2-1

University of Asia Pacific

Department of CE

Semester Final Examination, Fall 2024

Programme: BSc. Engineering in CE

(Self-study)

Course Title: Bangladesh Studies: Society and Culture | Course Code: HSS211(a)
Time: 2 hours | Credit: 2.00 | Full Marks: 50

[There are **six** questions. Answer **FOUR including questions 1 and 2.**
Figures in the right margin indicate marks.]

QUESTION 1 [10 MARKS]

1. What are the major theoretical perspectives? Define them. Mention the names of the key persons ofeach perspective. [10]

QUESTION 2 [10 MARKS]

2. Define socialization. Briefly discuss the agencies of socialization. [10]

QUESTION 3 [15 MARKS]

3. Define Gerherd Lenski's sociocultural evolution. Discuss how he relates the evolution of human societies with the innovation of technology. [15]

OR

QUESTION 4 [15 MARKS]

4. What is social stratification? What are the systems of social stratification? Name them. Briefly discuss the systems of social stratification. [15]

QUESTION 5 [15 MARKS]

5. Define Culture. Describe the nonmaterial elements of culture [15]

OR

QUESTION 6 [15 MARKS]

6. Distinguish between: [15]
high culture and popular culture; and subculture and counterculture

University of Asia Pacific
Department of Civil Engineering
Final Examination, Fall 2024
Program: B. Sc. in CE
(Self-study)

Course Title: Bangladesh Studies | Course Code: HSS 211(b)
Time: 2 hours | Credit Hour: 02 | Full Marks: 100

Instructions:

- Each question carries 25 marks.
- Read the questions carefully before you start. Answer **any 05 (five)** of the following questions. (25x4)

There are **six** questions. Answer any **four including Q5 and Q6**. All questions are of equal value. Figures in the right margin indicate marks.

QUESTION 1 [25 MARKS]

Explain the contribution of Ishwarchandra Vidyasagar to the society. [25]

OR

QUESTION 2 [25 MARKS]

Explain the contribution of Raja Rammohon Roy to the society. [25]

QUESTION 3 [25 MARKS]

Explain the background and reaction of the Lahore Resolution. [25]

OR

QUESTION 4 [25 MARKS]

Discuss the first and second phase of the Language Movement. [25]

QUESTION 5 [25MARKS]

Explain the 6-point program of 1966. [25]

QUESTION 6 [25 MARKS]

Write an article on the Liberation War of Bangladesh [25]

University of Asia Pacific
Department of Civil Engineering
Final Examination, Fall 2024
Program: B.Sc. in Civil Engineering
2nd Year 1st Semester

Course Title: Basic Electrical Engineering Course Code: ECE 201
Time: 3 hours Credit Hour: 3.00 Full Marks: 150

Answer all the questions

QUESTION 1 [25 MARKS] [CO1]

Solve the power of the source in the circuit given in **figure 1**.

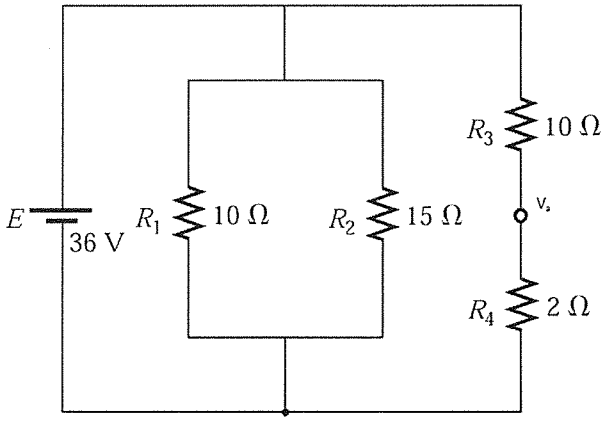


Figure 1

QUESTION 2 [25 MARKS] [CO1]

Construct a simplified presentation of the circuit given in **figure 2** with respect to 2 kilo-ohm resistor. From that simplified circuit, containing a source and a resistor, calculate- the power absorbed by the 4 kilo-ohm resistor.

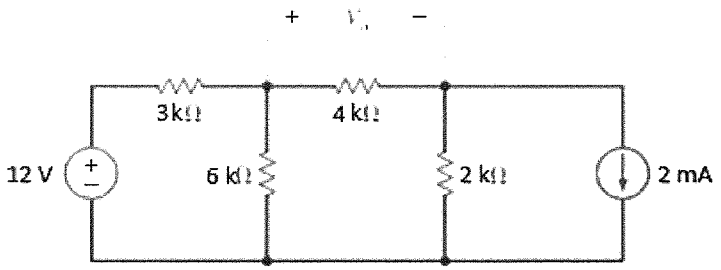


Figure 2

QUESTION 3 [15+5+5=25 MARKS] [CO3]

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

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

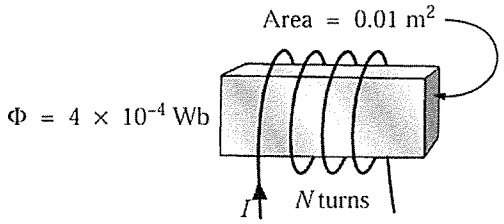


Figure 3

QUESTION 4 [25+25+25=75 MARKS] ***(answer any one)*** [CO2]

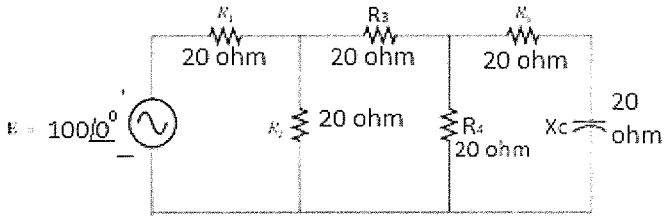


Figure 4

a) From **figure 4**, **solve-**
i. Power and power factor of the R-C branch.
ii. Power and power factor w.r.t the source.
iii. And **show** Wave forms of source Voltage and the corresponding Current.

OR

b) From **figure 5**, **solve-**
i. Power and power factor of the R-C branch [not the R-L-C branch].
ii. Power and power factor w.r.t the source.
iii. And **show** Wave forms of source Voltage and the corresponding Current.

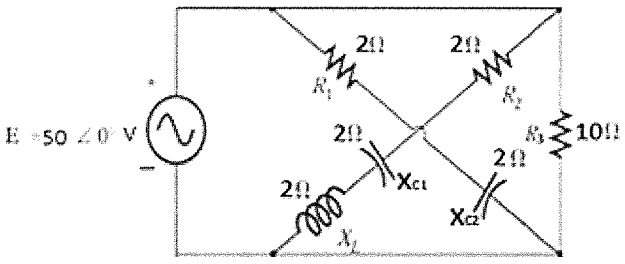


Figure 5

University of Asia Pacific
Department of Civil Engineering
Final Examination, Fall 2024
Program: B.Sc. in Civil Engineering
2nd Year 1st Semester

Course Title: Engineering Geology and Geomorphology | Course Code: CE 203
Time: 3 hours | Credit Hour: 3.00 | Full Marks: 100

Answer all the questions

QUESTION 1 [2 MARKS]

Mention the characteristics of drainage basin affecting runoff.

QUESTION 2 [8 MARKS]

Using rational method, calculate the peak runoff (Q_p) for the catchment area as shown in **Figure 1**.

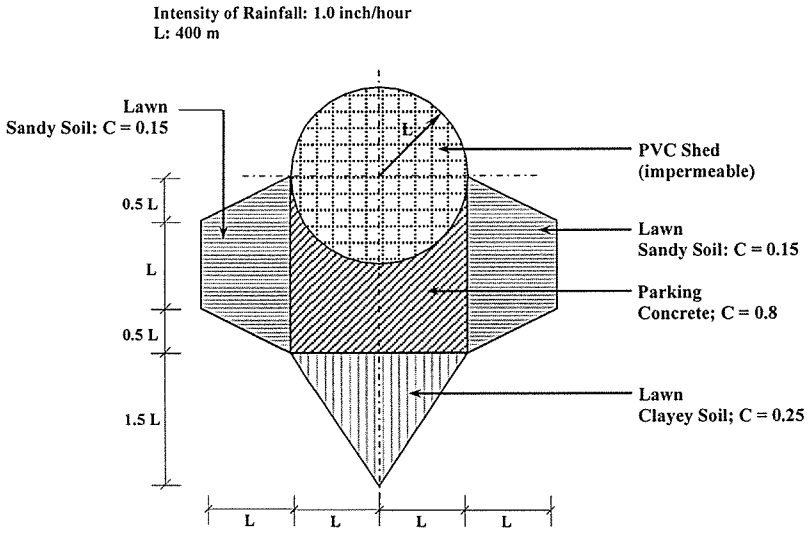


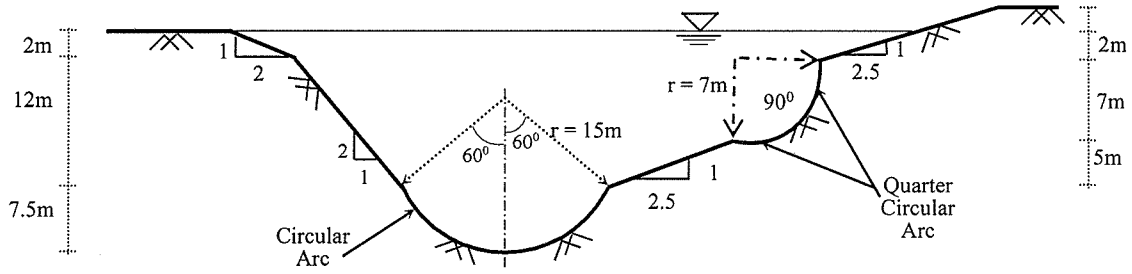
Figure 1

QUESTION 3 [2 MARKS]

Define Capacity and Competence of a river.

QUESTION 4 [8 MARKS]

Cross-sectional profile of a channel, shown in **Figure 2**. The gradient of the channel bed is $7.67*10^{-4}$. Calculate the tractive pressure along the channel.



X-Sectional Profile of Channel Course

Figure 2

QUESTION 5 [2 MARKS]

Define "graded stream".

QUESTION 6 [8 MARKS]

Calculate Stream Frequency (SF) of a catchment area (having DD = 0.0340744 km/km^2) from the information provided in the table below.

Stream Rank	No. of Streams (Ns_i)	BR	ABR	Mean Length (Lm_i, km)	LR	ALR
1	---	2.143	2.492	---	3.0	2.5
2	---	---		---	---	
3	3	---		---	2.5	
4	---			200		

QUESTION 7 [5 MARKS]

Consider two sections of a river. Hydraulic radiuses for sections 1 and 2 are 300 feet and 200 feet, respectively. Gradients are 0.002 and 0.003 for sections 1 and 2, respectively. Considering unit weight of water to be constant, compare erosional tendency at these two sections of the river.

QUESTION 8 [15 MARKS]

Describe the following drainage patterns with appropriate diagrams-

a. Trelis
b. Dendritic
c. Annular

QUESTION 9 [5 MARKS]

Discuss the importance of the seismic hazard map of Bangladesh updated in BNBC-2020.

QUESTION 10 [10 MARKS]

Explain how rocks are transformed from one type to another with the help of a neat sketch.

QUESTION 11 [5 MARKS]

Discuss briefly the agents of metamorphism.

QUESTION 12 [15 MARKS]

Discuss in depth the three processes of V-shaped valley formation.

QUESTION 13 [5 MARKS]

Compare between earthquake magnitude and earthquake intensity scale.

QUESTION 14 [10 MARKS]

Explain how crystalline structure influence the physical properties of minerals. Also, discuss how you will identify mineral in a natural setting.

University of Asia Pacific
Department of Civil Engineering
Final Examination, Fall 2024
Program: B.Sc. in Civil Engineering
2nd Year 1st Semester

Course Title: Engineering Materials | Course Code: CE 201
Time: 3 hours | Credit Hour: 3.00 | Full Marks: 100

[Answer all the questions. Assume value for any missing data]

PART A

QUESTION 1 [22 MARKS]

a. Addition of superplasticizers provides concrete the same workability with 10-25% less water. Describe the principle behind this. **[7]**

b. Assume a reinforced concrete beam in a building is damaged due to overloading. Briefly demonstrate the key steps involved in retrofitting the beam to restore its structural integrity from the lecture demonstration conducted in class. **[5]**

c. Three aggregates are to be mixed together to obtain an aggregate blend for an asphalt mixture. The grain size distribution is given below:

Table 1: Sieve Analysis of Aggrtegate

Sieve size	% Passing			
	Aggregate A	Aggregate B	Aggregate C	Target Specification
3"	100	-	-	
2"	97	100	-	
1"	40	85	100	
¾"	55	65	15	35
1/2"	10	18	8	
No. 4	1	8	2	3
No. 8	0	0	0	

i. Determine the mix ratio of aggregates A, B, and C to meet the target specification provided in **Table 1.** Additionally, determine the %passing for the combined aggregate in each sieve. **[6]**

ii. If the bulk densities of aggregates A, B, and C are 1250, 1475, and 1600 kg/m^3 respectively, calculate the bulk density of the aggregate blend. **[4]**

QUESTION 2 [08 MARKS]

Estimate the mix ratio to produce a medium consistency concrete with strength of 3500 psi after 28 days. Given: Maximum size of coarse aggregate is 1.5", fineness modulus of coarse and fine aggregates are 7.2 and 2.6, respectively. **[8]**

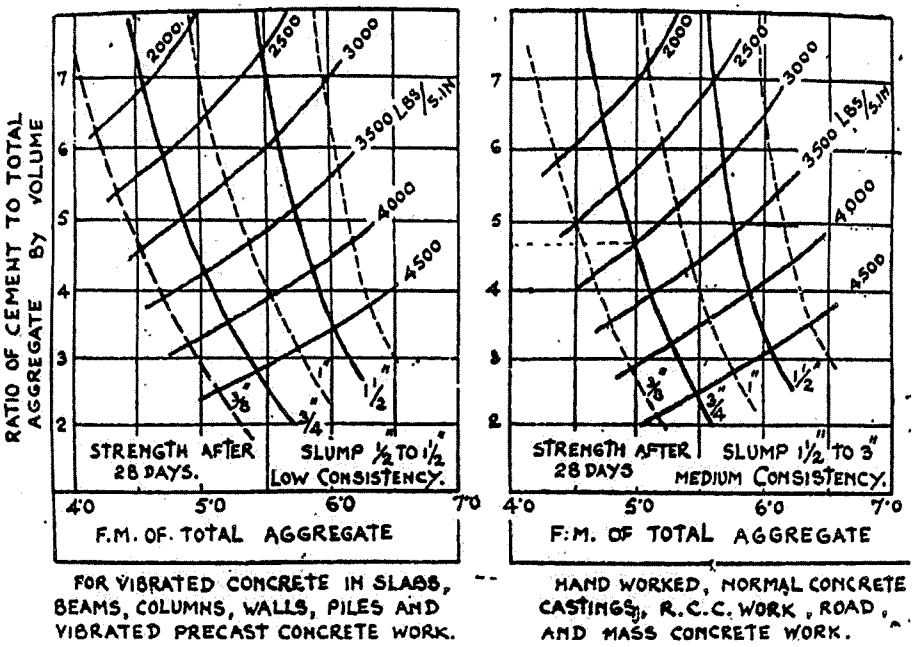


Figure 1: Design Chart

QUESTION 3 [20 MARKS]

Design a concrete mix following the ACI 211.1 mix design method for a non-air entrained concrete pavement with a specified compressive strength of 30 MPa. Maximum allowable slump of concrete is 50 mm. A high-range water reducer (specific gravity 1.16) is to be used at 0.8% of the cement weight, capable of reducing water demand by approximately 30% while maintaining workability. Thirty tests were conducted to estimate a standard deviation of 3 MPa for the concrete mixture. Table 1 to Table 4 with the following data are provided for the mix design. **[20]**

Cement: Ordinary Portland Cement; Specific gravity = 3.17

Coarse Aggregate:

- Maximum size: 37.5 mm
- Absorption capacity: 2%
- Moisture content: 1.1%
- Bulk specific gravity (Oven Dry): 2.65
- Unit weight (dry-rodded): 1850 kg/m^3

Fine Aggregate:

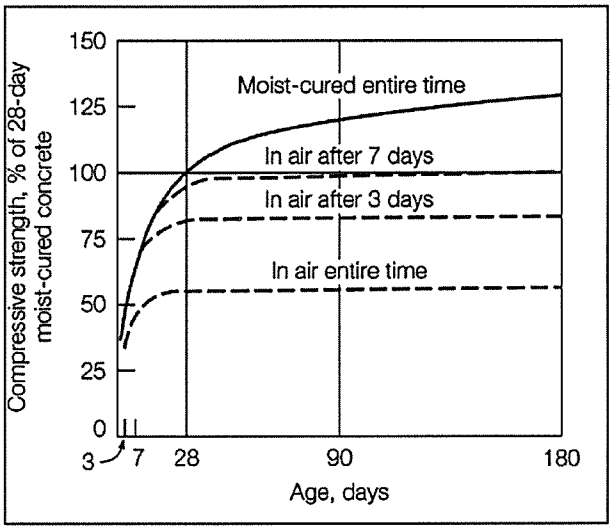
- Fineness modulus: 2.9
- Absorption capacity: 2.9%
- Moisture content: 4.6%
- Bulk specific gravity (OD): 2.4

PART B

QUESTION 4 [10 MARKS]

a. Define workability of concrete. Differentiate between zero slump and collapse slump of concrete. **[5]**

b. Explain the following graph: **[5]**



QUESTION 5 [30 MARKS]

a. Explain how alkali could be a harmful ingredient for brick. Discuss the potential defects arise from excess alkali in brick **[5]**

b. A brick sample of 1.255 kg oven dry weight is tested for determination of unit weight of brick. If the brick is coated with wax and it is weighed 1.52 kg and if the amount of water displaced by wax coated brick is 1.115 kg, calculate the unit weight of the brick. Assume specific gravity of wax is 0.85 and density of water = 1 gm/cc.
Find the unit weight of the brick and comment whether the brick meets minimum specifications **[5]**

c. Explain bulking phenomenon of different grade of sand graphically.
To measure the bulking of a sand, the sand sample is filled in a measuring cylinder up to 200 mm height. When the sand sample is completely inundated with water, the height of the sand sample comes down to 180 mm. Calculate amount of bulking of the sand sample. **[10]**

d. Mix design of mortar is necessary for plastering work (10mm thick mortar) of a brick masonry wall (both side) of 40 feet long and 10 feet height. The following data are provided:
cement: sand: water = 1: 2: 0.45
Specific gravity of sand, $G_s = 2.4$
Cement type = Ordinary Portland cement ($G_c = 3.15$)
Air content = 1.0%
Calculate the unit weight of mortar. **[10]**

QUESTION 6 [10 MARKS]

a. Differentiate between heartwood and sapwood. **[2]**

b. Draw load-strain diagram for a ***Plastic*** material for the following load pattern shown in Figure:2 Take equal time intervals: $t_0=t_1=t_2$. **[8]**

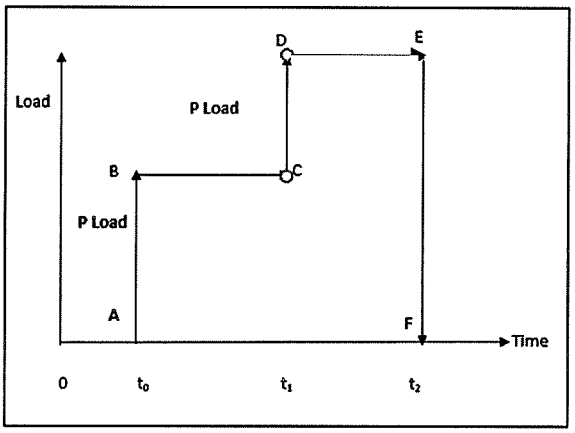


Figure 2: Load diagram for plastic material

Annexure

Table 1

Slump, mm	Water, kilograms per cubic meter of concrete, for indicated sizes of aggregate*							
	9.5 mm	12.5 mm	19 mm	25 mm	37.5 mm	50 mm**	75 mm**	150 mm**
	Non-air-entrained concrete							
25 to 50	207	199	190	179	166	154	130	113
75 to 100	228	216	205	193	181	169	145	124
150 to 175	243	228	216	202	190	178	160	—
Approximate amount of entrapped air in non-air-entrained concrete, percent	3	2.5	2	1.5	1	0.5	0.3	0.2

Table 2

Compressive strength at 28 days, MPa	Water-cementitious materials ratio by mass	
	Non-air-entrained concrete	Air-entrained concrete
45	0.38	0.30
40	0.42	0.34
35	0.47	0.39
30	0.54	0.45
25	0.61	0.52
20	0.69	0.60
15	0.79	0.70

Table 3

Number of Tests[B]	Standard Deviation, psi					
	300	400	500	600	700	Unknown
15	470	620	850	1120	1390	[C]
20	430	580	760	1010	1260	[C]
30 or more	400	530	670	900	1130	[C]
	Standard Deviation, MPa					
	2.0	3.0	4.0	5.0		Unknown
15	3.1	4.7	7.3	10.0		[C]
20	2.9	4.3	6.6	9.1		[C]
30 or more	2.7	4.0	5.8	8.2		[C]

Table 4

Nominal maximum size of aggregate, mm (in.)	Bulk volume of dry-rodded coarse aggregate per unit volume of concrete for different fineness moduli of fine aggregate*			
	2.40	2.60	2.80	3.00
9.5 (⅜)	0.50	0.48	0.46	0.44
12.5 (½)	0.59	0.57	0.55	0.53
19 (¾)	0.66	0.64	0.62	0.60
25 (1)	0.71	0.69	0.67	0.65
37.5 (1½)	0.75	0.73	0.71	0.69
50 (2)	0.78	0.76	0.74	0.72
75 (3)	0.82	0.80	0.78	0.76
150 (6)	0.87	0.85	0.83	0.81

University of Asia Pacific
Department of Civil Engineering
Final Examination, Fall 2024
Program: B.Sc. in Civil Engineering
2nd Year 1st Semester

Course Title: Engineering Materials | Course Code: CE 201 (Self-study)
Time: 3 hours | Credit Hour: 4.00 | Full Marks: 120

[Answer all the questions. Assume value for any missing data]

PART A

QUESTION 1 [25 MARKS]

a. List the deleterious substances in aggregate and their effects on Portland cement concrete. [5]
b. Define alkali-aggregate reactivity and explain the measures to control it. [6]
c. Three aggregates are to be mixed together to obtain an aggregate blend for an asphalt mixture. The grain size distribution is given below:

Table 1: Sieve Analysis of Aggrtegate

Sieve size	% Passing			
	Aggregate A	Aggregate B	Aggregate C	Target Specification
3"	100	-	-	
2"	97	100	-	
1"	40	85	100	
¾"	55	65	15	35
1/2"	10	18	8	
No. 4	1	8	2	3
No. 8	0	0	0	

i. Determine the mix ratio of aggregates A, B, and C to meet the target specification provided in **Table 1.** [5]
ii. Calculate the fineness modulus of the combined aggregate. [5]
iii. If the specific gravities of aggregates A, B, and C are 2.921, 3.018, and 2.475 respectively, calculate the specific gravity of the aggregate blend. [4]

QUESTION 2 [10 MARKS]

a. Addition of air-entraining admixture increases concrete workability and resistance to freeze-thaw degradation. Describe the principle behind this. [5]
b. A reinforced concrete beam in a building is damaged due to earthquake. Briefly demonstrate the key steps involved in retrofitting the beam to restore its structural integrity from the lecture demonstration conducted in class. [5]

QUESTION 3 [25 MARKS]

a. Design a concrete mix following the ACI 211.1 mix design method for a non-air entrained concrete pavement with a specified compressive strength of 25 MPa. Maximum allowable slump of concrete is 50 mm. A high-range water reducer (specific gravity 1.214) is to be used at 0.8% of the cement weight, capable of reducing water demand by approximately 30% while maintaining workability. Thirty tests were conducted to estimate a standard deviation of 3 MPa for the concrete mixture. Table 1 to Table 4 of the Appendix with the following data are provided for the mix design. [18]

Cement: Ordinary Portland Cement; Specific gravity = 3.17

Coarse Aggregate:

- Maximum size: 37.5 mm
- Absorption capacity: 2%
- Moisture content: 1.1%
- Bulk specific gravity (Oven Dry): 2.65
- Unit weight (dry-rodded): 1850 kg/m^3

Fine Aggregate:

- Fineness modulus: 2.9
- Absorption capacity: 2.9%
- Moisture content: 4.6%
- Bulk specific gravity (OD): 2.4

b. Estimate the mix ratio to produce a concrete with slump of 1" and strength of 3500 psi after 28 days. Given: Maximum size of coarse aggregate is 1.5", fineness modulus of coarse and fine aggregates are 7.2 and 2.6, respectively. [7]

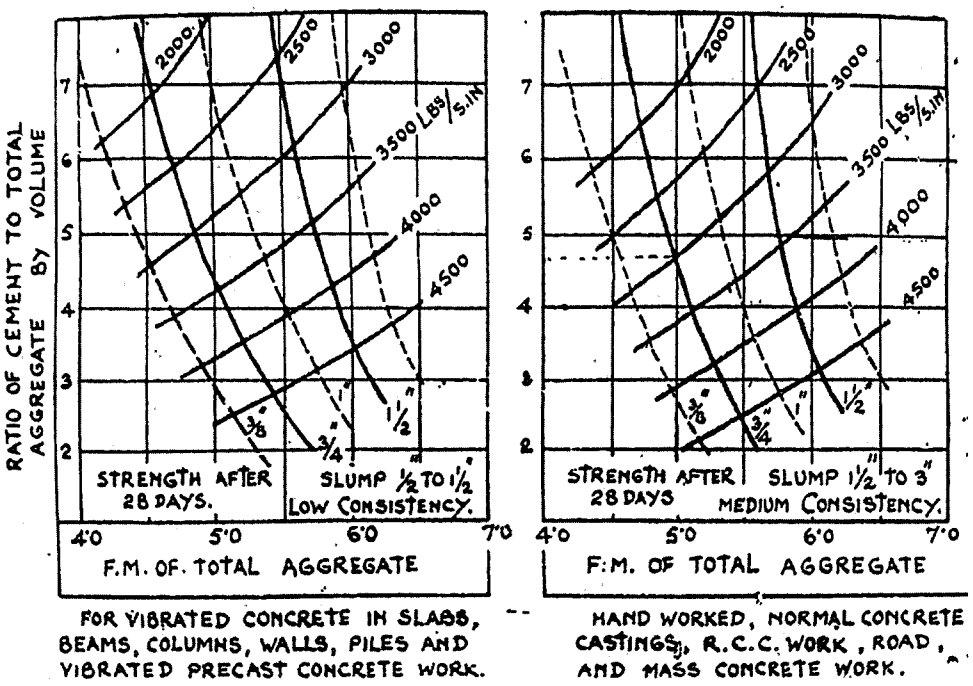


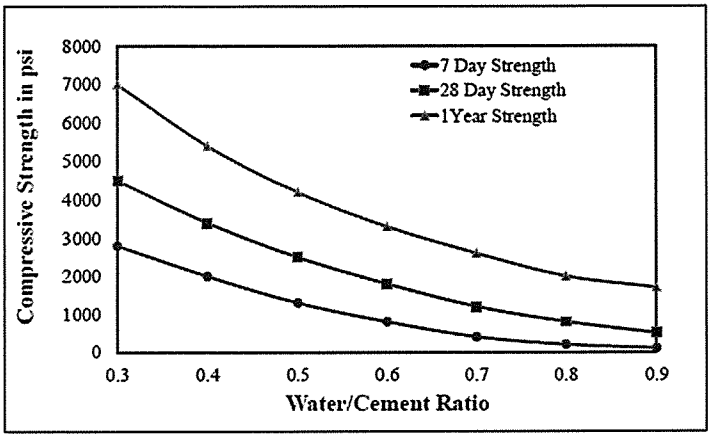
Figure 1: Design Chart

PART B

QUESTION 3 [15 MARKS]

a) Explain bleeding problem of concrete. Discuss the steps of solving this problem. [5]

b) Explain the following graph: [5]



c) Provide solutions for following durability related problems of concrete: [5]
Sulphate-attack, freeze and thaw, alkali-silica reaction.

QUESTION 4 [15 MARKS]

a) Explain how lime could be a harmful ingredient for brick. Discuss defects may arise from excess lime in brick. [5]

b) One brick sample is tested for compressive strength and water absorption capacity. Following results in Table 1 are obtained from the tests. [5]
Assume unit weight of the brick 100 lb /ft^3 and average depth of brick sample is 2.75 inch. Calibration equation: Y=0.952X-4.72.
Calculate compressive strength and absorption capacity of the brick sample.

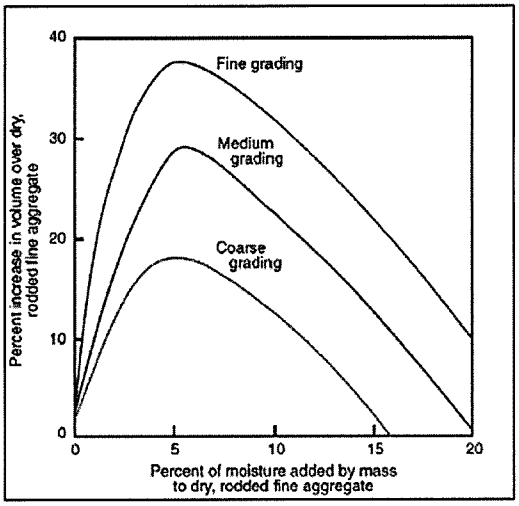
Table 1: Test results of brick sample

Sample	Dimension (inch)				Observed Load (lb)	SSD weight of brick (lb)
	Side-1		Side-2			
	L	W	L	W		
1	4.5	4.55	4.6	4.55	53050	3.81

QUESTION 5 [15 MARKS]

a) Define hydraulicity of lime. Draw and explain lime-mortar cycle. [5]

b) Explain the following graph. **[5]**



c) To measure the bulking of a sand sample, sand is filled in a measuring cylinder up to 200 mm height. When the sand sample is completely inundated with water, the height of the sand sample comes down to 180 mm. Calculate amount of bulking of the sand sample. **[5]**

QUESTION 6 [15 MARKS]

a) Name the main constituents of paint. **[5]**

b) Draw load-strain diagram for a ***Elastoplastic*** material for the following load pattern. Take equal time intervals: $t_0=t_1=t_2$. **[10]**

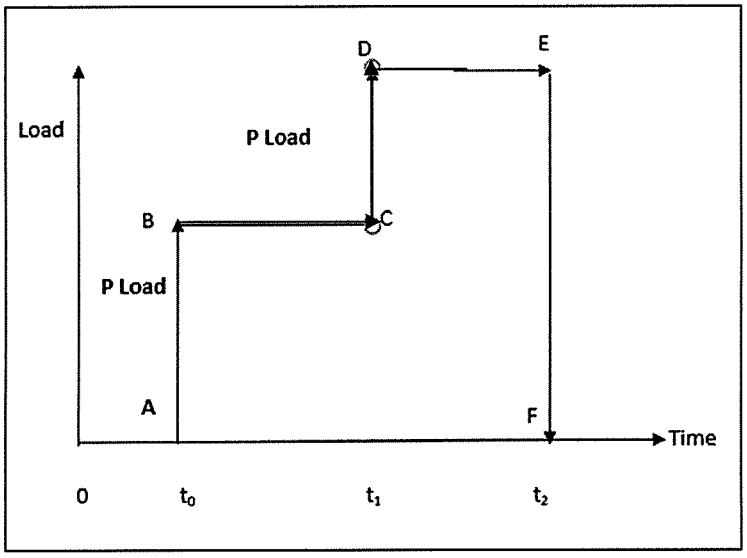


Figure: Load diagram for elastoplastic material

Appendix

Table 1

Slump, mm	Water, kilograms per cubic meter of concrete, for indicated sizes of aggregate*							
	9.5 mm	12.5 mm	19 mm	25 mm	37.5 mm	50 mm**	75 mm**	150 mm**
	Non-air-entrained concrete							
25 to 50	207	199	190	179	166	154	130	113
75 to 100	228	216	205	193	181	169	145	124
150 to 175	243	228	216	202	190	178	160	—
Approximate amount of entrapped air in non-air-entrained concrete, percent	3	2.5	2	1.5	1	0.5	0.3	0.2

Table 2

Compressive strength at 28 days, MPa	Water-cementitious materials ratio by mass	
	Non-air-entrained concrete	Air-entrained concrete
45	0.38	0.30
40	0.42	0.34
35	0.47	0.39
30	0.54	0.45
25	0.61	0.52
20	0.69	0.60
15	0.79	0.70

Table 3

Number of Tests[B]	Standard Deviation, psi					
	300	400	500	600	700	Unknown
15	470	620	850	1120	1390	C
20	430	580	760	1010	1260	C
30 or more	400	530	670	900	1130	C
	Standard Deviation, MPa					
	2.0	3.0	4.0	5.0		Unknown
15	3.1	4.7	7.3	10.0		C
20	2.9	4.3	6.6	9.1		C
30 or more	2.7	4.0	5.8	8.2		C

Table 4

Nominal maximum size of aggregate, mm (in.)	Bulk volume of dry-rodded coarse aggregate per unit volume of concrete for different fineness moduli of fine aggregate*			
	2.40	2.60	2.80	3.00
9.5 (⅜)	0.50	0.48	0.46	0.44
12.5 (½)	0.59	0.57	0.55	0.53
19 (¾)	0.66	0.64	0.62	0.60
25 (1)	0.71	0.69	0.67	0.65
37.5 (1½)	0.75	0.73	0.71	0.69
50 (2)	0.78	0.76	0.74	0.72
75 (3)	0.82	0.80	0.78	0.76
150 (6)	0.87	0.85	0.83	0.81

University of Asia Pacific
Department of Civil Engineering
Final Examination, Fall 2024
Program: B.Sc. in Civil Engineering
2nd Year 1st Semester

Course Title: Material Science and Environmental Sustainability | Course Code: CE 207
Time: 3 hours | Credit Hour: 3.00 | Full Marks: 100

Answer all the questions. Assume reasonable data if required.

PART A

QUESTION 1 [11 MARKS]

a. Interplanar spacing for (110) set of planes is 0.357 nm. Calculate the diffraction angle for (110) set of planes if a monochromatic radiation of 0.166 nm wavelength is used to made a diffraction of 2nd order.

[4]

b. A cylindrical rod, 8.5 inch long and having a diameter of 0.65 inch is to be deformed using a tensile load of 120 kip. At fracture achieved strain level is 0.05. Poisson's ratio for the material is 0.29. Determine the ductility in terms of -

(i) % Elongation in length & (ii) % Reduction in area

[7]

QUESTION 2 [11 MARKS]

a. Draw the types of point defects in crystal structure.

[4]

b. A furnace is used to burn the final solid waste in a waste water treatment plant. To ensure fuel efficiency by preventing heat loss, the surface of the furnace will be covered by a composite material of 20 W/m-K thermal conductivity. During the burning process temperature rises from 20°C to 150°C and the composite material's length elongates 0.5 mm per 1 m initial length. Determine the Thermal shock resistance (TSR) value of the covering composite material.

[7]

Table 1. Stress and strain values of the composite material

stress, σ (MPa)	strain, ε
0.00	0.0000
23.00	0.0007
45.50	0.0020
40.00	0.0050
Fracture	

QUESTION 3 [11 MARKS]

a. Briefly discuss the mechanisms of thermal conductivity.

[4]

b. An Extravehicular Mobility Unit (EMU) is to be built on the moon as shown in the **Figure 1**. The outside temperature in moon at EMU location may vary between -180°C to 100°C but the inside temperature has to be maintained 20°C. To maintain this temperature 400 mm thick regolith layer will be used. Total area of the EMU surface is 8 m^2 and thermal conductivity of regolith is 0.01 W/m-K. Determine heat loss in 29.5 days through regolith layer when temperature drops to -180°C.

[7]

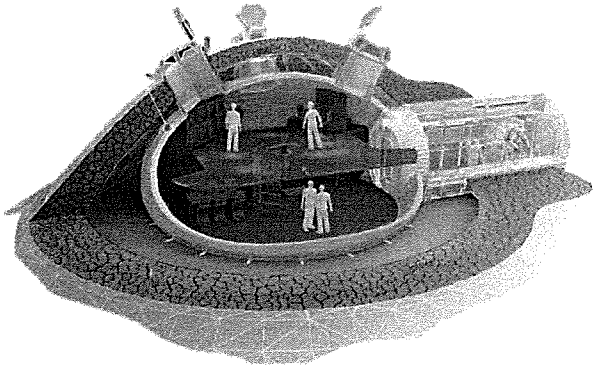


Figure 1. EMU model by European Space Agency's (ESA)

QUESTION 4 [11 MARKS]

a. Discuss elastic recovery of a material after plastic deformation using graph.

[4]

b. A specimen made of alloy has been tested for tension and a True stress vs True strain curve is obtained as shown in **Figure 2.** Determine the engineering stress and engineering strain at 0.08 true strain level.

[7]

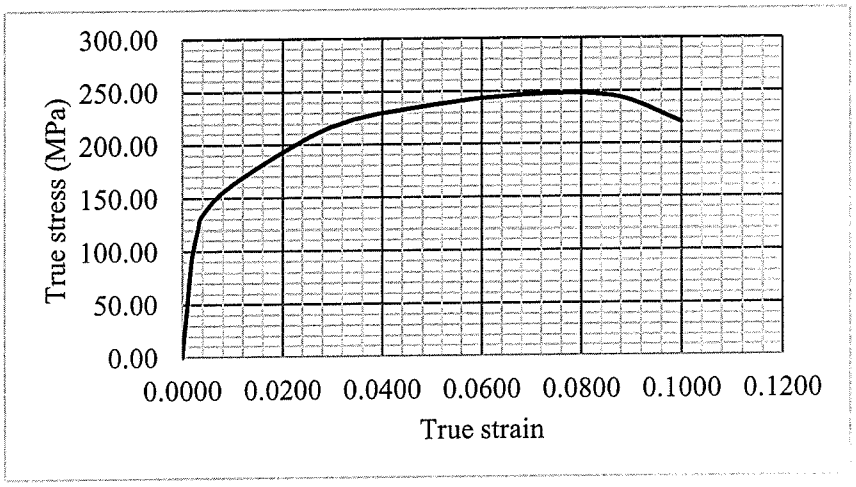


Figure 2. True Stress vs True strain graph

QUESTION 5 [11 MARKS]

a. State the effects of nanoparticles in self-consolidating concrete. [3]

b. With neat sketch show the formation of polycrystals. [8]

PART B

QUESTION 6 [9 MARKS]

a. Describe the Impact Chain Approach and Standards. [3]

b. Determine the Multidimensional Poverty Index (MPI) using data as provided. [6]

Indicator	Household		
	Rahim	Karim	Parvez
Household Size	7	5	7
1. Health			
a. At least one member is undernourished	0	1	0
b. One or more children have died	0	0	1
2. Education			
a. No one has completed at least six years of schooling	1	1	1
b. At least one school-age child not enrolled in school	0	0	1
3. Standard of living			
a. No electricity	0	0	1
b. No access to improved sanitation	0	1	1
c. No access to an improved source of drinking water	0	1	0
d. House built with inadequate materials	0	0	1
e. Household cooks with dung, wood, charcoal or coal	1	1	0
f. Household does not own a car or truck and does not own more than one of the following assets: radio, television, telephone, computer, animal cart, bicycle, motorbike or refrigerator.	1	0	1

QUESTION 7 [9 MARKS]

a. Describe the Solid waste management hierarchy. [3]

b. State some powers and functions of the Director General of the Department of Environment (DoE). [6]

QUESTION 8 [9 MARKS]

a. Describe externalities and how they cause environmental market failure. [3]

b. A textile company emits 300 m^3 gases annually. The Marginal Abetment Cost (MAC) curve for emission reduction is shown in **Figure 3**. To control emission, government imposed a tax of BDT 20 per cubic meter emission. Mathematically which amount of emission will be cost effective. [6]

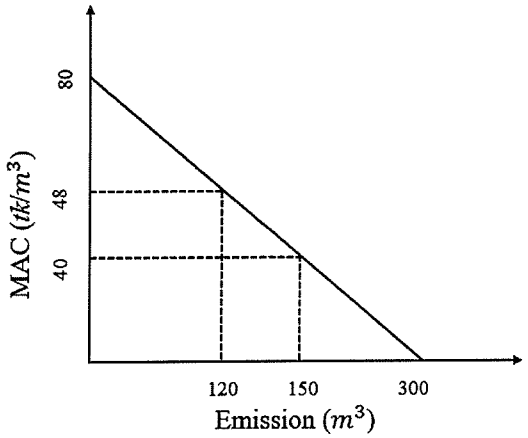


Figure 3. MAC curve

QUESTION 9 [9 MARKS]

a. Describe the major areas of Sustainable Development. [3]

b. The following table shows the Human Development Index (HDI) indicator values of country 'X'. Calculate the Gender Development Index (GDI) of country 'X' and comment on it. [6]

Indicators	Male	Female
Life expectancy at Birth	73.4	78.8
Mean years of schooling	14.3	13.9
Expected years of schooling	13.0	11.6
GNI per capita (PPP USD)	11,795	11,568

QUESTION 10 [9 MARKS]

a. Explain how clean air can be priced. [3]

b. Express the procedure of attaining the Environmental Clearance Certificate (ECC) for Orange-B category using a flowchart. [6]

University of Asia Pacific
Department of Civil Engineering
Final Examination, Fall 2024
Program: B.Sc. in Civil Engineering
2nd Year 1st Semester

Course Title: Mathematics III | Course Code: MTH 201

Time: 3 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. Using system of linear equation balance the following equation [15]

$$CH_3COF + H_2O \rightarrow CH_3COOH + HF$$

b. Using row echelon form find A^{-1}, Where $A = \begin{bmatrix} 1 & 2 & 3 \\ 2 & 5 & 3 \\ 1 & 0 & 8 \end{bmatrix}$. [10]

QUESTION 2 [25 MARKS]

a. A body cools from 370°C to 330°C in 10 min in air which is maintained to 290°C. What is the temperature after 40 min? [15]

b. Solve the Bernoulli's differential equation $\frac{dy}{dx} - \frac{y}{x} = y^2 sinx^2$. [10]

QUESTION 3 [25 MARKS]

a. Calculate standard deviation of the following distribution. Using empirical relationship find mean deviation and quartile deviation [15]

Class interval	0-4	4-8	8-12	12-16
Frequency	4	8	2	1

b. Calculate mean deviation of the following distribution [10]

Class	0-5	6-11	12-17	18-23	24-29
Frequency	8	10	12	9	5

QUESTION 4 [25 MARKS]

a. A function $f(x)$is continuous random variable function defined as follows [10]

$$f(x) = \begin{cases} k(2x+3) & 0 < x < 4 \\ 0 & otherwise \end{cases}$$

a) Find k?
b) Find $P(1 < x < 2)$.
c) Find $P(x > 2)$.

b. Check the following function mass function or not [10]

(i) $f(x) = \frac{2x-1}{5}; x = 0,1,2,3$

(ii) $f(x) = \frac{2x+1}{5}; x = 0,1,2,3$

(iii) $f(x) = \frac{x+1}{5}; x = 0,1,2$

c. If f(x) is a mass function defined as the following [05]

x	-2	-1	0	1	2
f(x)	0.15	0.25	0.10	k	0.40

a) Find the value of k?
b) Find $P(-1 \leq x \leq 1)$.
c) Find $P(0 \leq x \leq 2)$.

QUESTION 5 [25 MARKS]

a. Solve the following system of linear equation [15]

$$x_1 + 3x_2 - 2x_3 + 2x_5 = 0$$
$$2x_1 + 6x_2 - 5x_3 - 2x_4 + 4x_5 - 3x_6 = 0$$
$$5x_3 + 10x_4 + 15x_6 = 0$$
$$2x_1 + 6x_2 + 8x_4 + 4x_5 + 18x_6 = 0$$

b. Find determinant of the matrix $\begin{bmatrix} 10 & 2 & -3 \\ 5 & 12 & 15 \\ 7 & -6 & 4 \end{bmatrix}$ with the help of Gaussian elimination. [10]

OR

QUESTION 6 [25 MARKS]

Calculate moments and kurtosis of the following distribution [25]

Class	0-5	6-11	12-17	18-23	24-29
Frequency	8	10	12	9	5

QUESTION 7 [25 MARKS]

a. Three boxes contain 6 red, 4 black; 4 red, 6 black and 5 red, 5 black balls respectively. One of the box is selected at random and a ball is drawn from it. If the ball drawn is red find the probability that it is drawn from the first box. [10]

b. Three bulbs are chosen at random from a lot of 15 bulbs of which 5 are defective. Find the probability that [10]
i. none are defective,
ii. exactly one is defective,
iii. at least one is defective.

OR

QUESTION 8 [25 MARKS]

a. Solve the homogeneous differential equation $x^3 dy = (xy^2 - x^2 y)dx$. [10]

b. Check the differential equation exact or not and solve it [15]

$$(3x^2y^4+2xy)\,dx + (2x^3y^3 - x^2)dy = 0.$$

University of Asia Pacific
Department of Civil Engineering
Final Examination, Fall 2024
Program: B. Sc. in Civil Engineering
2nd Year 1st Semester

Course Title: Mechanics of Solids I | Course Code: CE 211
Time: 3 hours | Credit Hour: 3 | Full Marks: 100 (10 x 10)

ANSWER ALL THE QUESTIONS

QUESTION 1 [10 MARKS]

Draw axial force (AF), shear force (SF) and bending moment (BM) diagram **EITHER** for member ***cd*** of the structure ***abcdef*** loaded as shown in ***Fig.1*** **OR** for member ***ac*** of the structure ***abcd*** loaded as shown in ***Fig.5***. (Consider members are weightless) [10]

QUESTION 2 [10 MARKS]

Draw axial force (AF), shear force (SF) and bending moment (BM) diagram for member ***bd*** of the frame ***abcd*** loaded as shown in ***Fig.2***. [10]

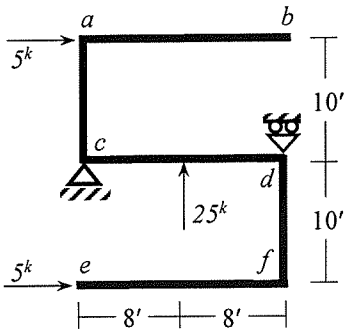


Fig.1

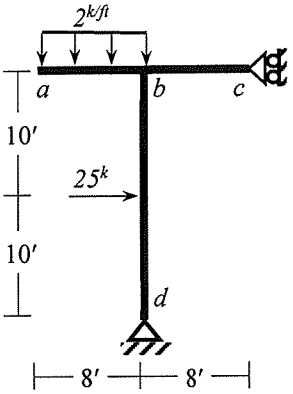


Fig.2

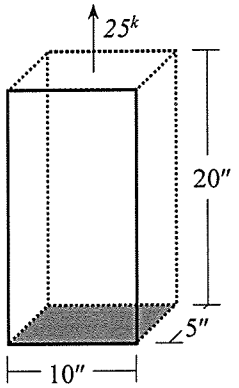


Fig.3

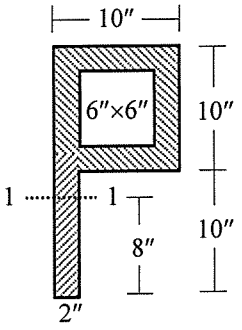


Fig.4

QUESTION 3 [10 MARKS]

The rectangular prism shown in ***Fig.3*** is subjected to normal force in the Y direction. Calculate the normal stresses and strains that developed in the prism [Given: Modulus of Elasticity = *25000 ksi* and Poisson's Ratio = *0.25*]. [10]

QUESTION 4 [10 MARKS]

Calculate the flexural shear stress produced at ***1-1*** (8 inch above from the bottom) of the section shown in ***Fig.4*** **OR** in ***Fig.7*** if the induced shear force is *50 kips*. [10]

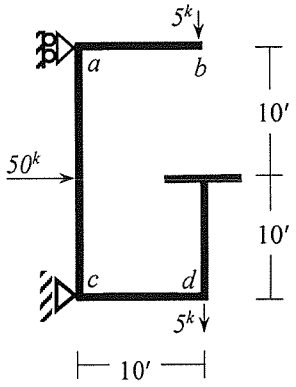


Fig.5

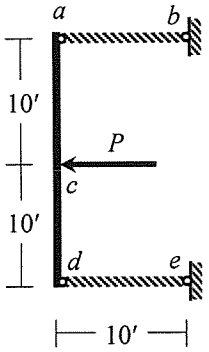


Fig.6

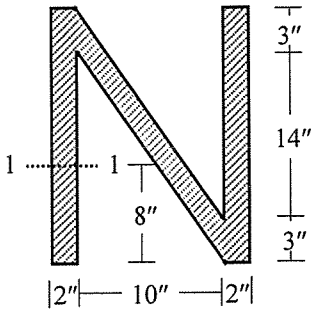


Fig.7

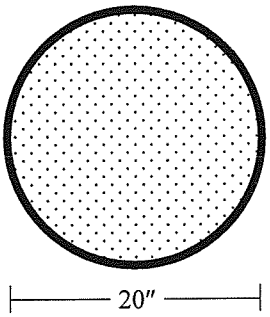


Fig.8

QUESTION 5 [10 MARKS]

A rigid vertical member ***acd*** is attached to two rods: steel rod ***ab*** and aluminum rod ***de***, and restrained at ***b*** and ***e***, respectively. A concentrated load ***P*** is applied at mid-point of the rigid member as shown in ***Fig.6***. Determine the required cross-sectional area A_{st} so that the axial deformations in both rods are equal under the applied load [Given: $E_{st} = 29000\ ksi$, $E_{al} = 10000\ ksi$, $A_{al} = 3in^2$] [10]

QUESTION 6 [10 MARKS]

A cylindrical steel pressure vessel (***Fig.8***) of *20″* in diameter with a wall thickness of 1″ is subjected to an internal pressure of *250 psi* [Given: Modulus of Elasticity = *30000 ksi* and Poisson's Ratio = *0.25*]

a) Calculate the tangential and longitudinal stresses and strains in the steel. [5]
b) To what value may the internal pressure be increased if the allowable stress in steel is *75 ksi*. [5]

QUESTION 7 [10 MARKS]

The vertical shear force is *2 kips*. Compute and illustrate shear flow and determine the location of shear center for the cross section shown in ***Fig.9*** [Given, thickness of the cross section, $t = ¼\ inch$]. [10]

QUESTION 8 [10 MARKS]

For a cantilever beam shown in ***Fig.10*** (a) calculate the flexural shear flow at bolt level, and (b) calculate the spacing of *1″* diameter bolts required at the joint to withstand the shear flow [Given: Shear force at the section, *V = 50 kips*, Allowable shear stress for bolt is *30 ksi*]. [10]

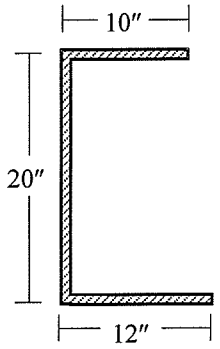


Fig.9

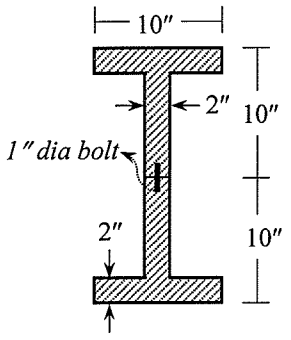


Fig.10

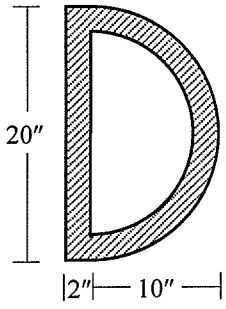


Fig.11

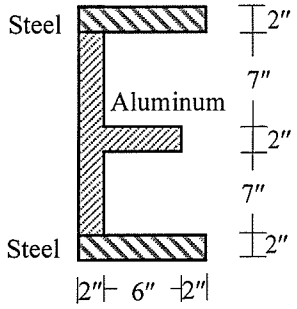


Fig.12

QUESTION 9 [10 MARKS]

Fig.11 shows a cross section consisting of a metal of a cantilever beam having a thickness of 2 inch. Calculate the maximum allowable induced bending moment [Given: $E_{metal} = 25000\ ksi$, $\sigma_{allowable} = 50\ ksi$]. [10]

QUESTION 10 [10 MARKS]

Fig.12 shows a composite cross section consisting of steel and aluminum of a simply supported beam. Calculate the maximum stresses produced in aluminum and steel for induced bending moment of *50 kip-ft* [Given: $E_{steel} = 30000\ ksi$, $E_{aluminum} = 10000\ ksi$]. [10]

University of Asia Pacific
Department of Civil Engineering
Final Examination, Fall 2024
Program: B.Sc. in Civil Engineering
2nd Year 1st Semester

Course Title: Principles of Accounting | Course Code: ACN 201
Time: 2 hours | Credit Hour: 2 | Full Marks: 50

(PO11/ CO1/ K5)

QUESTION 1 [12 MARKS]

Answer all the following questions:

i. "All steps of the accounting cycle are linked with each other"- do you agree with the statement? Why? [4]

ii. Differentiate variable cost and fixed cost with appropriate examples related to a construction company. [4]

iii. Explain the assumptions of CVP analysis with examples. [4]

(PO11/ CO5/ K5)

QUESTION 2 [14 MARKS]

Data for Iftekhar Corporation are shown below:

	Total	Per unit
Sales	Tk. 500,000	Tk 100
(-) Variable expense	300,000	(60)
Contribution margin	200,000	Tk 40

Fixed expenses are Tk 70,000 per month and the company is selling 5,000 units per month.

i. Refer to the original data, what is the revised net operating income if the selling price per unit increases by 10%, variable expenses increase by Tk 3.20 per unit, and the number of units sold decreases by 10%? [5]

ii. Refer to the original data, how much will net operating income increase (decrease) per month if the company uses higher-quality components that increase the variable expense by Tk 5 per unit, increase unit sales by 5% and increase fixed expense by Tk 5,000. [5]

iii. **Refer to question (ii),** calculate breakeven point in dollar sales. How much units do the company need to sell if the organization wants to earn the original/ previous net operating income? [4]

(PO11/ CO2, CO3/ K5)

QUESTION 3 [12 MARKS]

Answer any one of the followings (a or b):

a. The comparative statements of Jupiter Company are presented below:

Jupitar Company
Balance sheet

	2020(Taka)	2019(Taka)	2018 (Taka)
Assets:			
Current assets			
Cash	21,000	18,000	20,000
Short- term investments	18,000	15,000	14,000

Accounts receivables (net)	86,000	74,000	70,000
Inventory	90,000	70,000	100,000
Total Current Assets	215,000	177,000	204,000
Fixed Assets	423,000	383,000	346,000
Total Assets	**Tk 638,000**	**Tk. 560,000**	**Tk 550,000**
Liabilities and Stockholder's Equity:			
Current liabilities			
Accounts payable	122,000	110,000	100,000
Income tax payable	23,000	22,000	20,000
Total Current Liabilities	145,000	130,000	120,000
Long term liabilities			
Bond payable	120,000	80,000	100,000
Total Liabilities	265,000	210,000	220,000
Stockholders' equity			
Common stock (Tk 5 par)	150,000	150,000	150,000
Retained earnings	223,000	200,000	180000
Total stockholders' equity	373,000	350,000	330,000
Total Liabilities & Stockholders' Equity	**Tk 638,000**	**Tk 560,000**	**Tk 550,000**

Other Information:

	2020 (Taka)	2019 (Taka)	2018 (Taka)
Net Sales	600,000	520,000	550,000
Cost of Goods Sold	415,000	354,000	300,000
Net Income	38,400	31,400	35,000

Required: Compute the following ratios of 2020 and 2019 and compare the results of two years:

i. Current ratio
ii. Inventory turnover
iii. Profit margin
iv. Asset turnover
v. Debt to asset ratio
vi. Return on shareholder's equity

Or,

b. Some of the beginning balances of Moon Company of its trial balance on July 01, 2023:

	Debit (tk)	Credit (tk)
Cash	60,000	
Supplies	2,800	
Equipment	25,000	
Unearned rent revenue		10,200
Service revenue		60,000
Interest expense	1000	
Salaries and wages expense	14,000	

i. **Prepare the journal entries of Moon Company:**

July 1. Moon company invested Tk 500,000.
July 3. Purchased supplies Tk 5,000 on account.

July 12. Paid one year insurance policy Tk 3,600.
July 13. Cash received Tk. 10,200 but service has not yet been performed.
July 15. Purchase equipment Tk 20,000.
July 31. Salaries are paid Tk. 20,000 of which Tk 15,000 is paid for current month.

ii. Prepare the adjusting entries of Moon Company:

1. The equipment depreciates Taka 400 per month.
2. One-third of total unearned rent revenue was earned during the quarter.
3. Supplies on hand total Taka 900.
4. Insurance expires at the rate of Taka 200 per month.
5. Accrued utility expense Taka 1,000.
6. Service performed Tk 15,000 but cash has not been received yet.

(PO11/ CO4/ K5)

QUESTION 4 [12 MARKS]

Consider the following account balances (in thousands) for the Shaler Corporation on Year 2022:

	Beginning of the year	End of the year
Raw Material	TK 130,000	TK 68,000
Work- in process	1 66,000	1 44,000
Finished goods	246,000	204,000

	End of the year
Purchase of direct materials	TK. 256,000
Direct manufacturing labor	212,000
Indirect manufacturing labor	96,000
Indirect materials	28,000
Plant insurance	4,000
Depreciation- plant, building, equipment	42,000
Plant utilities	24,000
Repair and maintenance- plant	16,000
Marketing and distribution expense	124,000
General and administration expense	68,000
Revenue	Tk 2,000,000

a) Prepare a schedule of cost of goods manufactured. [8]
b) Prepare an income statement. [4]