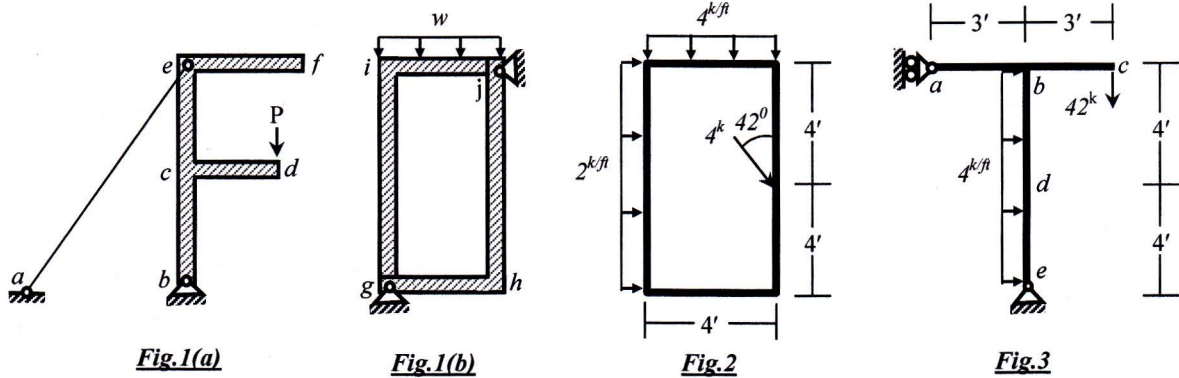Course Title: Engineering Mechanics I   Credit Hours: 3.0   Course Code: CE 101
Time: 3 hours   Full Marks: 100 (= 10 × 10)

ANSWER ALL THE QUESTIONS

1. In the structures shown in *Fig.1(a, b)* draw the free-body diagram of
    (a) Member *bcdef*, Cable *ae* and Support *b* [*Fig.1(a)*]
    (b) Member *gij* and Support *g* [*Fig.1(b)*]

| *Fig.1(a)* | *Fig.1(b)* | *Fig.2* | *Fig.3* |

2. *Fig.2* shows a system of forces acting on a structure (shown by lines). Calculate the magnitude, direction and location of resultant of the forces.

3. For the frame *abcde* loaded as shown in *Fig.3*, calculate the (i) reactions of supports *a* and *e* and (ii) shear force and bending moment at *d* (mid-point of member *be*).

4. Compute moment of inertia (I_x, I_y and J) of the shaded area with respect to given co-ordinate system shown in *Fig.4*.

| *Fig.4* | *Fig.5* | *Fig.6* | *Fig.7* |
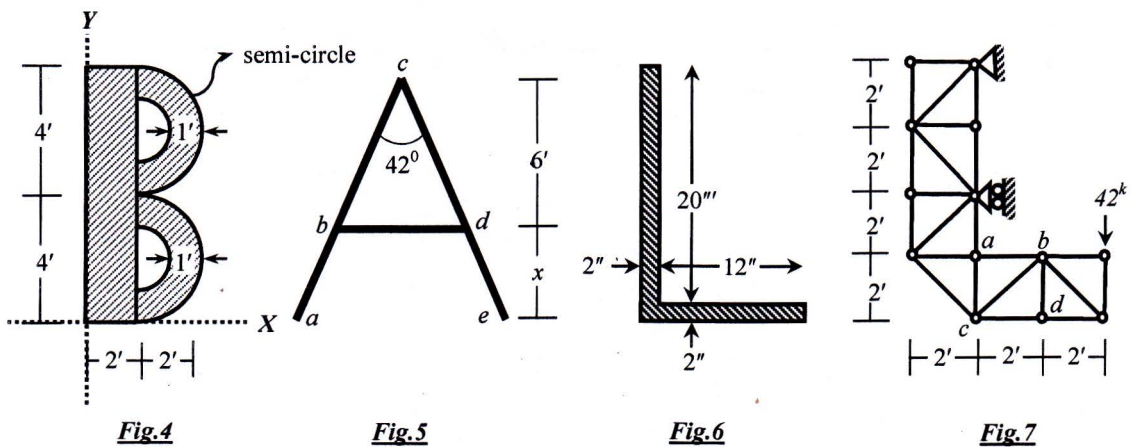
5. Calculate the value of *x*, if centroid of the composite line *abcde (Fig.5)* is at the mid-point of line *bd*.

6. Compute product of inertia P_{xy}, minimum moment of inertia I_{min} and maximum moment of inertia I_{max} of the shaded area shown in *Fig.6*.

7. In the truss loaded as shown in **Fig.7**, (i) identify zero force members, (ii) Calculate reactions at supports and (iii) forces in member **ab, bc** and **cd**.

8. **Fig.8** shows a system of forces acting on a structure (shown by bold lines). Calculate the value of forces w_1, w_2 and **P** if the structural system is in equilibrium condition.
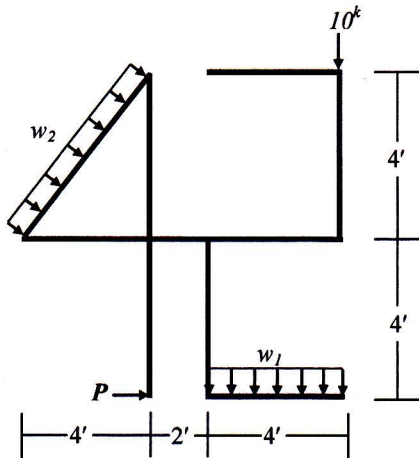

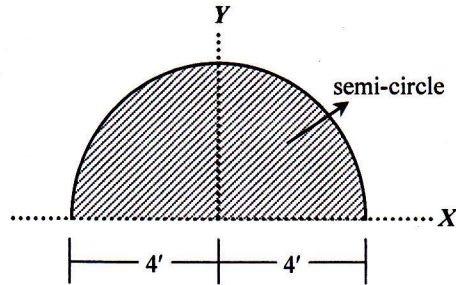Fig.8   Fig.9

9. Compute moment of inertia of the shaded area with respect to given co-ordinate system by integration method shown in **Fig.9**.

   Or

   Locate the centroid of the shaded area with respect to given co-ordinate system by integration method shown in **Fig.9**.

10. Locate the centroid of the composite weight with respect to given co-ordinate system as shown in **Fig.10** [Given: Unit weight of concrete, $\gamma_{concrete}$ = 150 lb/ft³; unit weight of steel, γ_{steel} = 490 lb/ft³].

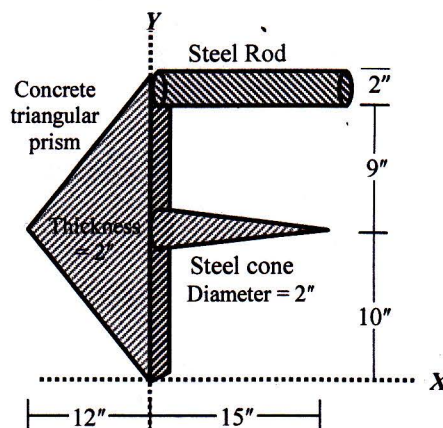
Fig.10

University of Asia Pacific
Department of Civil Engineering
Final Examination Spring 2018
Program: B. Sc. Engineering (Civil)

Course Title: Introduction to Civil and Environmental Engineering	Course Code: CE 107
Time- 2 hours	Full marks: 100

PART I
### Answer all the questions.

1. (a) Write short notes on: i) Environment ii) Environmental Engineering. [2.5+2.5]
   (b) Discuss the reasons and control measures for i) Industrial pollution ii) Water pollution. [5+5]

2. (a) Discuss the relationship between human and environment. [10]
   (b) Explain with figure Point source and Non-point source of water pollution. [5]
   (c) Compare between the following: i) Natural eutrophication and Cultural eutrophication
   ii) Natural environment and Built environment. [2.5+2.5]

3. (a) What is 3R principle? Justify its necessity in environmental view point. [3+2]
   (b) Explain the term "Environmental ethics" with its principles. [3+2]
   (c) Discuss the effects of i) Global warming ii) Acid rain. [2.5+2.5]

PART II
Answer all the questions.

4. A four-storied residential building is to be constructed. Estimate the construction cost of foundation, superstructure and boundary wall as per the following particulars and specifications of the building. Use PWD schedule and other relevant information provided in the attached appendix. [16]

Sl No	Particulars	Specification
01	Land Size	Determine from plot layout as shown below
02	Building type	Residential (Standard)
03	Allowable Bearing Capacity (q_a)	4.0 ksf
04	Floor Level	Four
05	Plinth Area	65 % of Land Size
06	Construction Material	24 MPa, RCC Structure 1:1.5:3 (Stone Chips)
07	Ground Floor	Car Parking
08	Roof top RCC water tank including beams and supports etc	1000 Gallons
09	Structure type	RCC Frame Structure
10	Underground water reservoir, distribution line, water pump, pump house, WASA charge	3000 gallons
11	Boundary wall	RCC frame
12	Incidental Cost	Consider 8% for this building

32.0m

18.29 m

60 ft

28.28 yard

55°

Arc of a circle
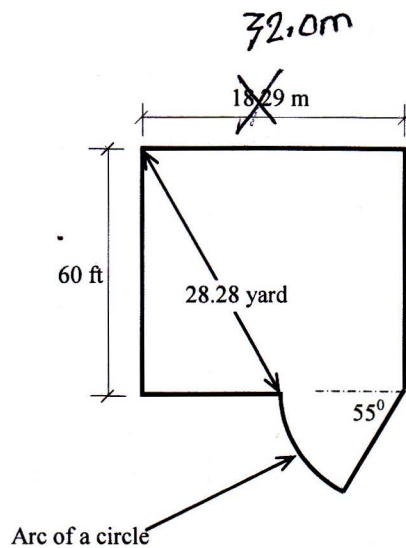
5. (a) Using a diagrammatic expression mention some features of scientists, engineers, society and 5
technology.
(b) Define civil engineering according to ASCE. What are the major branches of civil engineering? 3+2
(c) What should be the major foci of any civil engineering project? 2
(d) Mention five major roles of civil engineers in infrastructure development. 5

6. (a) Mention (names only) few types of loads to be considered in design. 3
(b) Depending on the character of occupancy or type of use, classify buildings. 2
(c) Categorize (with examples) building materials in consideration to specific properties. 3
(d) Calculate the unit weight of a brick material (γ_b) in lb/ft^3 if its size is about 9.5 in x 4.5 in x 2.75 4
in. Consider its weight (W_b) 3.2 kg.
(e) For the brick as mentioned above (in question no. 6(d)), calculate the pressures on the surface in 5
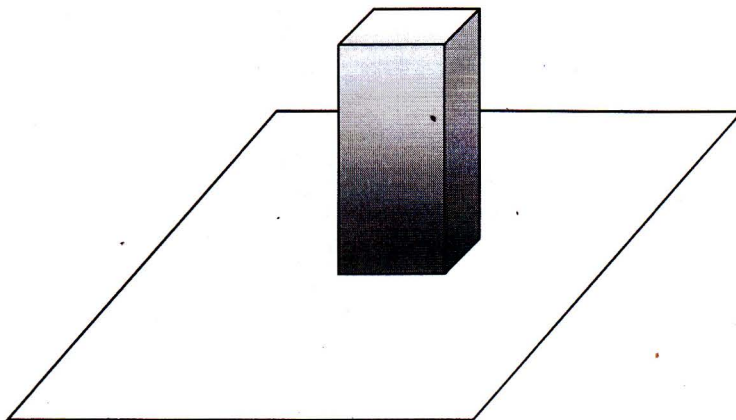(i) psi, (ii) Pa (N/m^2) and (iii) kg/cm^2, according to its position as shown below.

Figure: A brick resting on a plane surface

2

APPENDIX
PWD SCHEDULE

1. Foundation Cost upto PL (per m^2 of Plingth 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 Plingth 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

SOME ADDITIONAL COSTS

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:

(ii) 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

Course Title: English Language 1	Course Code: HSS 101	Credit: 3.00
Time: 3.00 Hour		Full Marks: 50

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

Section A

1. Read the passage carefully and then answer the corresponding questions.   4 x 1 = 4

Until two years ago, Clearing, Illinois was a tranquil suburb of Chicago. But residents grew alarmed when they noticed armed teenagers on the streets, giving gang signals and shouting at passing cars. Then a series of burglaries and graffiti messages came on storefronts. By the time local authorities realized they had a gang problem, it was too late. Last December, two 13-year-old girls were shot outside their school as they sat in a car with two members of a local gang, the Ridgeway Lords.

Nearly all 50 states have recently passed laws that allow youths aged 14-17 to be tried in court as adults. In about 25 states they have passed laws to punish parents for their children's behavior. And in 146 of the nation's largest cities, they have imposed curfews to reduce juvenile violence. When you look at the spectacular rise of violent crime among young people recently, it's easy to understand the concern. Over the past decade, there has been a decline in adult murders in the US, while murder rates have surged for youths aged from 14-17.

For young offenders who aren't sent to prison, the punishments vary. Some are ordered to perform community service, others are placed in job training programs, still others sent to youth prisons. But the Republicans in Congress want to reverse a basic principle of juvenile justice - the separation of young criminals from hardened adult criminals in prison. The reasons are partly financial – to reduce the cost of having separate prisons for young people – and partly psychological – to end what Republicans consider as society's overly protective attitude towards young criminals.

Answer the following questions:
a) What does the passage primarily discuss about?
b) What changes took place over the past decade regarding murder rates?
c) What happens to young criminals who are not sent to prison?
d) What attitude do the Republicans have towards young offenders?

Section – B

2. Fill in the blanks with appropriate parts of speech.   4 x 1 = 4

a. It is a _____ (fool) act to _____ (glorious) your work before actually finishing it.

b. The _____ (beautiful) of the photograph was somehow diminished after _____ (large) it.

c. The new range of employees are both _____ (creation) and _____ (energize).

d. The Board of Trustees has _____ (decisive) to maintain _____ (equal) within the faculty members.

3. Add either a prefix or a suffix with <u>any eight (8)</u> of the following words.   8 x0.5 = 4

-ship, micro-, hyper-, in -, -en, de-, inter-, trans-

visible, continental, action, white, centralize, danger, tension, biology, leader, person

4. Make separate sentences from any <u>four (04)</u> homophone pairs (with meanings) that are given below: 4 x 1=4

a. maid, made   d. knot, not

b. waste, waist   e. flour, flower

c. sight, site   f. grown, groan

5. The following excerpt has some spelling errors, punctuation errors, grammatical problems with capitalization. Trace them out and write the passage correctly.   6

Butterflies are sume of the most interesting insects on the planet Earth. There are more than seventeen thousand diffirent kinds of butterflies! Butterflies come in all shapes and sizes. Butterflies go throuhg four maine stages of life. The first stage is the egg stage followed by the larva stage. As it grows, it shades it outer skin, or exoskeleton. This may happen four or five times. After a few weaks, the caterpillar enters the next stage of its life, the chrysalis stage. In the chrysalis, the caterpillar will liquefi into a soup of living cells. Then, it will reorganaize into a butterfly and the metamorphosis is complete. When the butterfly emerges from the chrysalis, it pumps its wings to send blood through them so that it can fly. Most butterflies only live a couple of weeks, just enuff time to drink flower nectare and to mate.

Section – C

6. Write a review of an English or Bangla movie you have watched recently.   7

7. Suppose, as a convener you have arranged a CE Fest after the mid-term exam. Now, write an invitation to the Head of the Department inviting him along with the faculty members to attend the program.   7

8. Write paragraphs on the following topics (maximum 200 words)   7X2=14

a) Online shopping vs. shopping in the mall
b) Five attributes you want to change about yourself

Course Title: Mathematics-I   Course Code: MTH 101
Time: 3.00 Hours.   Full Marks: 150

There are **Eight** questions. Answer any **Six**. All questions are of equal values, indicated in the right margin.

1. (a) Investigate the Continuity and Differentiability of $f(x)$ at $x = 0$, where   18

$$f(x) = \begin{cases} 3 + 2x & if \quad -\frac{3}{2} < x \le 0 \\ 3 - 2x & if \quad 0 < x < \frac{3}{2} \end{cases}$$

   (b) If $y = \sin(a \sin^{-1} x)$ then show that $(1 - x^2)y_{n+2} - (2n+1)xy_{n+1} - (n^2 - a^2)y_n = 0$.   07

2. (a) If $f = e^{x^2 + xy + y^2} \sin x$, find f_{xy}, f_{xx}, f_{yy}.   15

   (b) If $u = x^2 y + y^2 z + z^2 x$, show that $u_x + u_y + u_z = (x + y + z)^2$.   10

3. (a) If $x = r \cos\theta$, $y = r \sin\theta$, then find $\dfrac{\partial(x,y)}{\partial(r,\theta)} = r$.   08

   (b) State Euler's theorem and verify Euler's theorem for $u = x^2 \ln(y/x)$.   17

4. (a) Find the equation of tangent and normal lines to $x^2 + 3xy + y^2 = 5$ at $(1, 1)$.   10

   (b) Establish a reduction formula for $\int \sin^n x \, dx$ and then evaluate $\int \sin^4 x \, dx$.   15

5. (a) Evaluate the following integral: 12

$$\int \frac{x^2 dx}{(x+1)^2 ((x+2)}$$

   (b) Find the radius of curvature at $(0, 1)$ of $y = e^{-x^2}$.   13

6. (a) Evaluate the improper integral $\int_0^1 \frac{\ln x}{\sqrt{x}} dx$ **15**

(b) Using Walli's formula solve $\int_0^{\pi/2} \cos^9 x \, dx$ **10**

7. (a) Expand e^x in power of x.   **07**

(b) Find the intervals on which the following function is increasing, decreasing and concave up, concave down. Also find the inflection points (if any)   **18**
$$f(x) = x^3 - 3x^2 + 1.$$

8. (a) Define Gamma and Beta functions. Show that,   **10**

$$\beta(m,n) = 2 \int_0^{\frac{\pi}{2}} \sin^{2m-1} \theta \cos^{2n-1} \theta \, d\theta \ , m, n > 0$$

(b) Evaluate the following integrals $\int_0^{\frac{\pi}{2}} \sin^8 \theta \cos^{10} \theta d\theta$ **08**

(c) Using gamma beta function solve $\int_0^1 x^2 (1-x)^{3/2} \, dx$ **07**

University of Asia Pacific
Department of Civil Engineering
Final Examination, Spring- 2018
Program: B. Sc in Civil Engineering

Course Title: Physics   Course Code: PHY-101   Credit: 3.00

Time: 3.00 Hours   Full Mark: 150

N.B- There are ***Eight*** Questions. Answer any ***Six***. All questions are of equal value. Figures in the right margin indicate marks.

1. (a) Define infrasonic and ultrasonic wave of sound. Prove that the total energy of a vibrating particle is equal to $2\pi^2 m a^2 n^2$. **[15]**

   (b) A particle performs simple harmonic motion given by the equation $y = 20 \sin [\omega t + \alpha]$. If the time period is 30 seconds and the particle has a displacement of 10 cm at t=0, find (i) epoch (ii) the phase angle at t=5 seconds and (iii) the phase difference between two positions of the particle 15 seconds apart. **[10]**

2. (a) Explain Lissajous' figures. Prove that $y = A \sin (\omega t + \phi)$ from the composition of two simple motions in a straight line. **[15]**

   (b) Two simple harmonic motions acting simultaneously on a particle are given by the equations $y_1 = \sin (\omega t + \pi/3)$ and $y_2 = 3 \sin \omega t$. Find the equation of the resultant vibration. **[10]**

3. (a) Define acoustics and reverberation of sound. Write down requisites for good acoustics in an auditorium. **[15]**

   (b) 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. **[10]**

4. (a) Write down three postulates of the kinetic theory of gases. Prove that $C = \sqrt{\frac{3P}{\rho}}$, where the terms have their usual meanings. **[15]**

   (b) At what Celsius temperature will oxygen molecules have the same root mean square velocity as that of hydrogen molecules at -100^0C? **[10]**

Turn over

5. (a) Define equilibrium state and Zeroth law of thermodynamics. State and explain Newton's law of cooling. [15]

(b) A liquid takes 4 minutes to cool from 70^0C to 50^0C. How much time will it take to cool from 50^0C to 40^0C? The temperature of the surrounding is 25^0C. Newton's law of cooling is applicable throughout the process. [10]

6. (a) State and explain Carnot's cycle and find out the efficiency of Carnot's reversible engine. [15]

(b) A Carnot's engine is operated between two reservoirs at temperature 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) [10]

7. (a) Explain how you can produce Newton's rings using a monochromatic light. Prove that $r^2=(2n-1)\lambda R/2$ for Newton's bright ring, where the terms have their usual meanings. [15]

(b) In a Newton's rings experiment the diameter of the 15 th ring was found to be 0.590 cm and that of the 5 th ring was 0.336 cm. If the radius of the plano-convex lens is 100 cm, calculate the wave length of light used. [10]

8. (a) Define interference and polarization of light. State and explain Malus law for a polarized light. [20]

(b) Calculate the thickness of a half wave plate of quartz for a wave length of 5000 Å. Here $\mu_E=1.553$ and $\mu_0=1.544$. [05]