

University of Asia Pacific
Department of Civil Engineering
Mid Semester Examination Fall 2022
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
[Assume any reasonable values if needed]

1. A car is slipping downward from a snow-covered inclined road. Some people are pushing the car upward as shown in *Figure 1*. If 5 people are needed just to prevent downward motion of the car, how many people are needed to push the car up the inclined road?
Given: Co-efficient of friction between snow-covered road and car wheel = 0.04; Average forward pushing force by a person = 75 pounds. [10]

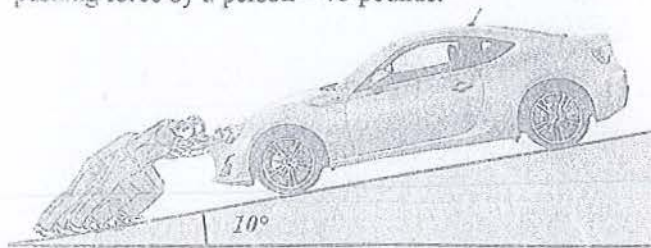
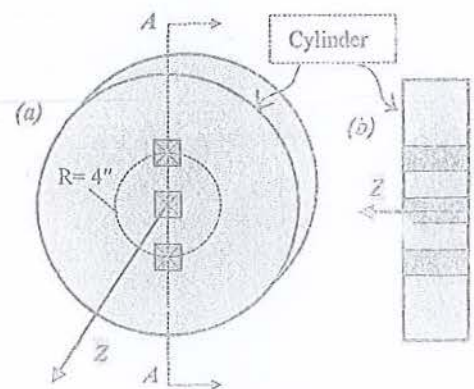


Fig. 1

2. a) The composite object shown in *Fig. 2* is made up of a cylinder and three embedded rectangular prisms (as defined in the table). Calculate the Moment of inertia of the object with respect to the Z axis shown in the figure. [6]

Object	Cross-section	Height	Unit weight
Cylinder	Radius: 1'	6"	40 lb/ft ³
Rectangular prism	2" x 2"	6"	490 lb/ft ³



*Fig. 2: (a) Isometric view
(b) AA section*

- b) The composite object shown in *Fig. 3* consists of a cylinder, thin rectangular plate and a frustum (as defined in the table). Calculate radius of gyration of the composite object with respect to the Y-axis (i.e. geometric axis of the cylinder, as shown in the figure).

Object	Cross-section	Height	Unit weight
Cylinder	Radius: 1'	6"	88 lb/ft ³
Thin Rectangular plate	3' x 2'	0.5"	490 lb/ft ³
Frustum	Top radius: 9" Bottom radius: 1'	6"	88 lb/ft ³

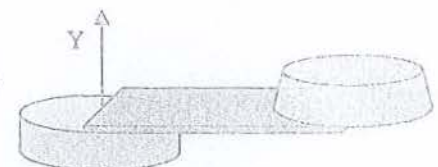


Fig. 3

3. a. How many revolutions will a drum turn in 40 seconds when initial angular velocity is 5 rad/sec and average acceleration is 2 rad/sec²?
After this phase (40 seconds), what angular acceleration will bring the drum to rest in 3 minutes? [3]
- b. The position of a particle is given by $s = (2t^2 - 8t + 6)$ in meters where t is in seconds.
Calculate the (i) total distance (s) travelled by the particle when time $t = 3$ s,
(ii) time when velocity of the particle is 0 (zero). [5]

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

Course Title: English Language II
Time: 1 hour

Credit Hour: 3.00

Course Code: HSS 103
Full Marks: 20

Instructions:

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

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

5×1 = 5

- a) Did she do her duty?
- b) The tiger was chasing the deer.
- c) Have you finished the report?
- d) Your order has been shipped by us.
- e) You shouldn't have done it.

2. Complete the following using proper conditionals:

5×1 = 5

- a) Had I saved more time, ...
- b) If I had the wings of a bird, ...
- c) I would be able to finish the novel early, ...
- d) I could have missed the bus, ...
- e) What would've happened, ...

3. Suppose your department has recently observed a day-long program celebrating the International Mother Language Day. Now, write a 350 word report describing the event in detail.

10×1=10

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

Course Title: Surveying
 Time: 1 hour

Credit Hour: 4

Course Code: CE 105
 Full Marks: 100

1. Consider a field filled with depressions here and there. It also has a 3-story building and a pond with 40'x30' dimension. Explain what method of surveying will you apply and also discuss your methods of overcoming these obstacles. 25

2. The following bearings were observed in running a closed traverse: 25

Line	F.B.	B.B.
AB	124°30'	304°30'
BC	68°15'	246°0'
CD	310°30'	145°15'
DA	200°50'	18°5'

Figure out which stations have local attraction. Determine the correct magnetic bearings. If declination was 6°10' W, what are the true bearings?

3. a) What is the closing error of traversing and how can you balance it? Explain graphically. 10
- b) The table below gives the lengths and bearings of the lines of a traverse ABCDE, the length and bearing of EA having been omitted. Calculate the length and bearing of the line EA. 15

Line	Length	W.C.B
AB	195	80°30'
BC	230	25°20'
CD	180	260°0'
DE	200	230°3'
EA	-	-

4. a) The following consecutive readings were taken with a level and 6 m leveling staff on a continuously sloping ground at a common interval of 30 meters: 1.395; 2.130; 2.935; 3.845; 4.725; 5.745; 1.623; 3.107; 4.225; 5.695. The reduced level of the first point was 310.23 m. Calculate the reduced level of the point by **rise and fall method** and also the gradient of the point by joining the first and the last point. 20
- b) Draw a contour line of 59 m, 60 m, 61 m, and 62 m. Also, comment on the shape of the contour line. Use Figure 1. 5

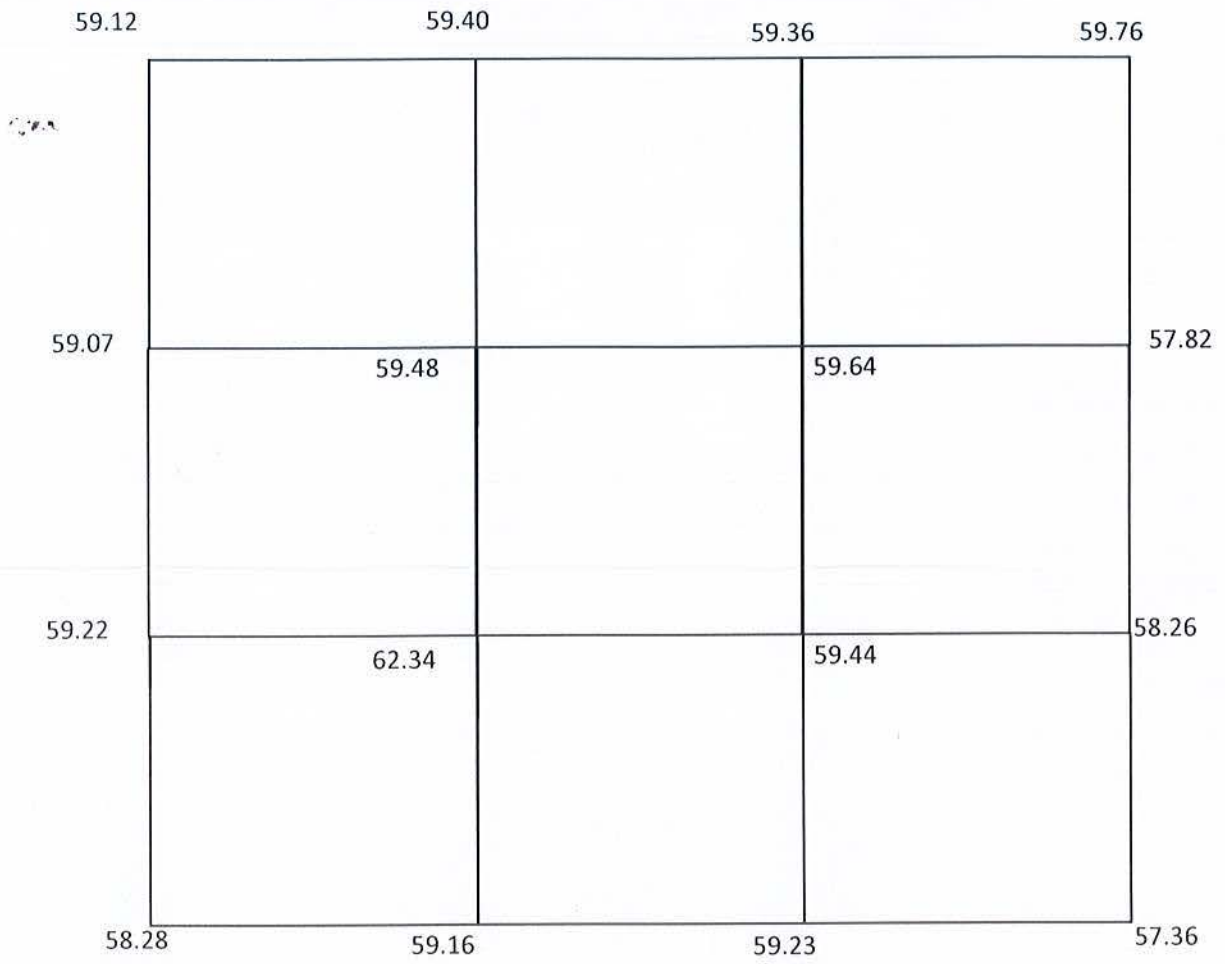


Figure 1

University of Asia Pacific
Department of Basic Sciences and Humanities
Mid-Semester Examination Fall-2022
Program: B.Sc. in CE

Course Title: Chemistry

Course No.: Chem111

Credit: 3.00

Time: 1 Hour

Full Mark: 60

There are **Four** Questions. Answer any three.

1. a. Draw the spectral lines of Balmer series for H atom. Calculate the wavelength (in nm) of the spectral line of Balmer series with minimum energy (given, $R_H = 10973731.6 \text{ m}^{-1}$). 12
b. Write the name of the quantum numbers to describe an electron in an atom according to quantum mechanical model. Draw the shapes of the possible orbitals when $l = 2$. 08

2. a. State Aufbau principle. Cu does not obey Aufbau principle. – Explain. 12
b. Explain the effective nuclear charge with the help of shielding effect. 08

3. a. Define hybridization. Explain the hybridization of carbon atom in ethylene molecule and show the formation of sigma and pi bonds. 12
b. Define resonance. Draw all the possible resonance structure for nitrate ion. 08

4. a. State valence shell electron pair repulsion theory. Draw the structure SF_4 and IF_5 , and also mention their geometry. 12
b. Show the types of bonds exist in NH_4Cl molecule. 08

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

Course Title: Mathematics II
Time: 1 hour

Credit Hour: 3.00

Course Code: MTH 103
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. Define the followings: 10
Like Vector, Parallel Vector, Negative Vector, Equal Vector, Unit Vector.
- b. Find the volume of a parallelepiped if $\vec{a} = -3\hat{i} + 7\hat{j} + 5\hat{k}$, $\vec{b} = -3\hat{i} + 7\hat{j} - 3\hat{k}$ and $\vec{c} = 7\hat{i} - 5\hat{j} - 3\hat{k}$. 10
2. a. If $\vec{a}' = \frac{\vec{b} \times \vec{c}}{[\vec{a} \vec{b} \vec{c}]}$, $\vec{b}' = \frac{\vec{c} \times \vec{a}}{[\vec{a} \vec{b} \vec{c}]}$ and $\vec{c}' = \frac{\vec{a} \times \vec{b}}{[\vec{a} \vec{b} \vec{c}]}$ then prove that $\vec{a} = \frac{\vec{b}' \times \vec{c}'}{[\vec{a}' \vec{b}' \vec{c}]}$, 10
 $\vec{b} = \frac{\vec{c}' \times \vec{a}'}{[\vec{a}' \vec{b}' \vec{c}]}$ and $\vec{c} = \frac{\vec{a}' \times \vec{b}'}{[\vec{a}' \vec{b}' \vec{c}]}$.
- b. A particle moves along a curve $x = 2t^2$, $y = t^2 - 4t$, $z = 3t - 5$ where t is time. 10
Find the components of its velocity and acceleration at time $t=1$ in the direction $\hat{i} - 3\hat{j} + 2\hat{k}$.
3. a. Show that $\vec{v} = (z^2 + 2x + 3y)\hat{i} + (3x + 2y + z)\hat{j} + (y + 2zx)\hat{k}$ is irrotational but not solenoidal. Also find scalar function ϕ such that $\vec{v} = \nabla\phi$. 12
- b. Find the directional derivative of $f = x^2 + xy + z^2$ at $(1, -1, -1)$ in the direction $2\hat{i} + 3\hat{j} - 2\hat{k}$. 8
- OR**
4. a. Find the angle between two surfaces $x^2 + y^2 + z^2 = 4$ and $x^2 + y^2 = z + 2$ at $(2, -1, 2)$. 8
- b. If $x = 3\cos t$, $y = 3\sin t$, $z = 4t$ then find Unit tangent \vec{T} , Curvature κ and radius of curvature ρ . 12