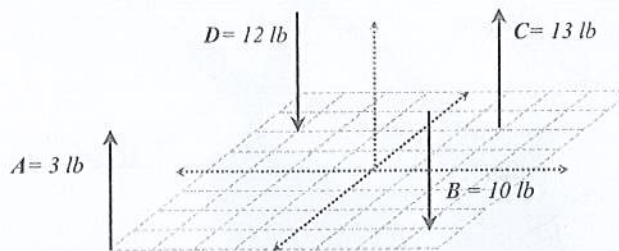
**Figure 1**



**Figure 2**

- Calculate the tension in cord AB, AC and AD used to support the 1200 lb plate shown in **Figure 2**.
  - Calculate and locate the resultant of the non-coplanar parallel force system shown in **Figure 3**.
- Each small square on the grid represents (1' × 1') area.

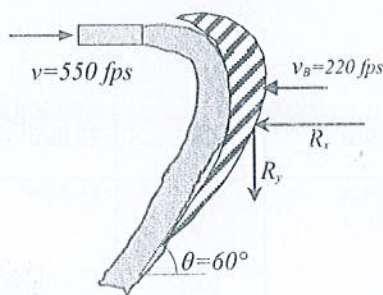
10  
10



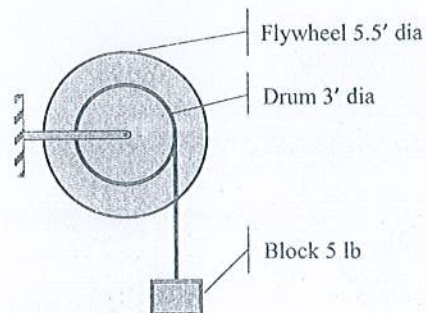
**Figure 3**

- 4 A jet of steam issued from a nozzle with a velocity of 550 fps and the absolute rate of 1.4 lb per sec. It enters a moving blade with a velocity of  $v_b = 220$  fps. The blade is shaped as shown in **Figure 4** and has a negligible frictional loss. Calculate resultant force exerted on the blade.

10



**Figure 4**



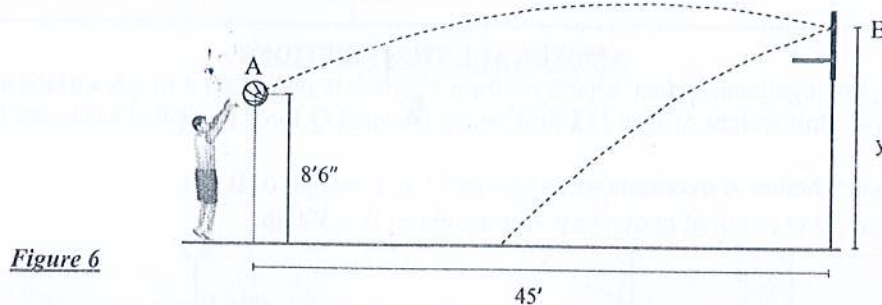
**Figure 5**

- 5 A cord is wrapped around a 3 ft drum which turns with a 5.5' flywheel. If a 5 lb block is suspended from the cord and released from rest, after 3 seconds flywheel's angular velocity is 2.5 rad/sec. Calculate the rotating part's moment of inertia with respect to its rotating axis.

10

6. A basketball player throws a 1.5 lb ball (as shown in **Figure 6**) at 55 ft/sec at an angle of  $20^\circ$  from point A. The ball follows the dashed path shown to hit the stand at point B and bounces back.
- Calculate the velocity of ball just before it hits the stand.
  - If coefficient of restitution between stand and ball is 0.8, calculate the velocity of the ball and the stand immediately after the impact.
  - Calculate velocity of the ball just before it hits the ground.

6  
10  
4

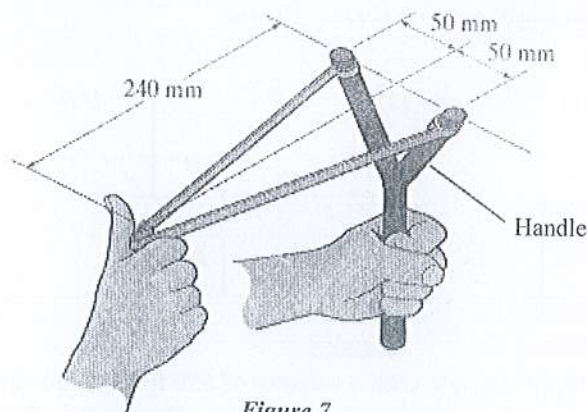


7. The angular displacement of a rotating body can be expressed as  $\theta = t - 0.1t^3$  rad,  $t$  is in seconds. Calculate:
- angular velocity and displacement at  $t = 10$  sec.
  - angular impulse and total work done after  $t = 5$  seconds,  $I = 50 \text{ in}^4$ .

6  
4

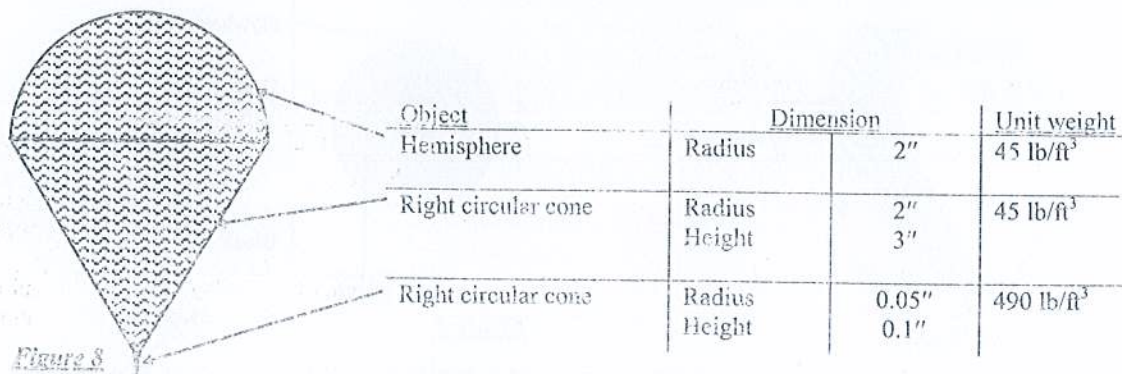
8. Each of the two elastic rubber bands of the slingshot shown in **Figure 7** has an unstretched length of 180 mm. If they are pulled back to the position shown and released from rest, the 25-g pellet follows projectile motion. Calculate velocity of the pellet at the moment it passes the handle. Neglect the mass of the rubber bands and the change in elevation of the pellet while it is constrained by the rubber bands. Each rubber band has a stiffness  $k = 50 \text{ N/m}$ .

10



9. Calculate moment of inertia of the top shown in **Figure 8** with respect to its axis of rotation.

10





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

Course Title: Surveying  
 Time: 3 (Three) hours

Course Code: CE 105  
 Full Marks: 200

[Assume Reasonable Values for Any Missing Data]

1. Fill up 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

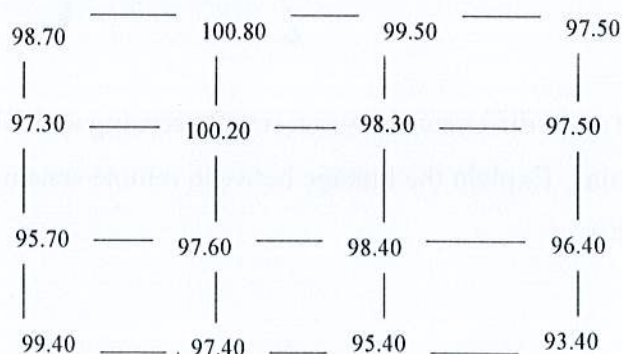
2. The following perpendicular offsets were taken from a chain line to a boundary: (20)

Chainage(m) 0    10    25    42    60    75  
 Offset (ft) 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 a suitable method.

3. 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, what method or methods would you undertake and why? Justify your answer. (20)

4. Draw contour lines of 100m, 97m, 99m and 96m. (20)



5. Two tangents intersect at chainage 47+60, the deflection angle being  $40^{\circ}30'$ . Calculate the necessary data for setting out a curve of 25 chains radius to connect the two tangents if it is intended to set out the curve by offset from chords. Take peg interval equal to 120 links, length of the chain being equal to 30 metres (100 links). (20)

6. The following fore and back bearing were observed in traversing with a compass in place where local attraction was suspected.

(20)

Line	F.B.	B.B.	Line	F.B.	B.B.
AB	38°30'	219°15'	CD	25°45'	270°15'
BC	100°45'	278°30'	DE	325°15'	145°15'

Find the corrected fore and back bearings and the true bearing of each of the lines given that the magnetic declination was 10°E.

7. A closed traverse was conducted round an obstacle and the following observations were made. Work out the missing quantities.

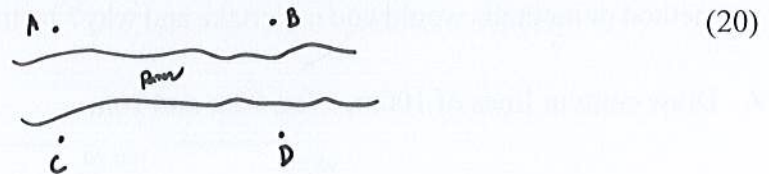
(20)

Side	Length (m)	Azimuth
AB	500	98°30'
BC	620	30°20'
CD	468	298°30'
DE	?	230°00'
EA	?	150°10'

8. The elevations of two points A and B on an aerial photograph are 700 ft and 765 ft respectively. The scales at these points on the photographs are 1:10,000 and 1:9870. If the elevation of point C is 1700 ft, determine the scale at point C. Also determine the flying heights at point A, B and C.

(20)

9. Which plane table survey method will you consider to measure the distance of AB, BD, and CA. The distance of CD on ground is 10 m. From C and D, A and B can be seen but not possible to measure the distance with chain on ground as there is a river in between. Explain with neat sketches



10. What is the main difference between remote sensing and GIS? Explain the process of remote sensing. Explain the linkage between remote sensing and GIS.

(5+15+5=20)