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University of Asia Pacific
Department of Basic Sciences and Humanities
Semester Final Examination, Fall-2023
Program: B.Sc. in Civil Engineering
(Self-study)

Course Title: Bangladesh Studies: Society and Culture
Time: 2.00 hours

Credit: 2.00

Course Code: HSS211(a)
Full Marks: 50

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

1. Define culture and its elements. Discuss the nonmaterial elements of culture. [10]
2. Define marriage and family. Discuss the forms and functions of family. [10]
3. Define Gerherd Lenski's sociocultural evolution. Discuss how he relates the evolution of human societies with the innovation of technology. [10]

OR

4. Name the determinants of social class. Analyze the theory given by Max Weber about social class stratification. [10]
5. Define social stratification. Mention the major systems of social stratification. Briefly discuss about slavery. [10]

OR

6. Define social mobility. Briefly describe the types of social mobility with examples. Relate social mobility with open class system. [25]

University of Asia Pacific
Department of Basic Sciences and Humanities
Final Examination, Fall 2023
Program: B. Sc. Engineering (Civil)
Self-Study

Course Title: Bangladesh Studies: History
Time: 02 hours

Credit Hours: 02

Course Code: HSS211(b)
Full Marks: 100

There are **five** questions. Answer any **four**. All questions are of equal value. Figures in the right margin indicate marks.

1. a. Explain the background of the Partition of Bengal (1905). [15]
 b. Explain the Reaction of the Hindus and the Muslims. [10]
2. a. Explain the background of the Lahore Resolution. [15]
 b. Explain the Reaction of the Lahore Resolution. [10]
3. a. Discuss the first phase of the Language Movement. [15]
 b. Discuss the significance of the Language Movement. [10]
4. Explain the 6-point program of the Awami League. [25]
5. Write an article on the Liberation War of Bangladesh. [25]

University of Asia Pacific
Department of Civil Engineering
Final Examination, Fall 2023
Program: B.Sc. in Civil Engineering

Course Title: Mechanics of Solids I (Old)
 Time: 3 hours

Credit Hour: 3.0

Course Code: CE 211
 Full Marks: 90 (9 x 10)

ANSWER ALL THE QUESTIONS

1. Determine the maximum stress in the concrete and the steel for a reinforced concrete beam with the section shown (in Fig.1) if it is subjected to bending moment of 35 kip-ft. The reinforcement consists of four #9 steel bars. (each bar area is 1 in^2). Assume a cracked section. [Given: E_s (steel) = 30000ksi, E_c (concrete) = 3000 ksi,

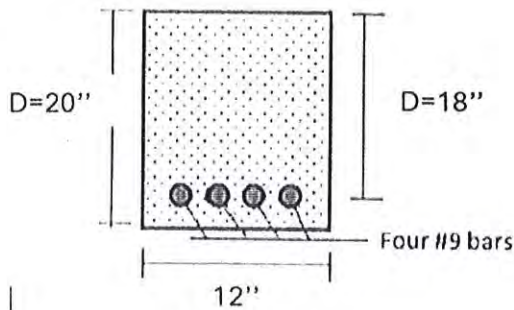


Fig.1

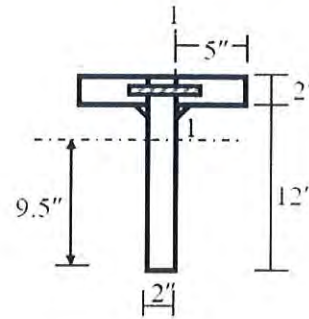


Fig.2

2. (i) Calculate the flexural shear flow at Level 1-1 of the T-sections joined as shown in Fig.2 if loaded as the simply supported beam, with uniform loading of 3 k/ft.
 (ii) Calculate the spacing of 5/8" bolts required at the joints to withstand the shear flow.
 (iii) Calculate the size of welds required at the joints [Given: Allowable shear stress = 15 ksi]
3. Determine the magnitude of the uniformly distributed load, w , on the simply supported beam of 20 ft, with a uniformly distributed load on w working on it if the maximum allowable tensile and compressive bending stress in the cross-section as shown in Fig.3 are 50 ksi and 30 ksi

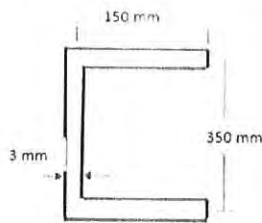


Fig.3

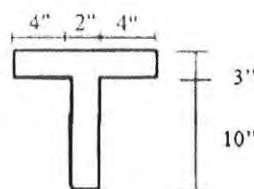


Fig.4

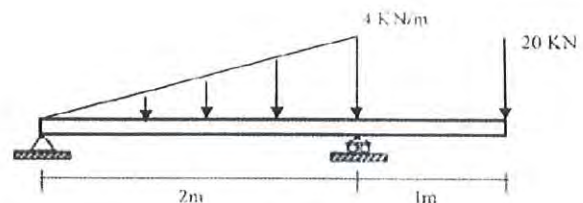


Fig.5

4. The vertical shear force is 5000 N. Compute and illustrate shear flow and determine the location of the shear center in Fig.4.
5. Draw the shear force diagram and bending moment diagram of the beam *ABCD* loaded as shown in Fig.5
6. A uniform concrete slab of total weight W is to be attached, shown in Fig. 6, to two rods whose lower ends are on the same level. Determine the length of the steel rod so that the slab will remain level.

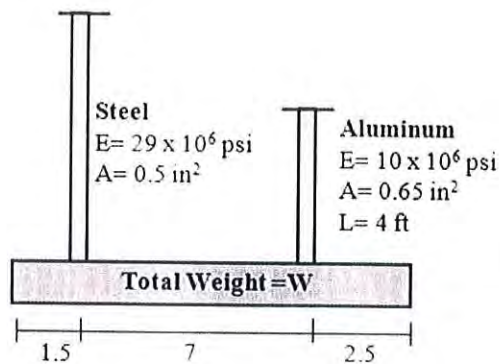


Fig.6

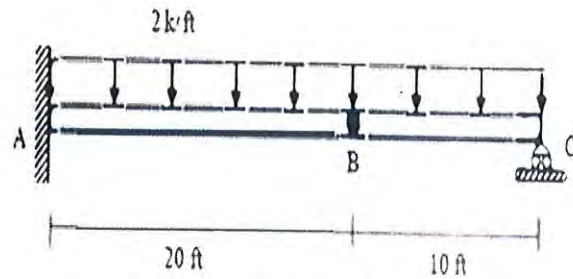


Fig.7

7. Draw the shear force and bending moment diagram for the beam loaded as shown in Fig. 7 . Note that B is an internal hinge.
8. A cylindrical steel pressure vessel of 520 mm in diameter with a wall thickness of 25 mm is subjected to an internal pressure of 5.4 MPa [Given: Modulus of Elasticity = 200 GPa and Poisson's Ratio = 0.25]
 - a) Calculate the tangential and longitudinal stresses and strains in the steel.
 - b) To what value may the internal pressure be increased if the allowable stress in steel is 130 MPa?
 - c) If the internal pressure is increased until the vessel bursts, sketch the type of fracture that would occur.
9. As shown in the figure 8, A small sandwich beam in Figure 8 spanning 400mm is made up by bonding two aluminum alloy strips to an alloy steel bar. The idealized stress-strain diagrams are shown in the figure. What is the magnitude of the applied bending moment if it causes -7.7×10^{-3} longitudinal strain in the gage attached on the top of the aluminum alloy strip

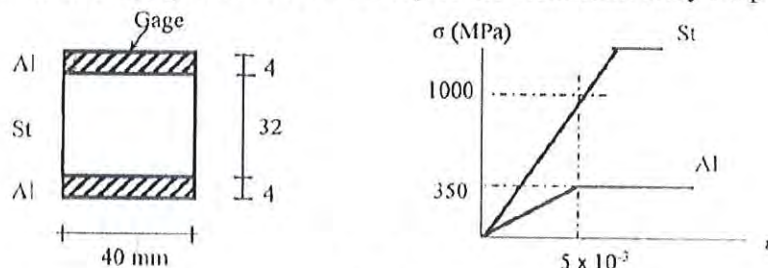


Fig.8

University of Asia Pacific
Department of Civil Engineering
Final Examination, Fall 2023
Program: B.Sc. in Civil Engineering

Course Title: Principles of Accounting
Time: 2 hour

Credit Hour: 2

Course Code: ACN 201
Full Marks: 50

1. Carla Tunnels started her own consulting firm on December 1, 2017. The following transactions occurred during the month of December.

December 1- Carla invested \$7000 cash in the business
December 2- Paid \$900 for office rent for the month
December-3 Purchased \$600 of supplies on account
December-5 Paid \$125 to advertise in the county news.
December-9 Received \$4000 cash for services provided.
December-12 Withdraw \$1000 cash for personal use.
December-15 Performed \$5400 of services on account.
December-17 Paid \$2500 for employees salaries
December-20 Paid for the suppliers purchased on account on December 3
December-23 Received a cash payment of \$4000 for services provided on account on
December-26 Borrowed \$5000 from the bank on a note payable
December-29 Purchased office equipment for \$4200 on account.
December-30 Paid \$275 for utilities.

- a. Prepare a tabular analysis on the basis of the given data. (7)
- b. Prepare an income statement for the given data. (3)
- c. Prepare an owner's equity statement and a balance sheet. (5+5)

2. Answer any of the following question

- (i) a. What is accounting. Describe the principles of accounting. (4)
- b. Explain the assumptions of accounting in your words. (6)

OR

- (ii) a. What are the qualitative characteristics of accounting information? (4)
- b. Explain the managerial accounting value chain of a manufacturing firm. (6)

3. a. Differentiate between product cost and period cost (3)

	Amount	Percent of sales
Sales	80000	100%
Variable Expense	32000	40%
Contribution Margin	48000	60%
Fixed expense	38000	
Net operating income	10000	

b. Compute the company's degree of operating leverage from the chart above. (3)

c. Using the DOL, estimate the impact on net income of a 5% increase in sales.

Verify your estimate from part 2 above by constructing a new contribution format income statement of the company assuming a 5% increase in sales. (4)

4. a. Do you think accounting and bookkeeping is same? If not, mention why. (3)

b. Journalize the following data. (7)

1.1.2000 Business Started with \$2,50,000 and cash deposited with Bank \$1,50,000

3.1.2000 Purchased machinery on credit from Rangan – \$50,000

6.1.2000 Bought furniture from Ramesh for cash – \$25,000

12.1.2000 Goods sold to Yesodha – \$22,500

13.1.2000 Goods returned by Yesodha – \$2,500

15.1.2000 Goods sold for cash –\$ 50,000

17.1.2000 Bought goods for cash – \$25,000

20.1.2000 Cash received from Yesodha – \$1000

21.1.2000 Cash paid to Ramola – \$20,000

25.1.2000 Cash withdrawn from bank –\$ 50,000

29.1.2000 Paid ad expense \$12500

30.1.2000 Bought stationery for cash --\$5000

31.1.2000 Cash withdrawn from bank for personal use of the proprietor –\$ 6,250

31.1.2000 Paid salaries –\$ 15,000

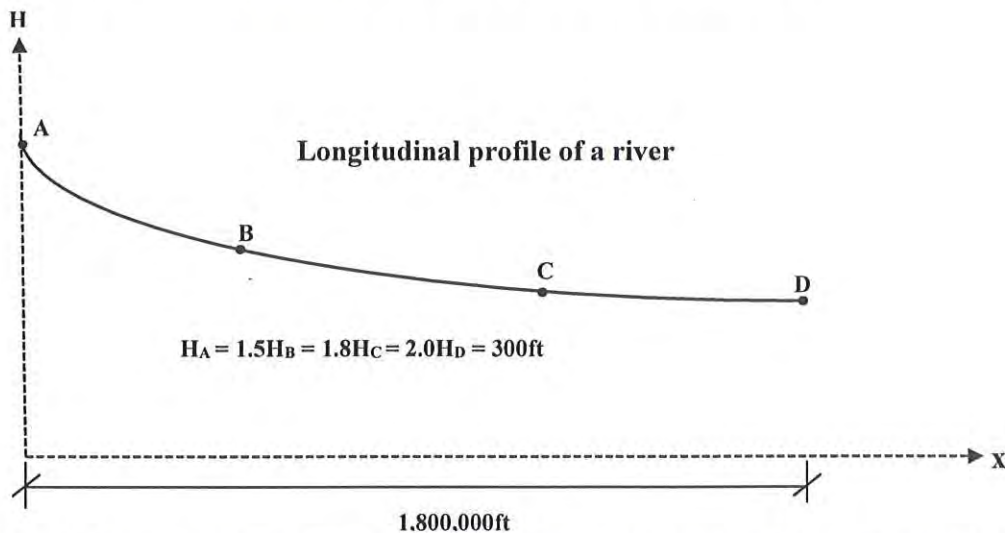
31.1.2000 Paid rent –\$ 2,500

University of Asia Pacific
Department of Civil Engineering
Final Examination, Fall 2023
Program: B.Sc. in Civil Engineering

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

(There are SIX questions in total.)

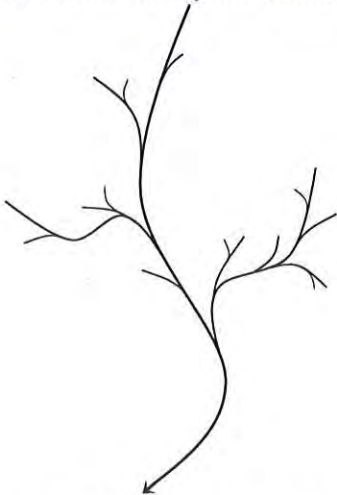
1. a) Derive a correlation between the diameter of sediment particles and the velocity of water flow. (6)
b) Describe the processes by which bed load is transported along the direction of the flow. (6)
c) Differentiate between ferromagnesian and non-ferromagnesian silicate minerals. (6)
d) Define the following properties of minerals: (6)
 i. Streak ii. Luster iii. Specific gravity
2. From the following figure: (5+5)
 i. Calculate the horizontal distance between locations B and D
 ii. Compute the erosional tendency at locations A, B, C and D



3. a) List the factors that influence drainage patterns and compare the parallel and trellis drainage patterns. (6)
b) Explain the possible effect of liquefaction on underground pipes. (6)
c) Rainfall with mild intensity can cause significant surface runoff if it persists for a long duration. Discuss. (6)
d) Imagine yourself as an exploration geologist, and evaluate the following scenarios: (4+4)
 i. As you venture into a scenic valley carved by a meandering river, you notice significant changes along the riverbanks. The previously narrow channels have expanded, with exposed sediment and eroded banks indicating ongoing erosion. Now, identify the mechanisms responsible for the widening of the valley that you observed during your exploration.

- ii. As part of an investigation in a seismic-prone region, you came across two different fault lines, each displaying distinct characteristics. Upon inspecting the first fault, you observed that the rock layers on one side of the fault have moved downward in relation to the other side. Moving on to the next fault line, you notice a contrasting situation. Classify the faults with a neat sketch and justify your answer.

4. Rank the streams of the following drainage basin having drainage density of 0.12/km. The results of the survey are summarized in the table below. (5+10)

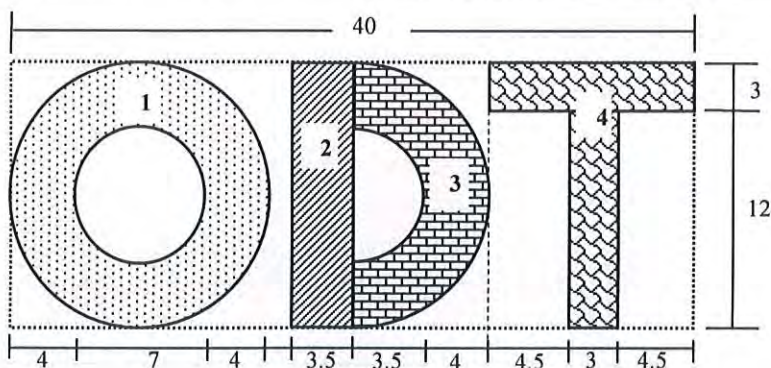


Stream Rank	Average Length (km)
1	5.9
2	18.3
3	40.4
4	98.2

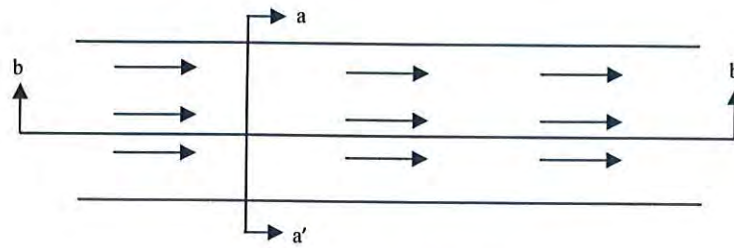
Hence, or otherwise calculate the following parameters:

- Average Bifurcation Ratio (ABR)
 - Average Length Ratio (ALR)
 - Stream Frequency (SF)
5. Using the following figure, calculate the rainfall intensity in inches/hr for the catchment area where the peak runoff is 150ft³/hr. [All units are in yard. 1 yard = 3 feet] (10)

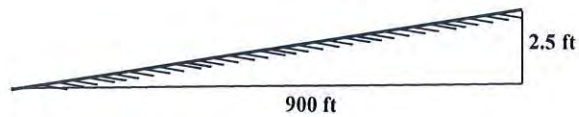
Area	Run-off co-efficient
1	0.75
2	0.42
3	0.57
4	0.30



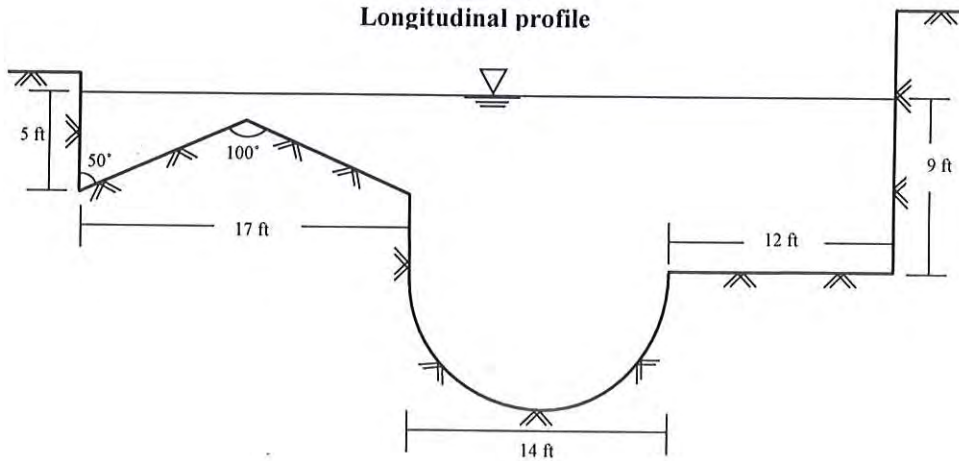
6. The longitudinal and cross-sectional profiles of a channel are given. Calculate the traction pressure along the channel bottom. (15)



Plan of a channel course



Section b-b'
Longitudinal profile



Section a-a'
Cross-sectional profile

University of Asia Pacific
Department of Civil Engineering
Final Examination, Fall 2023
Program: B.Sc. in Civil Engineering

Course Title: Material Science and Environmental Sustainability
Time: 3 hours

Credit Hour: 3.0

Course Code: CE 207
Full Marks: 100

There are **EIGHT** questions. Answer **ALL** of the.

1. (a) Briefly discuss current trend of using solar energy in Bangladesh. [2.5]
- (b) List the limitations of GDP as an indicator of welfare. [4]
- (c) Determine the Multidimensional Poverty Index (MPI) using data as provided. [6]

Indicator	Household		
	Karim	Jobaida	Polash
Household Size	7	5	6
1. Health			
a. At least one member is undernourished	1	0	0
b. One or more children have died	0	0	1
2. Education			
a. No one has completed at least six years of schooling	0	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	1	0	1
c. No access to an improved source of drinking water	1	0	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.	0	1	1

2. (a) State the ecosystem services with one example. [2.5]

(b) Explain how externality act as a reason of environmental market failure. [4]

(b) A textile company emits 300 m³ gases annually. The Marginal Abatement Cost (MAC) curve for emission reduction is shown in Figure: 1. To control emission, government imposed a tax of 20 Taka per cubic meter emission. Mathematically explain the reason of not reducing the emission up to 180 m³ annually upon tax introduction. [6]

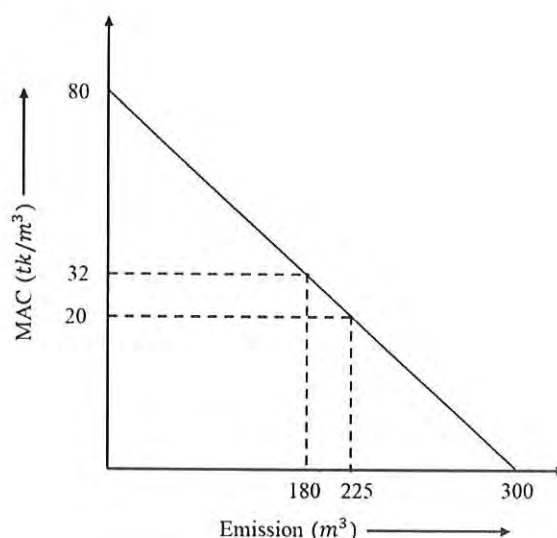


Figure: 1

3. (a) Name the guiding legislations of Environmental Court. [2.5]

(b) State some power and functions of the Director General of Department of Environment (DoE). [4]

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

4. (a) Tabulate the objectives of sustainable development. [2.5]

(b) "Sustainable development is about equity"- defend the statement. [4]

(c) The following table shows the Human Development Index (HDI) indicator values of country 'X'. [6]

Indicators	Male	Female
Life expectancy at Birth	76.4	78.8
Mean years of schooling	14.3	12.9
Expected years of schooling	11.0	11.6
GNI per capita (PPP USD)	12,895	11,568

Calculate the Gender Development Index (GDI) of country 'X' and comment on it.

5. (a) Identify two potential climate change impacts with examples. [2.5]

(b) Steel reinforcement inside beam is stress free at 20°C temperature. Calculate the temperature for which a stress of 172 MPa will be generated. For Steel, modulus of elasticity is 200 GPa and coefficient of thermal expansion $12 \times 10^{-6} \text{ } ^\circ\text{C}$. [4]

(c) Two specimens (Specimen A & Specimen B) have been tested for tension and resulting graphs are shown in Figure: 2. The initial length of each specimen is 10 inch and diameter of each is 0.5 inch. Analyze the energy absorbing capacity of the materials up to permanent deformation and up to fracture. [6]

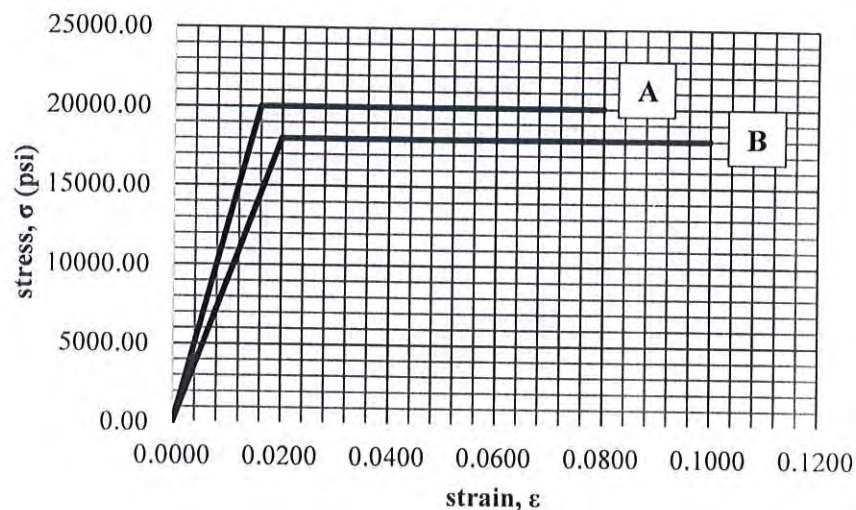


Figure: 2

6. (a) Show the chemical reactions of primary air pollutants generation through combustion. [2.5]

(b) Write a short note on Short Lived Climate Pollutant (SLCPs). [4]

(c) On 27 May, 2024 the following air quality data have been recorded at a monitoring station in Dhaka: $\text{PM}_{2.5} = 180 \mu\text{g}/\text{m}^3$ (24-hr); $\text{PM}_{10} = 300 \mu\text{g}/\text{m}^3$ (24-hr); $\text{O}_3 = 0.1 \text{ ppm}$ (8-hr). Prepare the AQI index report of the given scenario according to USEPA. [6]

7. (a) Outline the advantages of transfer and transport of solid waste. [2.5]

(b) Explain biologically accumulative water pollutants. [4]

(c) Compare the surface water and ground water polluting processes in Bangladesh. [6]

8. (a) Point some limitations of standards in ECR 1997. [2.5]
- (b) Differentiate between source-oriented approach and impact-oriented approach in case of standard setting. [4]
- (c) Discuss the objectives of Bangladesh Environment Policy (BEP) 2018. [6]

Required Tables

Breakpoints							AQI
O ₃ (ppm) 8-hr	O ₃ (ppm) 1-hr	PM _{2.5} (µg/m ³) 24-hr	PM ₁₀ (µg/m ³) 24-hr	CO (ppm) 8-hr	SO ₂ (ppm) 24-hr	NO ₂ (ppm) Annual	
0.000-0.064	--	0.0-15.4	0-54	0.0-4.4	0.000-0.034	(ii)	0-50
0.065-0.084	--	15.5-40.4	55-154	4.5-9.4	0.035-0.144	(ii)	51-100
0.085-0.104	0.125-0.164	40.5-65.4	155-254	9.5-12.4	0.145-0.224	(ii)	101-150
0.105-0.124	0.165-0.204	65.5-150.4	255-354	12.5-15.4	0.225-0.304	(ii)	151-200
0.125- 0.374	0.205-0.404	150.5-250.4	355-424	15.5-30.4	0.305-0.604	0.65-1.24	201-300
(iii)	0.405-0.504	250.5-350.4	425-504	30.5-40.4	0.605-0.804	1.25-1.64	301-400
(iii)	0.505-0.604	350.5-500.4	505-604	40.5-50.4	0.805-1.004	1.65-2.04	401-500

University of Asia Pacific
Department of Civil Engineering
Final Examination, Fall 2023
Program: B.Sc. in Civil Engineering

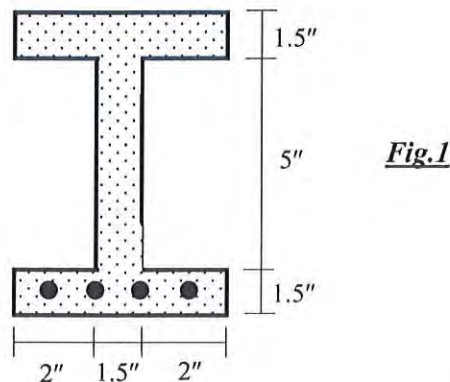
Course Title: Mechanics of Solids I
 Time: 3 hours

Credit Hour: 3.0

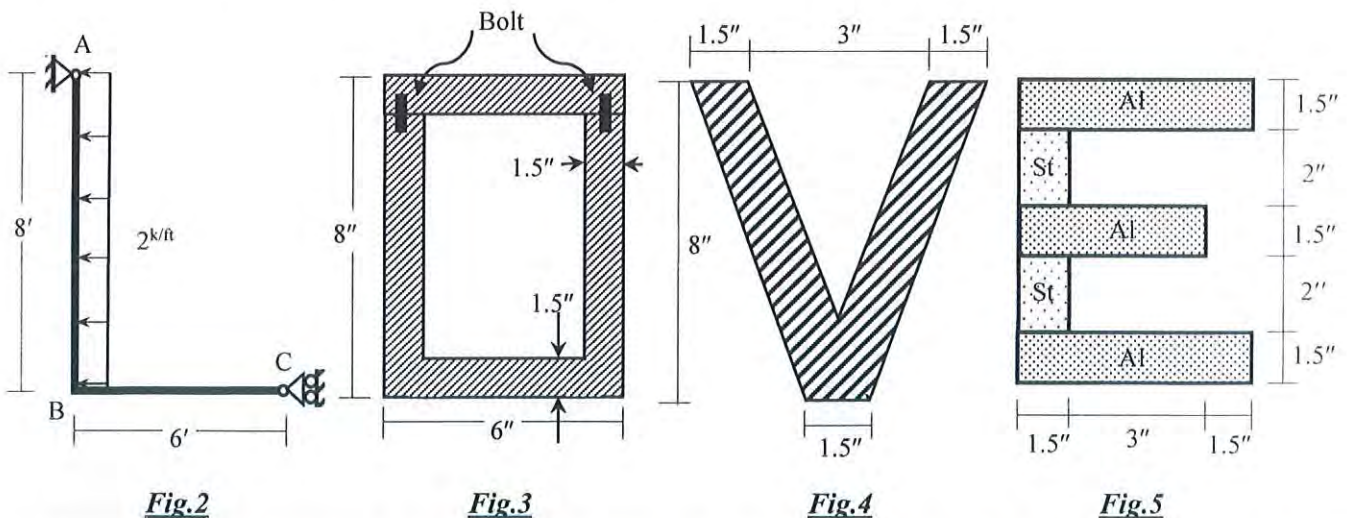
Course Code: CE 211
 Full Marks: 100 (10 x 10)

ANSWER ALL THE QUESTIONS

1. **Fig.1** shows a mid-span cross-section of a simply supported Reinforced Concrete beam. For maximum demand moment of 10 kip-ft, calculate the maximum compressive and tensile stresses produced in concrete and steel reinforcements respectively. Assume that the section is 'cracked' [Given: $E_{\text{steel}} = 30000$ ksi, $E_{\text{concrete}} = 3000$ ksi, Reinforcement area, $A_s = 4$ in²].



2. Draw the axial force, shear force and bending moment diagram for the frame **ABC** loaded as shown in **Fig.2**.
3. **Fig.3** shows cross section of a simply supported beam. (a) Calculate the flexural shear flow at bolt level, (b) Calculate the spacing of 3/4" bolts required at the joints shown in **Fig.3** to withstand the shear flow [Given: Shear force at the section, $V = 5$ kips, Allowable shear stress for bolt is 24 ksi].



4. Calculate the maximum shear stress produced in the section shown in **Fig.4** if the induced shear force is 5.10 kips.
5. **Fig.5** shows a composite cross section consisting of steel and aluminium of a simply supported beam. Calculate the maximum stresses produced in aluminium and steel for induced bending moment of 100 kip-ft [Given: $E_{\text{steel}} = 30000$ ksi, $E_{\text{aluminium}} = 10000$ ksi].

6. The vertical shear force is 2024 N. Compute and illustrate shear flow and determine the location of shear center shown in either Fig.6 or Fig. 7.

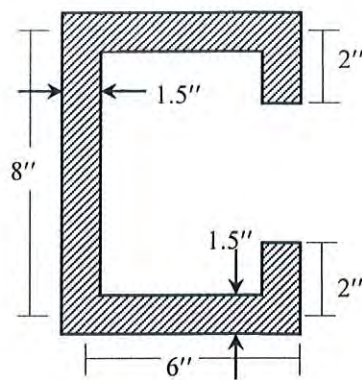


Fig.6

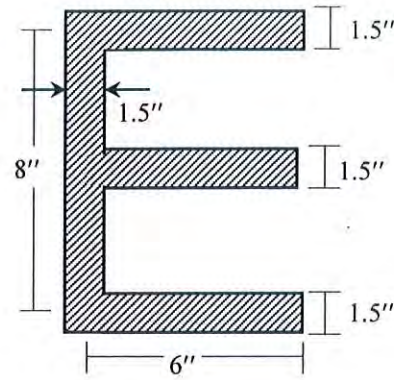


Fig.7

7. Draw the shear force diagram and bending moment diagram of the beam *ABCD* loaded as shown in Fig.8.



Fig.8

8. A uniform concrete slab of total weight *W* is to be attached, shown in Fig. 9, to two rods whose lower ends are on the same level. Determine the length of the steel rod so that the slab will remain level.

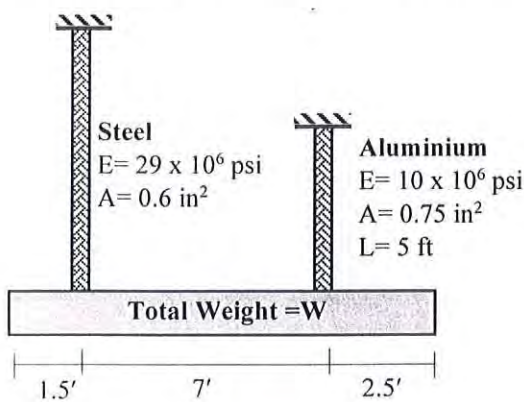


Fig.9

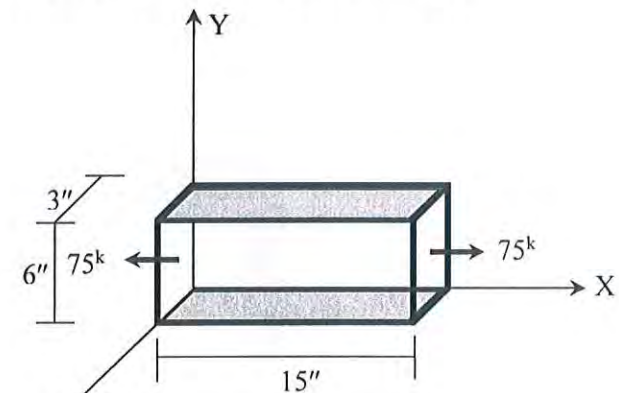


Fig.10

9. The rectangular prism shown in Fig.10 is subjected to normal force in the X direction and is restrained in the Y direction only. Calculate the normal stresses and strains that develop in the prism [Given: Modulus of Elasticity = 2000 ksi and Poisson's Ratio = 0.30].
10. A cylindrical steel pressure vessel of 510 mm in diameter with a wall thickness of 20 mm is subjected to an internal pressure of 5.1 MPa [Given: Modulus of Elasticity = 200 GPa and Poisson's Ratio = 0.25]
- Calculate the tangential and longitudinal stresses and strains in the steel.
 - To what value may the internal pressure be increased if the allowable stress in steel is 120 MPa.
 - If the internal pressure is increased until the vessel burst, sketch the type of fracture that would occur.

University of Asia Pacific
Department of Civil Engineering
Final Examination, Fall 2023
Program: B.Sc. in Civil Engineering

Course Title: Mathematics-III
Time: 3.00 Hour

Credit Hour: 3.00

Course Code: MTH 201
Full Marks: 150

There are **eight (8)** questions. Answer **six (6)** questions including **Q1, Q2, Q3 and Q4**.
Figures given in the right margin indicate the marks of the respective questions.

1. a. Solve the differential equation $\frac{dy}{dx} = \frac{y}{x} + \tan\left(\frac{y}{x}\right)$. [10]

b. Determine whether the differential equation $(x + \sin y)dx + (x \cos y - 2y)dy = 0$ is exact and solve it. [15]

2. a. Solve $x \frac{dy}{dx} + y = y^2 \ln x$. [10]

b. Solve $(D^2 + 1)y = x^2 \sin 2x$. [15]

3. a. Solve $x \cos x \frac{dy}{dx} + y(x \sin x + \cos x) = 1$, $0 < x < \frac{\pi}{2}$. [10]

b. Solve $(D^2 - 2D + 1)y = x^2 e^x$. [15]

4. a. Calculate the mean, median of the frequency distribution given below. Hence calculate the mode using relation. Also calculate mean deviation. [15]

Marks	0-20	20-40	40-60	60-80	80-100	100-120	120-140
No of Student	4	26	22	10	9	6	3

b. Calculate Q_1 , Q_2 and Q_3 . [10]

Height	30-40	40-50	50-60	60-70	70-80
Frequency	18	37	45	27	15

5. a. Solve the differential equation $(x^2 D^2 + xD - 4)y = 0$. [15]
- b. Define favorable event. In a bag, there are 4 red, 5 white, and 6 black balls. A ball is chosen randomly. What is the probability of getting (a) Red (b) White (c) Red or Black (d) Orange (e) Red or white or black. [10]

OR

6. a. Solve the differential equation $(x^2 D^2 + 1)y = 3x^2$. [15]
- b. What is sample space? Use a two-dimensional grid to illustrate the sample space for tossing a coin and rolling dice simultaneously. From this grid determine the probability of (a) getting a head (b) getting a tail and (c) getting a tail or 5. [10]

7. a. Suppose that X is a random variable with density function [10]

$$f(x) = \begin{cases} \frac{k}{(1+x)^2}, & x > 0 \\ 0, & \text{otherwise} \end{cases}$$

- (a) Find the value of k .
 (b) Find $f(x)$
 (c) Find $p(X < 1)$
 (d) Find $p(X > 1)$

- b.

Overtime	10-15	15-20	20-25	25-30	30-35	35-40
No of workers	11	20	35	20	8	6

 [15]

Calculate coefficient of skewness, and comments on its value.

OR

8. a. Consider the following density function [10]

$$f(x, y) = \begin{cases} \frac{(x(1+3y^2))}{4}, & 0 \leq x \leq 2, 0 \leq y \leq 1 \\ 0, & \text{otherwise} \end{cases}$$

Find $p\left[0 < x < 1, \frac{1}{4} < y < \frac{1}{2}\right]$.

- b.

Earnings	50-70	70-90	90-110	110-130	130-150	150-170	170-190
No of employees	4	8	12	20	6	7	3

 [15]

Calculate first four moments about assumed mean. Convert the results into moments about the mean.

University of Asia Pacific
Department of Basic Sciences and Humanities
Final Examination, Fall-2023
Program: B.Sc. in Civil Engineering
Self-Study

Course Title: Mathematics-III
Time: 3.00 Hours

Credit Hour: 3.00

Course Code: MTH 201
Full Marks: 150

There are **eight** (8) questions. Answer any **six** (6). All questions are of equal values, indicated in the right margin.

1. (a) Calculate the eigenvalues and associated eigenvectors for the matrix 15
$$A = \begin{pmatrix} 1 & 0 & -2 \\ 0 & 0 & 0 \\ -2 & 0 & 4 \end{pmatrix}.$$

(b) Find the characteristic equation of the matrix $A = \begin{pmatrix} 1 & 2 & 3 \\ 2 & -1 & 4 \\ 3 & 1 & 1 \end{pmatrix}$ and verify cayley- 10
hamilton theorem for the given matrix.
2. (a) Show whether the transformation is linear or not 10
 $T: \mathbb{R}^3 \rightarrow \mathbb{R}^2, T(x, y, z) = (3x - 2y + z, x - 3y - 2z).$
(b) Find the rank and nullity of the linear transformation defined as follows 15
 $T: \mathbb{R}^3 \rightarrow \mathbb{R}^3, T(x, y, z) = (x + 2y, y - z, x + 2z).$
3. (a) Determine whether $(4, 2, 1, 0)$ is a linear combination of vectors 10
 $\{(1, 2, -1, 0), (1, 3, 1, 2), (6, 1, 0, 1)\}$
(b) Test whether the following matrices are linearly dependent or independent 15
 $\left\{ \begin{pmatrix} 1 & 1 \\ 1 & 1 \end{pmatrix}, \begin{pmatrix} 1 & 0 \\ 0 & 1 \end{pmatrix}, \begin{pmatrix} 1 & 1 \\ 0 & 0 \end{pmatrix} \right\}.$
4. (a) Solve the following system of linear equations by gaussian elimination method 12
$$\begin{aligned} 5x - 6y + 4z &= 15 \\ 7x + 4y - 3z &= 19 \\ 2x + y + 6z &= 46 \end{aligned}$$

(b) Find the solution of the system by applying crammer's rule 13
$$\begin{aligned} x + 2y - z &= 9 \\ 2x - y + 3z &= -2 \\ 3x + 2y + 3z &= 9 \end{aligned}$$

5. (a) Calculate mean and median of the distribution given below. Hence calculate the mode using empirical relation 20, 18, 22, 27, 25, 12, 15. 15
- (b) Calculate standard deviation for the following data 10

Tax(thousands)	5-10	10-15	15-20	20-25	25-30	30-35	35-40
No. of managers	18	30	46	28	20	12	6

6. Find kurtosis for the following distribution 25

Profit(lakhs)	70-90	90-110	110-130	130-150	150-170
No. of companies	8	11	18	9	4

7. (a) Based on the frequency distribution given below calculate mean for mid exam 10

marks	10	75	80	45	55
No. of students	15	10	13	11	12

- (b) Calculate quartile deviation for the following data and then calculate mean deviation using empirical relation 15

profit(lakhs)	0-10	10-20	20-30	30-40	40-50	50-60	60-70
no. of companies	8	3	6	2	5	4	7

8. (a) Write down the probability density function of binomial distribution. An unbiased coin is tossed 8 times. The mean and variance of a binomial distribution are 6 and 8 respectively. Find the probability density function of at best 2 flower. 12
- (b) Write down the probability density function of poisson distribution. The mean of death of kids per day in a village is 7. What is the probability of no death in a particular day. 13

University of Asia Pacific
Department of Civil Engineering
Final Examination Fall 2023
Program: B.Sc. Engineering (Civil)

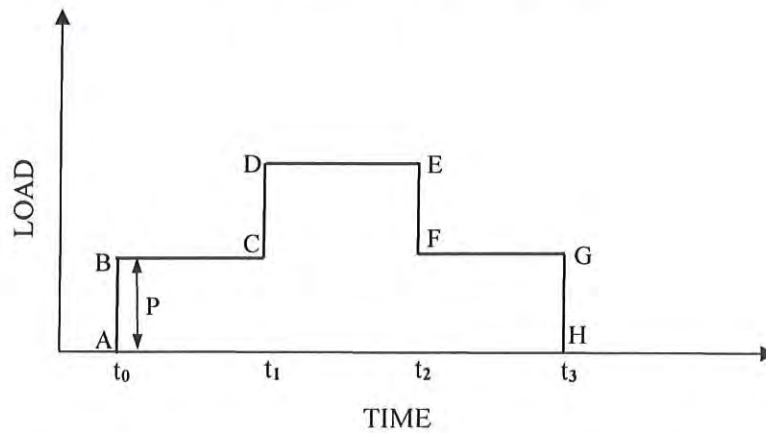
Course Title: Engineering Materials
Time: 3 hours

Credit Hour: 4.00

Course Code: CE 201
Full Marks: 120

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

1. a) Draw the strain response diagram using the load versus time graph of an elasto-plastic material shown below ($t_1 - t_0 = t_2 - t_1 = t_3 - t_2$; $AB = CD = EF = GH = P$). [7+5+3]



- b) First class brick samples are tested for density. The following results are obtained from the test. Calculate the density of brick in kg/m^3 . Assume specific gravity of wax at $25^\circ\text{C} = 0.877$.
- Oven dry weight of a brick = 1870 gm
 - Weight of wax coated brick in air = 2100 gm
 - Weight of wax coated brick in water = 840 gm
- c) Outline the procedure in brief to determine the field test of sand.
2. a) Explain the effect of water/cement ratio on the strength of concrete. [8+12]
- b) The following data are provided in a mortar mix design for plastering work of a brick masonry wall of 15 m long and 7 m height:
- Cement to sand ratio (weight basis) = 3
 - Water to cement ratio = 0.45
 - Specific gravity of sand, $G_s = 2.65$
 - Cement type = Ordinary Portland cement ($G_c = 3.15$)
 - Air content = 1%
 - Mortar thickness = 12 mm

- i. Determine the unit weight of mortar.
- ii. Estimate the amount of each ingredient of mortar necessary for the plastering work of both surfaces of the wall. Assume 20% extra volume of material is necessary due to the loss of mortar during application on the wall.

3. a) Three aggregates are to be mixed together to obtain an aggregate blend for an asphalt mixture. Estimate the mix ratio of aggregate A, B, and C to meet the specification using equation solution method and determine the percentage of blended aggregate for each sieve. [9+6]

Material	Aggregate A	Aggregate B	Aggregate C	Target Specification
Sieve	% Passing	% Passing	% Passing	% Passing
1.5	100	100	100	
$\frac{3}{4}$	100	92	100	99%
$\frac{3}{8}$	100	46	100	
No. 4	73	23	100	82%
No. 8	55	11	100	
No. 16	43	0	92	
No. 30	15	-	41	28%
No. 50	3	-	2	

- b) For a concrete mix ratio of 1:2:4 (volume basis), calculate the volume of sand required to cast 80 m³ concrete considering bulking of sand. During the bulking test, sand was initially filled up to 300 mm into a measuring cylinder. After full inundation with water, the height of the sand sample came down to 210 mm.
4. a) Suppose urgent repair work is required for a highway. Discuss the type of concrete admixture need to be used for prompt service and clarify your discussion. [5+5+5]
- b) State the features of good stones.
- c) List down the constituents of paints along with their functions.
5. a) Define Permeability. Identify the factors that influences the permeability of concrete. [5+5]

- b) Aggregates from four sources having absorption capacities of 1.3%, 1.5%, 0.9% and 1.8% are blended at a ratio of 40:30:20:10 by weight, respectively. Compute the absorption capacity of the aggregate blend.
6. a) Design a concrete mix following **ACI 211.1 mix design method** for pavement. Also [20+5]
find the amount of ingredients required for a trial mix of 9 set of cylinders. Use **Table 1- Table 4** for the necessary data. The required properties are given below:
- Cement type: Ordinary Portland Cement; Specific gravity = 3.15
 - Specified compressive strength, $f'_c = 32$ MPa
 - Slump value = 75 mm
 - Loss factor = 1.1
 - Coarse Aggregate:
 - ✓ Maximum size: 37.5 mm
 - ✓ Absorption capacity: 1.1%
 - ✓ Moisture content: 0.8%
 - ✓ Bulk specific gravity (Oven Dry): 2.5
 - ✓ Unit weight (dry-rodded): 1680 kg/m³
 - Fine Aggregate:
 - ✓ Fineness modulus: 2.9
 - ✓ Absorption capacity: 1.5%
 - ✓ Moisture content: 3.4%
 - ✓ Bulk specific gravity (OD): 2.64
- b) Design the mix ratio of a concrete comprising of crushed stone and coarse sand using **minimum voids method**. Laboratory test result provided that voids in crushed stone was 35% and voids in coarse sand was 20%. Consider 15% excess for cement and 8% excess for fine aggregate.
7. a) Differentiate between hydrated lime and lime putty. [8+12]
- b) Explain the advantages and disadvantages of ferrocement.

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

Specified compressive strength, f'_c , MPa	Required average compressive strength, f'_{cr} , MPa
Less than 21	$f'_c + 7.0$
21 to 35	$f'_c + 8.5$
Over 35	$1.10 f'_c + 5.0$

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 ($\frac{3}{8}$)	0.50	0.48	0.46	0.44
12.5 ($\frac{1}{2}$)	0.59	0.57	0.55	0.53
19 ($\frac{3}{4}$)	0.66	0.64	0.62	0.60
25 (1)	0.71	0.69	0.67	0.65
37.5 ($1\frac{1}{2}$)	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