1-1

University of Asia Pacific
Department of Civil Engineering
Final Examination, Spring 2025
Program: B.Sc. in Civil Engineering
1st Year 1st Semester

Course Title: Physics I | Course Code: PHY 101
Time: 3.00 Hours | Credit Hour: 3.00 | Full Marks: 150

There are eight questions. Answer **any six,** including **QUESTION 1, QUESTION 2, QUESTION 3,** and **QUESTION 4.**

QUESTION 1 [25 MARKS]

a. Define Cantilever and Beam. [5]

b. Show that depression of a cantilever at the free end $y = Wl^3/3YI_g$, where the terms have their usual meanings. [15]

c. A uniform rod of length 2.5 m is clamped horizontally at one end. A weight of 3.5 kg is attached at the free end. Calculate the depression at the mid-point of the rod. The diameter of the rod is 100 mm. ($Y = 10^{10}\ N/m^2$) [5]

QUESTION 2 [25 MARKS]

a. Define equation of continuity of fluid. [5]

b. Show that for a liquid in stream line motion $\frac{P}{\rho} + gh + \frac{v^2}{2} = constant$, where the symbols have their usual meanings. [15]

c. Ten equal drops of water (surface tension T), each of radius r, are falling through air (viscosity η) with a steady velocity v. If the ten drops coalesce to form a bigger drop, (i) compute the energy released and, (ii) find the new velocity of fall. [5]

QUESTION 3 [25 MARKS]

a. Explain Doppler effect of sound. [5]

b. Find out the apparent pitch of sound, when the source moves towards and away from the stationary observer. [15]

c. The apparent frequency of the whistle of an engine changes in the ratio 6:5 as the engine passes a stationary observer. If the velocity of sound is 352 m/sec, calculate the velocity of the engine. [5]

QUESTION 4 [25 MARKS]

a. Briefly describe sound distribution system in an auditorium. [5]

b. Mention eight requisites for good acoustics in an auditorium. [15]

c. An ultrasonic beam is used to determine the thickness of a steel plate. It was noticed that the difference in two adjacent harmonic frequencies is 50 kilo hertz. The velocity of sound in steel is 5000 m/sec. Calculate thickness of the steel plate. [5]

QUESTION 5 [25 MARKS]

a. Define Fresnel and Fraunhofer diffraction of light. [5]

b. Show that for Newton's dark ring $r^2 = n\lambda R$, where the terms have their usual meanings. [15]

c. A plano-convex lens of radius 300 cm is placed on an optically flat glass plate and is illuminated by monochromatic light. The diameter of the 8th dark ring in the transmitted system is 0.72 cm. Calculate the wavelength of light used. [5]

OR

QUESTION 6 [25 MARKS]

a. Define interference and polarization of light. [5]

b. State and explain Malus law for a polarized light. [15]

c. Calculate the thickness of a half wave plate of quartz for a wave length of 5000 Å. Here $\mu_E = 1.553$ and $\mu_0 = 1.544$. [5]

QUESTION 7 [25 MARKS]

a. State first law and second law of thermodynamics. [5]

b. Distinguish between Carnot's engine and refrigerator and also prove that efficiency of refrigerator is more than hundred percent. [15]

c. A Carnot's engine is operated between two reservoirs at temperatures of 450 K and 350 K. If the engine receives 1000 calories of heat from the source in each cycle, calculate the amount of heat rejected to the sink in each cycle. Calculate the efficiency of the engine and the work done by the engine in each cycle. (1 calorie = 4.2 joules) [5]

OR

QUESTION 8 [25 MARKS]

a. Mention four postulates of kinetic theory of gas. [5]

b. Briefly deduce Newton's law of cooling. [15]

c. A body cools in 8 minutes from 90^0 C to 60^0 C. What will be its temperature after next 8 minutes? Temperature of the surroundings is equal to 30^0 C. Assume that Newton's law of cooling holds well throughout the process. [5]

University of Asia Pacific
Department of Civil Engineering
Final Examination, Spring 2025
Program: B.Sc. in Civil Engineering
1st Year 1st Semester

Course Title: Mathematics I | Course Code: MTH 101

Time: 3 hours | Credit Hours: 3.00 | Full Marks: 150

Answer all the questions.

QUESTION 1 [25 MARKS]

a. State Euler's theorem. If $u = sec^{-1}\left(\frac{x^3+y^3}{x+y}\right)$, then prove that, [03+12]

$$x\frac{\partial u}{\partial x} + y\frac{\partial u}{\partial y} = 2cotu.$$

b. If $u = \frac{xy}{x-y}$ then prove that, $x^2\frac{\partial^2 u}{\partial x^2} + 2xy\frac{\partial^2 u}{\partial x \partial y} + y^2\frac{\partial^2 u}{\partial y^2} = 0$ when $\frac{\partial^2 u}{\partial x \partial y} = \frac{\partial^2 u}{\partial y \partial x}$. [10]

QUESTION 2 [25 MARKS]

a. State Mean Value theorem. Verify the theorem for $f(x) = (x-1)(x-2)(x-3)$ in the interval (0,4). [05+10]

b. If $u = sin^{-1}\left(\frac{y}{x}\right) + tan^{-1}\left(\frac{x}{y}\right)$, then prove that, $x\frac{\partial u}{\partial x} + y\frac{\partial u}{\partial y} = 0$. [10]

QUESTION 3 [25 MARKS]

Solve the followings [25]

(i) $\int \frac{dx}{1-cosx}$ (ii) $\int \frac{tanx\, sec^2x}{(a^2+b^2tan^2x)^2} dx$ (iii) $\int xlnx\, dx$

(iv) $\int (lnx)^2 dx$ (v) $\int Sec^n x\, dx$

QUESTION 4 [25 MARKS]

a. Solve the following definite integrals- [10]

(i) $\int_0^1 \frac{dx}{e^{-x}+e^x}$ (ii) $\int_1^{e^2} \frac{dx}{x(1+lnx)}$

b. Solve the following improper integrals- [15]

(i) $\int_1^3 \frac{dx}{(x^2-1)^{\frac{2}{3}}}$ (ii) $\int_{-\infty}^{\infty} \frac{dx}{e^{-x}+e^{x}}$ (iii) $\int_0^{\infty} \frac{xdx}{x^4+1}$

QUESTION 5 [25 MARKS]

a. Prove that $\int_0^1 sin^p\theta cos^q\theta \, d\theta = \frac{\Gamma\left(\frac{p+1}{2}\right)\Gamma\left(\frac{q+1}{2}\right)}{2\Gamma\left(\frac{p+q+2}{2}\right)}$. [15]

b. Define Beta and Gama function. Solve the integral $\int_0^1 \frac{1}{\sqrt{1-x^3}} dx$. [10]

OR

a. State and proof the relationship between Beta and Gamma function. [15]

b. Solve the integral $\int_0^{\infty} e^{-x^2} x^5 \, dx$. [10]

QUESTION 6 [25 MARKS]

a. Use cylindrical shells to find the volume of the solid generated when the region enclosed between $y = \sqrt{x}$, $x = 1$ and $x = 4$, the x axis is revolved about the y axis. [12]

b. Find the area of the region bounded above by $y = 2x + 6$, bounded below by $y = x^2$ and bounded on the sides by the lines $x = 1$ and $x = 3$. [13]

OR

a. Use cylindrical shells to find the volume of the solid generated when the region enclosed between $y = 3\sqrt{x}, x = 0$ and $x = 3$, the x axis is revolved about the y axis. [12]

b. Find the area of the region which is enclosed between the curves $y = x^2$ and $y = x + 6$. [13]

University of Asia Pacific
Department of Civil Engineering
Semester Final Examination, Spring 2025
Program: B.Sc. in Civil Engineering
1st Year 1st Semester

Course Title: Basic Electrical and Electronic Engineering | Course Code: ECE 101
Time: 3 hours | Credit Hour: 3.00 | Full Marks: 150

Answer all the questions

QUESTION 1 [25 MARKS] [CO1]

Solve the difference between powers, while a) the circuit is the same as in **Figure 1**, and b) while your friend accidentally shorts the 10-ohm resistor without the source in the same figure.

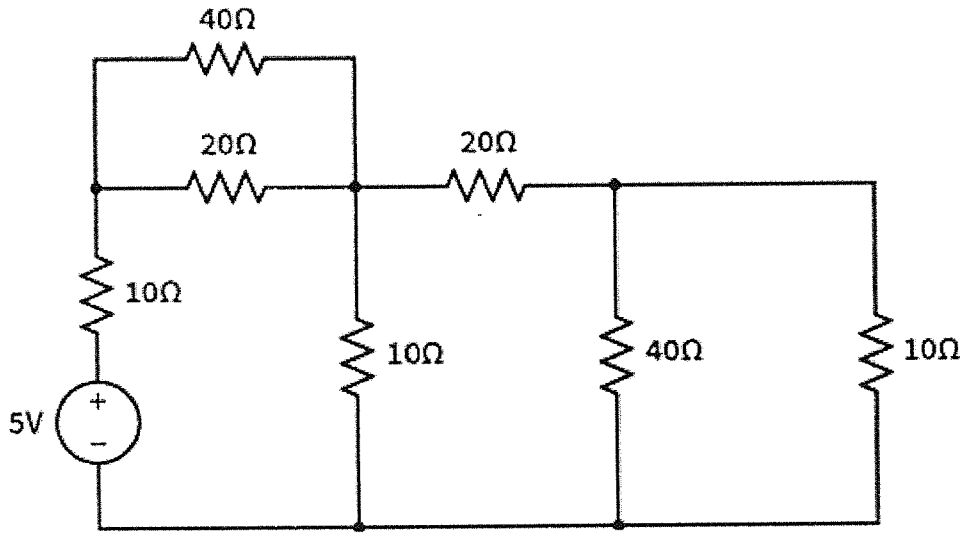


Figure 1

QUESTION 2 [25 MARKS] [CO1]

Construct Thevenin's Equivalent circuit of the circuit given in **Figure 2** with respect to the A and B nodes.

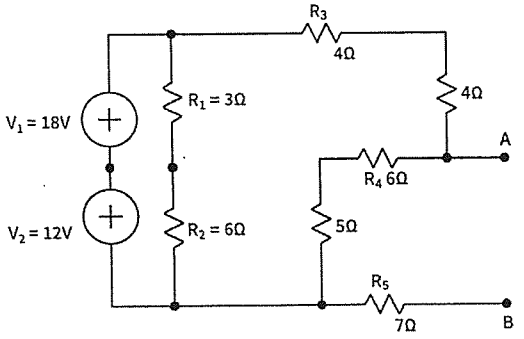


Figure 2

QUESTION 3 [25 MARKS] [CO3]

For the given electromagnet in the picture of **Figure 3**,

a. **Find** the Flux density. [15]
b. Redraw the electromagnet and **show** a few flux lines with directions. [5]
c. **Show** names of the poles on the picture. [5]

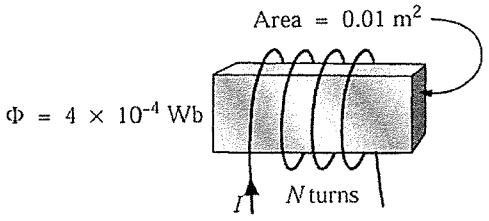


Figure 3

QUESTION 4 [75 MARKS] ***(answer any one from 'a' or 'b')*** [CO2]

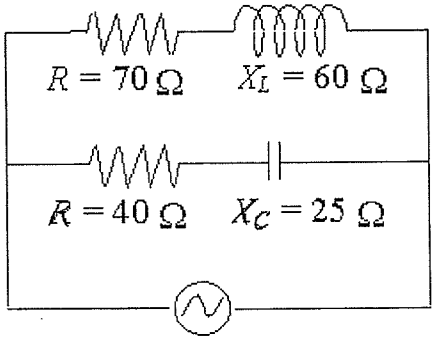


Figure 4

a) In **Figure 4**, the source voltage is $50\sqrt{2}Sin(\omega t)$. **Solve-**

i. Power and power factor of the R-C branch. [25]
ii. Power and power factor w.r.t the source. [25]
iii. Wave forms of source Voltage and the corresponding Current graphically. [25]

OR

b) From **Figure 5**, **solve-**

i. The voltage and phase angle of the source, i.e., expression for $V_s(t)$. Given that Z_R= 9 ohms, Z_c=2 ohms, and I_o=2 A, with phase angle 0°. [25]
ii. Power and Power Factor with respect to the source. [25]
iii. Voltage and current waveforms of the R-C branch graphically. [25]

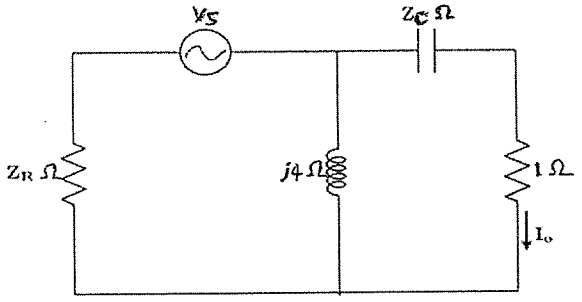


Figure 5

University of Asia Pacific
Department of Civil Engineering
Final Examination, Spring 2025
Program: B.Sc. in Civil Engineering
1st Year 1st Semester

Course Title: History of Bangladesh Independence, Society and Culture Course Code: HSS 105
Time: 3 hours Credit Hours: 03 Full Marks: 150

Answer the following questions.
Use separate answer scripts for Part-A and Part-B.
Figures in the right margin indicate marks.
You MUST answer all parts of a question consecutively.

Part A (Question 1-4)

QUESTION 1 [30 MARKS]

Discuss the Six-point Programme of 1966. [30]

QUESTION 2 [30 MARKS]

Write an article on the Liberation War of Bangladesh. [30]

QUESTION 3 [15 MARKS]

Discuss the second phase of the language movement of 1952. [15]

OR

QUESTION 4 [15 MARKS]

Write a short note on the Operation Searchlight. [15]

[Please turn over]

Part B (Question 5-8)

QUESTION 5 [30 MARKS]

a. Define socialization. [8]

b. Briefly discuss the agencies of socialization. [22]

QUESTION 6 [30 MARKS]

a. Define social stratification. [8]

b. What are the systems of social stratification? Name them. Briefly discuss the systems of social stratification. [22]

QUESTION 7 [15 MARKS]

Define the forms of family. [15]

OR

QUESTION 8 [15 MARKS]

Define the non-material elements of a culture. [15]

University of Asia Pacific
Department of Civil Engineering
Final Examination, Spring 2025
Program: B.Sc. in Civil Engineering
1st Year 1st Semester

Course Title: Engineering Mechanics | Course Code: CE 101(OBE)
Time: 3 hours | Credit Hour: 3.00 | Full Marks: 150

Answer all the questions

PART A

QUESTION 1 [25 MARKS]

a. Using the system of frictionless pulleys a weight W has to be lifted by applying a pulling force of P as shown in **Figure 1**. If P = 200 N, find the value of the weight W.

[5]

b. A bar AB of weight 600 N is hinged to a vertical wall at A and has been supported by a cable as shown in **Figure 2**. The length of the bar is 4 m. Determine the tension in the cable BC and components of pin reactions at A and C.

[12]

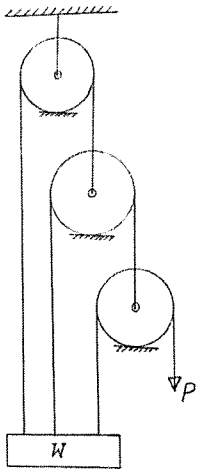


Figure 1

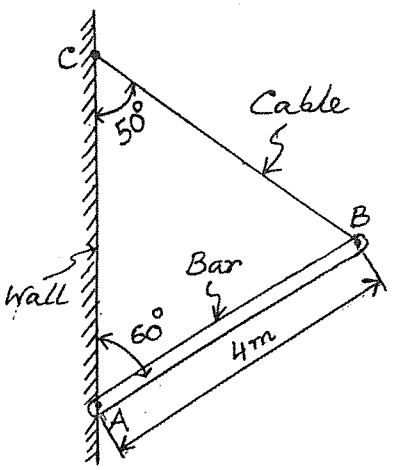


Figure 2

c. The body A weighing 300 N rests over the body B weighing 500 N as shown in **Figure 3**. The coefficient of static friction for all contact surfaces is 0.5. Calculate the value of the force P that will cause the body B to have impending motion toward right.

[8]

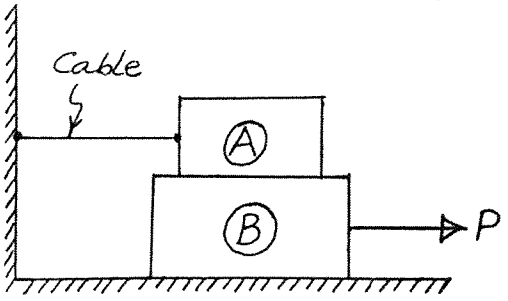


Figure 3

QUESTION 2 [25 MARKS]

a. For the truss shown in **Figure 4**, find the force in the members *cd*, *bf*, *be* and *gh*. [8]

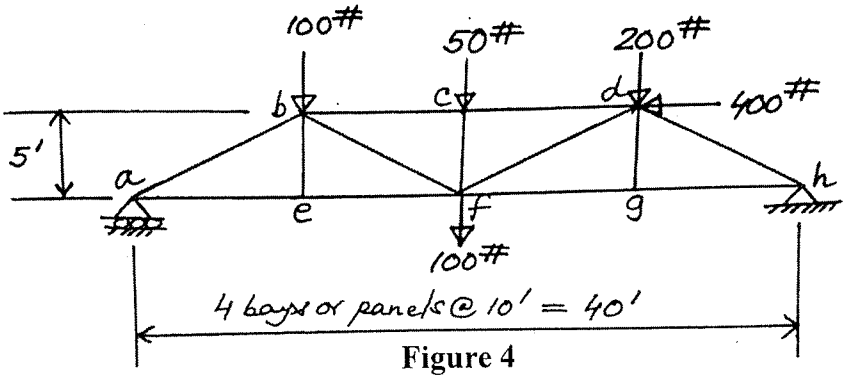


Figure 4

b. A ladder of length 4.5 m and weighing 200 N is placed against a vertical wall as shown in **Figure 5**. The ladder also supports a man weighing 550 N. The coefficient of static friction between the wall and the ladder is 0.35 and that between the floor and the ladder is 0.25. Calculate the minimum horizontal force P to be applied at the bottom of the ladder to prevent slipping of the ladder. [9]

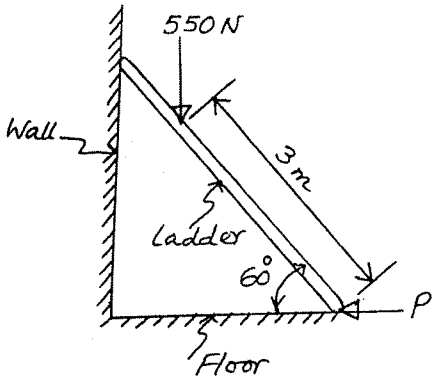


Figure 5

c. Two cables AC and BC terminate on a pole and exert forces in a horizontal plane x′y′ at C as shown in **Figure 6**. The tensions in the cables AC and BC are 5500 lb and 3500 lb, respectively. The guy cable makes an angle of 50° with the pole. Calculate the value of the angle θ, tension in the cable CD and force in the pole CE. [8]

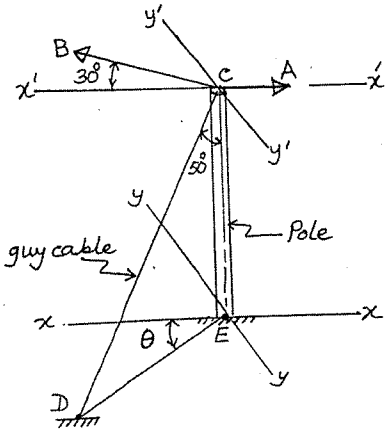


Figure 6

QUESTION 3 [25 MARKS]

a. The frame shown in **Figure 7** consists of two horizontal members AD and BE, a vertical member DE and an inclined member CF. All the members have been assumed to be weightless.

(i) Identify the two force member(s).

(ii) Calculate the components of pin reaction at B.

(iii) Determine the force in the two force member(s).

[10]

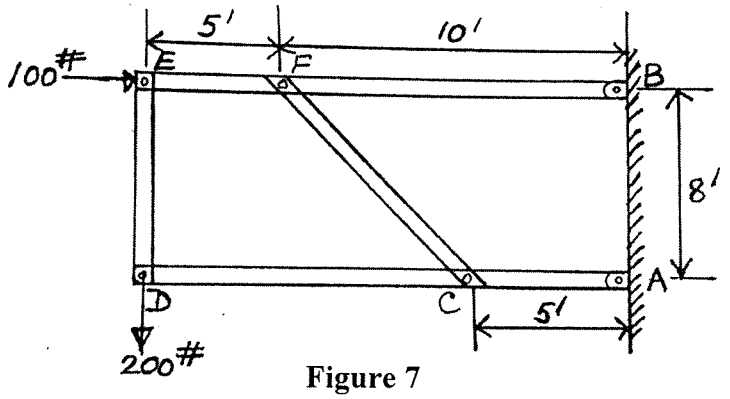


Figure 7

b. A right-angled bend solid pipe is supported in a horizontal plane with the help of three wires AB, CD and EF as shown in **Figure 8**. The pipe weighs 25 lb per foot. Calculate the tension in the wires AB, CD and EF.

[6]

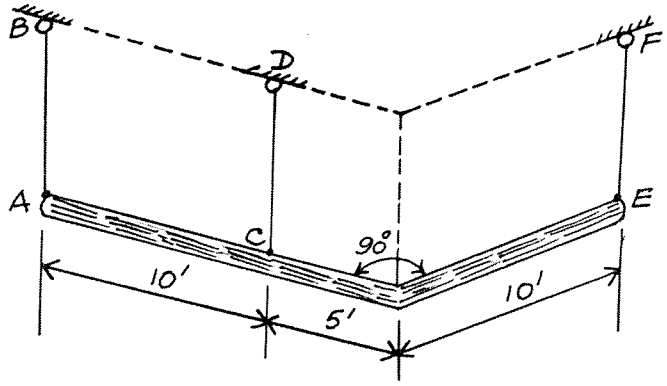


Figure 8

c. The body A in **Figure 9** weighs 100 lb. The coefficient of static friction between the body and the inclined plane is 0.2, and the coefficient of static friction between the rope and the drums is 0.3. Determine the value of W when the motion of the body A impends up the plane.

[9]

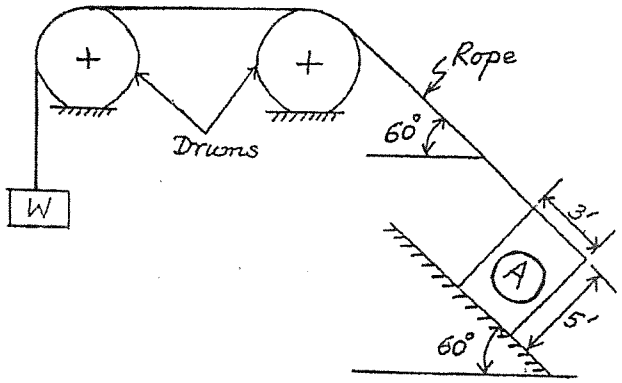


Figure 9

PART B

QUESTION 4 [25 MARKS]

a. A 140 ft diameter Ferris wheel which is rotating at a velocity of 5 rpm is slowing down at the rate of 0.005 radian per sec^2.

(i) Compute the number of revolutions from the time t = 5 sec until the wheel stops.

(ii) Determine the total acceleration of point **A** shown in **Figure 10** after 5 sec.

[12]

b. A 500 lb. heavy hammering bit is supported by a cable which is wound about a 3ft. wheel as shown in **Figure 11**. While hammering bit travels 70 ft. vertically downward the wheel rotates. The speed of the rotating wheel changes from 7 rpm to 90 rpm. The radius of gyration of the wheel is 1.1 ft. Determine the weight of the wheel.

[13]

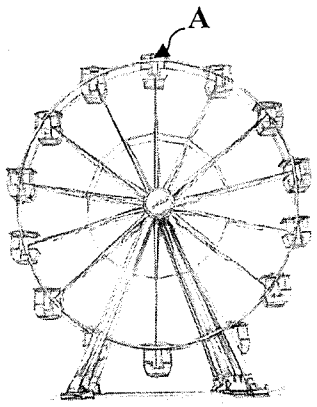


Figure 10: Ferris Wheel

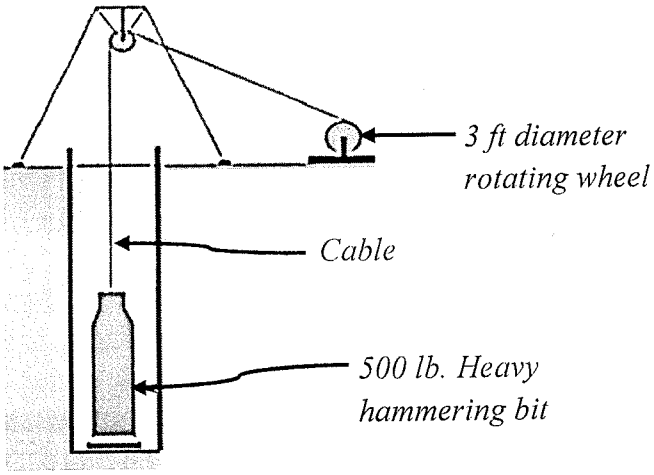


Figure 11: Percussion Drilling

QUESTION 5 [25 MARKS]

a. A henna design is shown in **Figure 12** from Shapa Day event. Compute minimum moment of inertia $\mathbf{I_{min}}$ and maximum moment of inertia $\mathbf{I_{max}}$ as well as angle of principal axis θ of the composite area. (The centroid axes are shown in the figure to use)

[14]

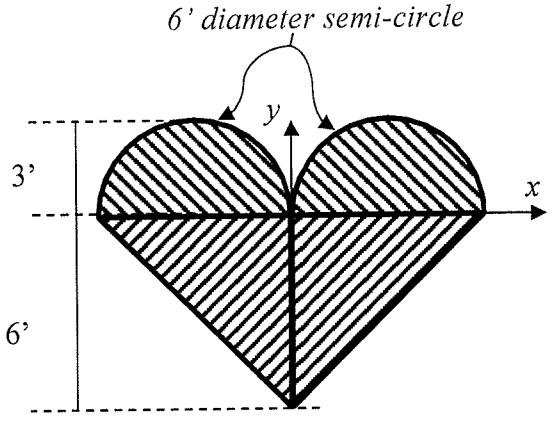


Figure 12: Composite Area

b. Calculate the moment of inertia as well as radius of gyration of the mass in **Figure 13** about shown **z** axis. The dimensions and the unit weights are given below.

[11]

Shape	Dimension	Unit Weight
Frustrum	Top Diameter = 6 ft; Bottom Diameter = 10 ft; Height = 7 ft	250 lb/ft^3
Cone	Diameter = 10 ft; Height = 12 ft	500 lb/ft^3

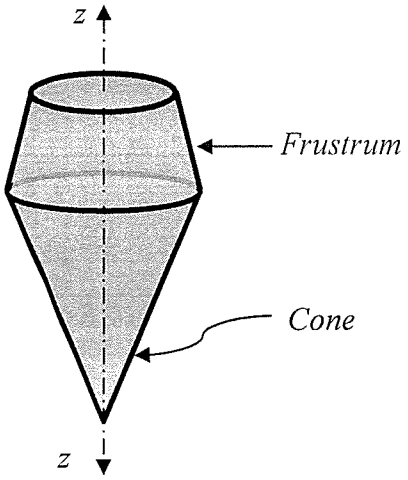


Figure 13: Mass

QUESTION 6 [25 MARKS]

a. A 1500 lb. stone block is being pulled by two workers up the slope of a hill to build a temple as shown in **Figure 14**. Worker 1 pulls with a force of 500 lb. at an angle of 15° above the plane of the slope. Worker 2 pulls with a force of 650 lb. at an angle of 25° above the plane of the slope. The slope angle is 35°, and the kinetic coefficient of friction is f = 0.25. If the stone starts from rest, determine its velocity after 5 s.

[13]

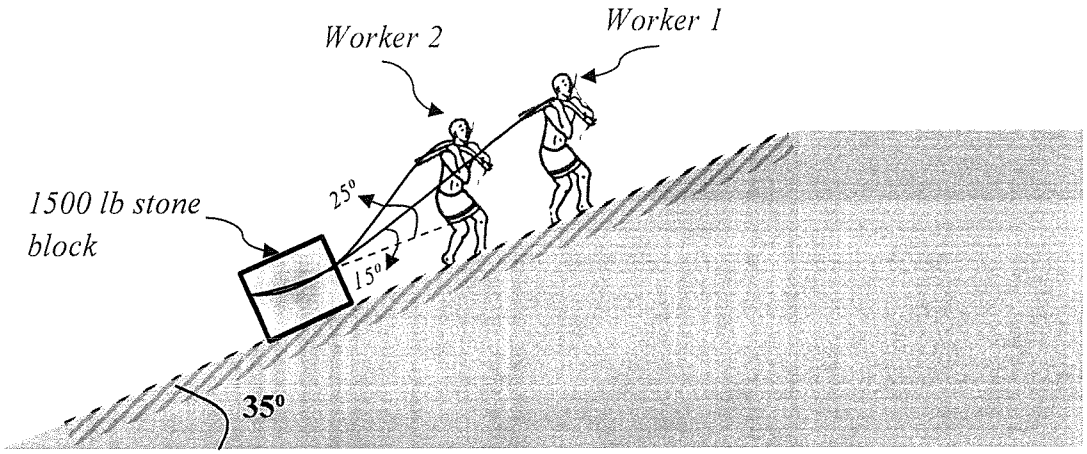


Figure 14

b. A jet of steam, flowing at the rate of W = 3 lb./sec., issues from a nozzle with a velocity of v_1 = 450 fps as shown in the **Figure 15**. It enters a fixed curved component and is turned through an angle of 120° before it is discharged. Assume that the passage of steam across the curved surface is frictionless.

(i) Determine the horizontal and vertical components of the force exerted upon the fixed component.

(ii) Determine the resultant force and angle.

[12]

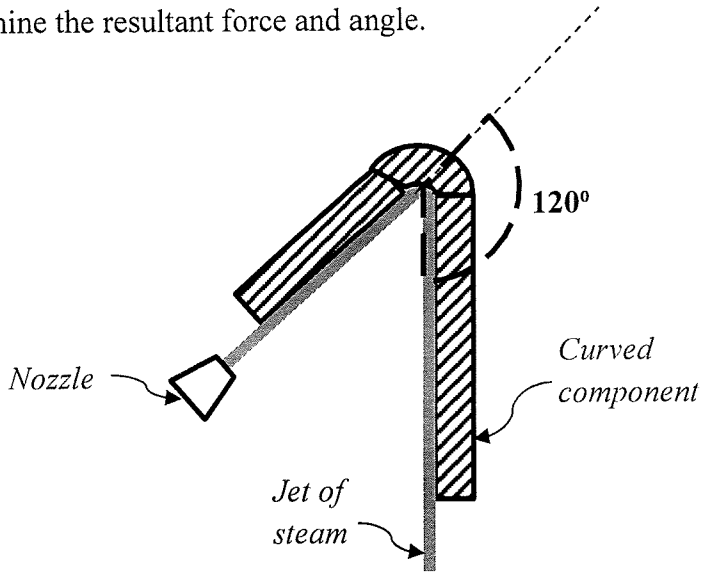


Figure 15

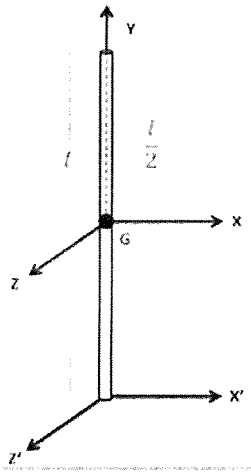
ANNEXURE

$$I_{max} = \frac{1}{2}(I_x + I_y) + \sqrt{\left\{\frac{(I_x - I_y)}{2}\right\}^2 + P_{xy}{}^2}$$

$$I_{min} = \frac{1}{2}(I_x + I_y) - \sqrt{\left\{\frac{(I_x - I_y)}{2}\right\}^2 + P_{xy}{}^2}$$

$$tan2\theta_m = \frac{2P_{xy}}{(I_y - I_x)}$$

Slender Rod

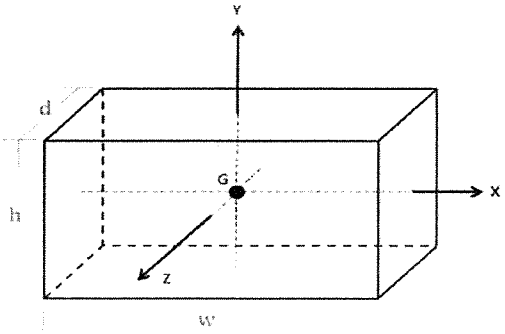


$$I_{xx} = I_{zz} = \frac{1}{12}ml^2$$

$$I_{yy} = 0$$

$$I_{xx'} = I_{zz'} = \frac{1}{3}ml^2$$

Rectangular Prism



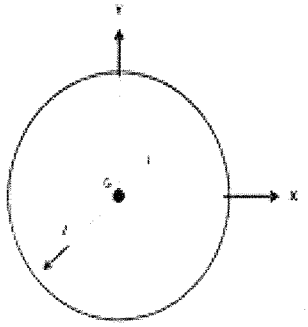
$$I_{xx} = \frac{1}{12}m(h^2 + d^2)$$

$$I_{yy} = \frac{1}{12}m(d^2 + w^2)$$

$$I_{zz} = \frac{1}{12}m(h^2 + w^2)$$

$$Volume = dhw$$

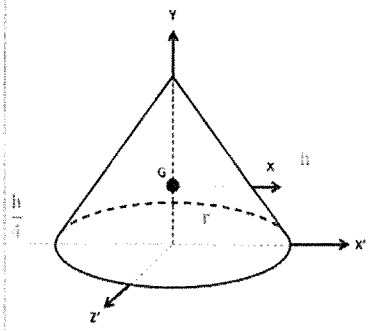
Sphere



$$I_{xx} = I_{yy} = I_{zz} = \frac{2}{5}mr^2$$

$$Volume = \frac{4}{3}\pi r^3$$

Right Circular Cone



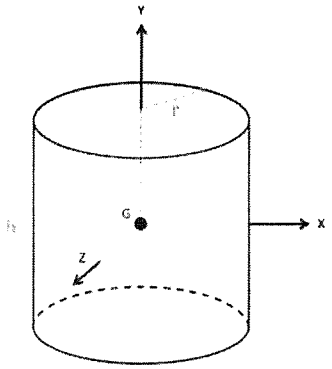
$$I_{xx} = I_{zz} = \frac{3}{80}m(4r^2 + h^2)$$

$$I_{yy} = \frac{3}{10}mr^2$$

$$I_{xx'} = I_{zz'} = \frac{1}{20}m(3r^2 + 2h^2)$$

$$Volume = \frac{1}{3}\pi r^2 h$$

Cylinder

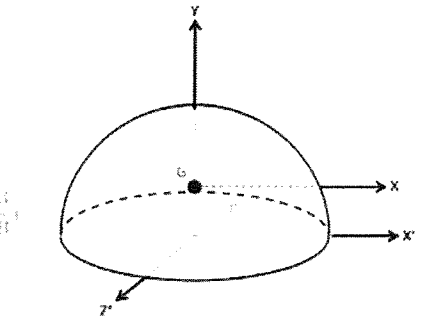


$$I_{xx} = I_{zz} = \frac{1}{12}m(3r^2 + h^2)$$

$$I_{yy} = \frac{1}{2}mr^2$$

$$Volume = \pi r^2 h$$

Hemisphere



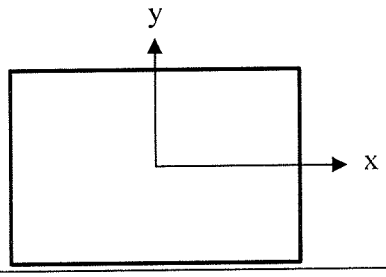
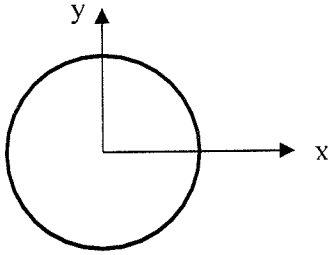
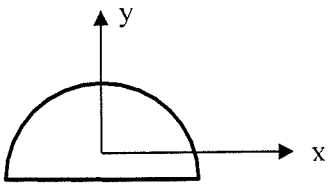
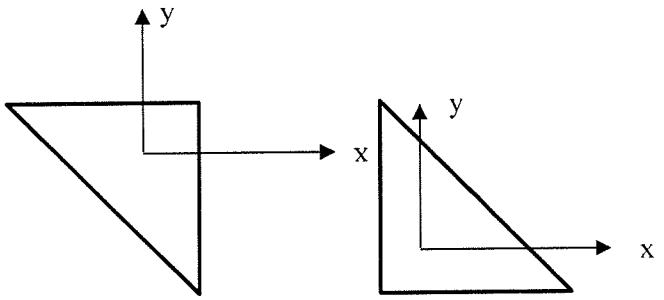
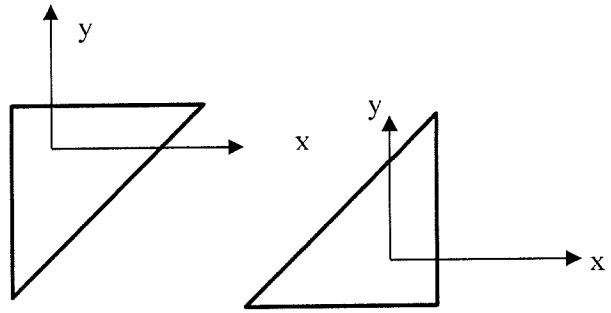
$$I_{xx} = I_{zz} = \frac{83}{320}mr^2$$

$$I_{yy} = \frac{2}{5}mr^2$$

$$I_{xx'} = I_{zz'} = \frac{2}{5}mr^2$$

$$Volume = \frac{2}{3}\pi r^3$$

Table for product of inertia

Shape	Axes	$\overline{P_{xy}}$
Rectangle		0
Circle		0
Semi-circle		0
Triangle		$-\frac{b^2h^2}{72}$
		$\frac{b^2h^2}{72}$

University of Asia Pacific
Department of Civil Engineering
Final Examination, Spring 2025

Program: B.Sc. in Civil Engineering
1st Year 1st Semester

Course Title: Introduction to Civil and Environmental Engineering | Course Code: CE 107
Time: 2 hours | Credit Hour: 2 | Full Marks: 100

Answer all the questions

QUESTION 1 [15 MARKS]

a. Define biodiversity hotspot. What are the criteria for a biodiversity hotspot? [3+3]
b. Discuss the types of biodiversity and identify the direct benefits of biodiversity. [4+5]

QUESTION 2 [15 MARKS]

a. Define flash flood? Discuss the management approach against this flood. [10]
b. Explain what factors make Bangladesh more vulnerable during flood. [5]

QUESTION 3 [15 MARKS]

a. Define ecology and ecosystem. Describe the purposes of studying ecology. [4+6]
b. Explain ecosystem hierarchy in brief. [5]

QUESTION 4 [19 MARKS]

a. Classify survey based on the objects of the survey and discuss each of them. [3+4]
b. Classify different types of roads of Bangladesh. [4]
c. Discuss on different types of loads that can act on a structure. [8]

QUESTION 5 [16 MARKS]

a. Why soil testing and site classifications are needed? [6]
b. Demonstrate the components of soil test and discuss them in brief. [10]

QUESTION 6 [10 MARKS]

A five-storied residential building is to be constructed. Estimate the total construction cost as per the PWD schedule. The particulars of the building are as follows: [20]

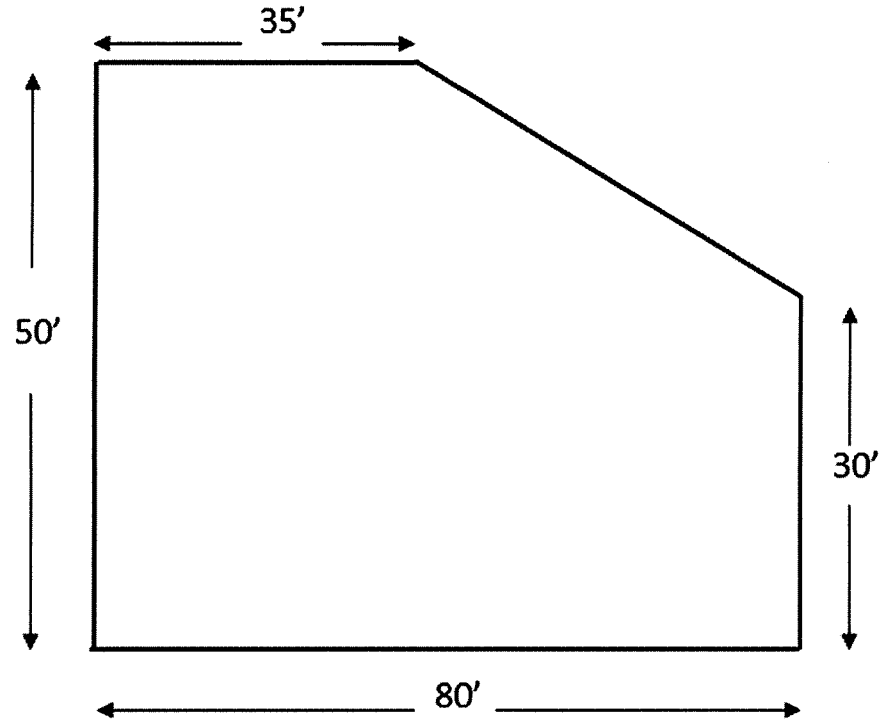


Figure 1

Serial No	Particulars	Specification
1	Land Size	Determine from plot layout as shown in Figure 1
2	Building type	Residential (Standard)
3	Allowable Bearing Capacity (q_a)	3.5 ksf
4	Floor Level	Six
5	Plinth Area	75 % of land size
6	Construction Material	24 MPa, RCC Structure 1: 1.5 : 3 (Brick Chips)
7	Ground Floor	Car Parking
8	Rooftop RCC water tank	1500 Gallon
9	Structure type	RCC Frame Structure
10	Underground water reservoir	4000 Gallon
11	Boundary wall	RCC Frame
12	Contingency Cost	Consider 10 % for this building

Annexure: PWD SCHEDULE

1. Foundation Cost upto PL (per m^2 of Plinth Area)

Storey	q_a= 2 ksf	q_a = 2.50 ksf	q_a = 3.0 ksf	q_a = 3.5 ksf	q_a = 4.0 ksf	q_a = 4.5 ksf	q_a = 5.0 ksf
1	3982	3875	3811	3769	3740	3718	3702
2	4684	4381	4199	4080	3997	3936	3830
3	5591	5036	4702	4482	4329	4217	4133
4	6566	5811	5296	4958	4723	4551	4421
5	8001	6774	6035	5550	5212	4965	4778
6	9495	7851	6862	6213	5759	5429	5178
7	10961	8908	7673	6862	6296	5883	5571
8		10043	8544	7560	6873	6371	5992
9		11252	9471	8302	7487	6891	6441
10		12529	10451	9088	8136	7441	6915

2. Superstructure Cost (per m^2 of Plinth Area)

Building Category													
		Non-Residential (fc=19-21 MPa, Brick Chips)			Residential (fc=19-21 MPa, Brick Chips)			Non-Residential (fc=22-25 MPa, Stone Chips)			Residential (fc=22-25 MPa, Stone Chips)		
Level	Floor	Economy	Standard	Superior	Economy	Standard	Superior	Economy	Standard	Superior	Economy	Standard	Superior
0	GF Park	5449	5812	6538	5634	6010	6761	5922	6317	7107	6124	6532	7349
0A	Habitation	8545	9601	12674	8837	9929	13106	9020	10135	13378	9631	10792	14274
1	1 st Floor	8242	9360	12224	8523	9576	12640	8699	9776	12903	9289	10409	13767
2	2nd Floor	8365	9399	12407	8651	9720	12830	8830	9921	13096	9568	10565	14180
3	3 rd Floor	8491	9540	12593	8780	9866	13023	8962	10070	13293	9855	10723	14606
4	4 th Floor	8618	9683	12782	8912	10014	13218	9097	10221	13492	10151	10884	15044
5	5 th Floor	8748	9829	12974	9046	10154	13416	9233	10374	13694	10455	11046	15495
6	6 th Floor	8835	9927	13104	9136	10265	13550	9326	10478	13831	11030	11158	15960

3. Boundary Wall: Tk.3500/m
4. External Water Supply: Tk.60.00/gallon
5. Gas Connection:
   - GF: Tk.260/sqm
   - Other floors: Tk.100/sqm
6. Internal Electrification:
   (i) Residential Building
   - Economy: Tk.1030 /sqm
   - Standard: Tk.1290 /sqm
   - Superior: Tk.1550 /sqm

   (ii) Non- Residential Building
   - Economy: Tk.775 /sqm
   - Standard: Tk.970 /sqm
   - Superior: Tk.1160 /sqm
7. Internal Sanitary and Water Supply:
   (i) Residential Building
   - Economy: Tk. 475 /sqm
   - Standard: Tk.715 /sqm
   - Superior: Tk. 1070 /sqm

   (ii) Non-Residential Building
   - Economy: Tk.360 /sqm
   - Standard: Tk.540 /sqm
   - Superior: Tk.800 /sqm
8. Floor Finish Work: Tk.1000.00/ sqm
9. Roof top RCC water Tank: Tk.85.00/gallon