

University of Asia Pacific  
 Department of Civil Engineering  
 Final Examination Spring 2017  
 Program: B. Sc. Engineering (Civil)

2-1

Course Title: Mechanics of Solids I  
 Time: 3 hours

Course Code: CE 211  
 Full Marks: 100

Answer ANY TEN (10) of the following questions.

1. The rigid bar  $ABC$  shown in Fig. 1 is hinged at  $A$  and supported by a steel rod at  $B$ . Determine the largest load  $P$  that can be applied at  $C$  if the vertical deflection of end  $C$  cannot exceed 0.25 inch. [10]

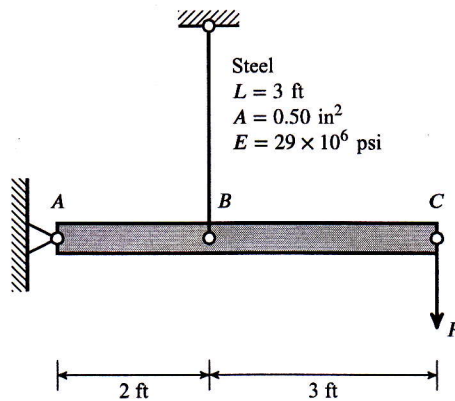


Fig. 1

2. Determine the required cross-sectional areas of members  $BC$ ,  $BG$  and  $FG$  of the truss to carry an inclined load of 500 kips as shown in Fig. 2, if the allowable tensile stress is 40 ksi and the allowable compressive stress is 24 ksi. [10]

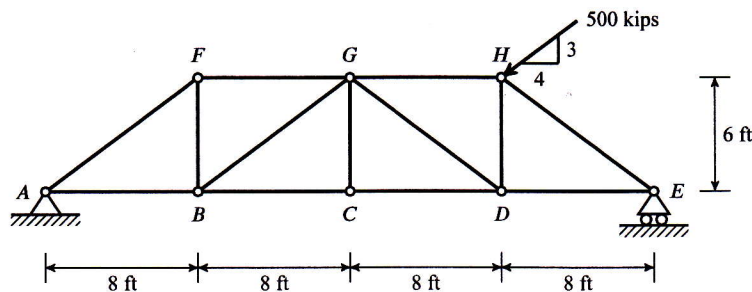


Fig. 2

3. Draw the shear force and bending moment diagram for the beam loaded as shown in Fig. 3. [10]

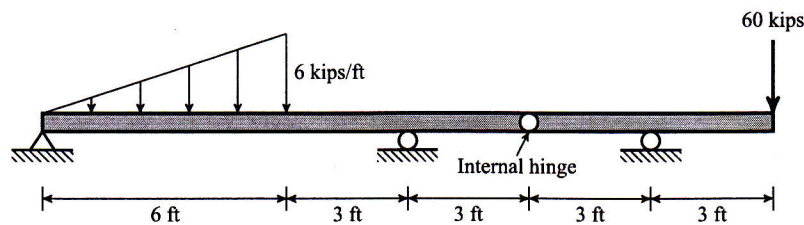


Fig. 3

4. Draw the shear force and bending moment diagram for the beam loaded as shown in Fig. 4. [10]

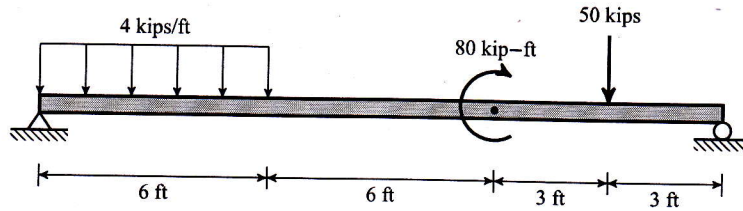


Fig. 4

5. Draw the shear force and bending moment diagram for the beam loaded as shown in Fig. 5 using the method of sections. [10]

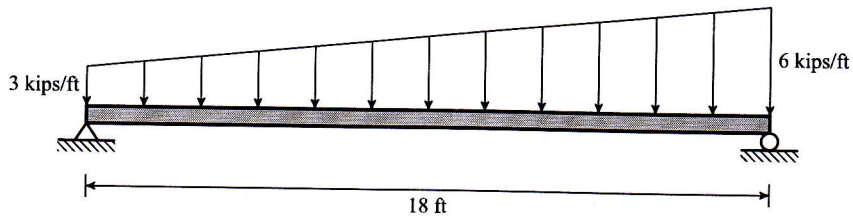


Fig. 5

6. Determine the magnitude of the uniformly distributed load,  $w$ , of the simply supported beam as shown in Fig. 6, if the maximum allowable tensile and compressive bending stresses in the cross-section are 60 ksi and 36 ksi, respectively. [10]

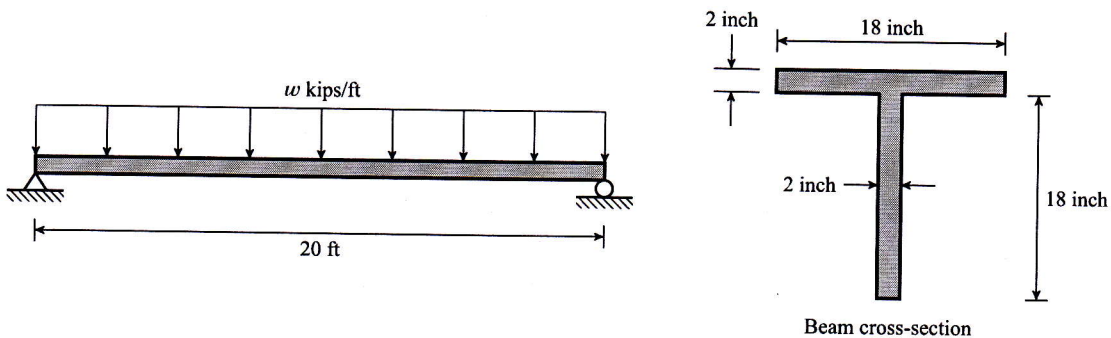


Fig. 6

7. Consider a composite beam of the cross-sectional dimensions shown in Fig. 7. The upper 100 mm by 100 mm part is aluminum,  $E_a = 50$  GPa; the lower 100 mm by 20 mm strap is steel,  $E_s = 200$  GPa. If this beam is subjected to a bending moment of 30 kN-m around the neutral axis, determine the maximum bending stresses in the steel and aluminum. [10]

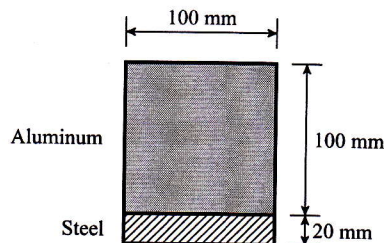


Fig. 7

8. A steel beam having the cross-section with the dimensions shown below in Fig. 8 transmits a vertical shear  $V = 100$  kips. Determine the shear stresses at sections  $a-a$  and  $b-b$ . Section  $b-b$  is at the neutral axis. [10]

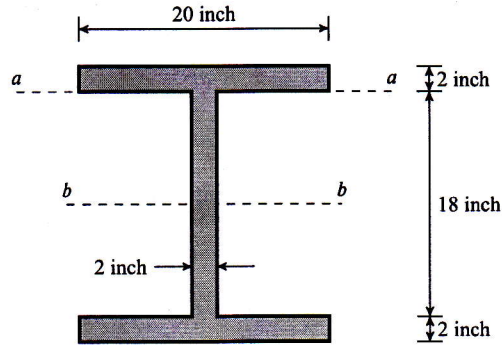


Fig. 8

9. Calculate the maximum shearing, tearing and bearing stresses in the riveted joint shown in Fig. 9 when subjected to a force  $P = 50$  kips. Also comment on the adequacy of the joint if the allowable shearing, tearing and bearing stresses are 20, 25 and 30 ksi respectively. [10]

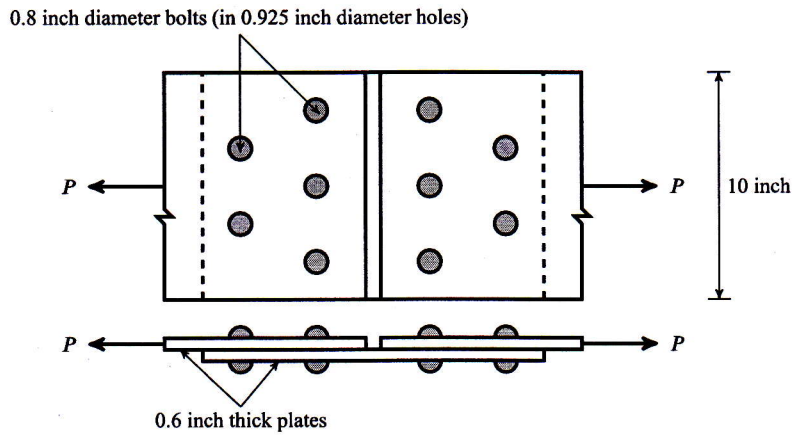


Fig. 9

10. Determine the shear center of the channel section shown in Fig. 10. [10]

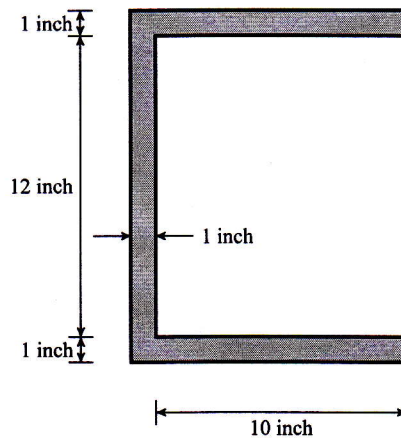


Fig. 10

11. A cylindrical steel pressure vessel having a diameter of 400 mm with a wall thickness of 20 mm is subjected to an internal pressure of 4.5 MPa. Calculate the tangential and longitudinal stresses and strains in the steel. Given that,  $E = 200 \text{ GPa}$  and  $\nu = 0.3$ . [10]
12. Determine the longitudinal spacing of 0.5 inch diameter screws required to fasten the parts of a beam section together as shown in Fig. 11 to carry a vertical shear force of  $V = 10 \text{ kips}$ . The allowable shear stress,  $\tau$ , of screw is 15 ksi. [10]

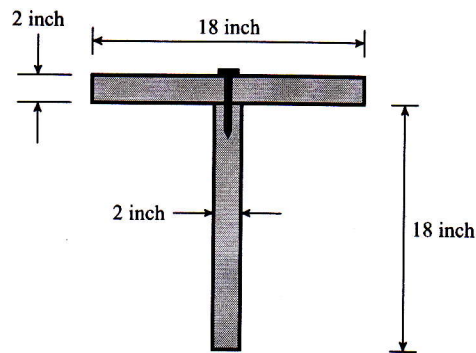


Fig. 11

13. Fig. 12 shows a  $4 \times 4 \times 3/8$  inch angle, which is to be welded to a gusset plate, carrying a load of 80 kips applied along its centroidal axis. Assuming the allowable shearing stress through the throat of each weld is 21 ksi and maximum weld size of  $5/16$  inch, determine the length of welds along 3 sides ( $a$ ,  $b$  and  $c$ ) of the angle. [10]

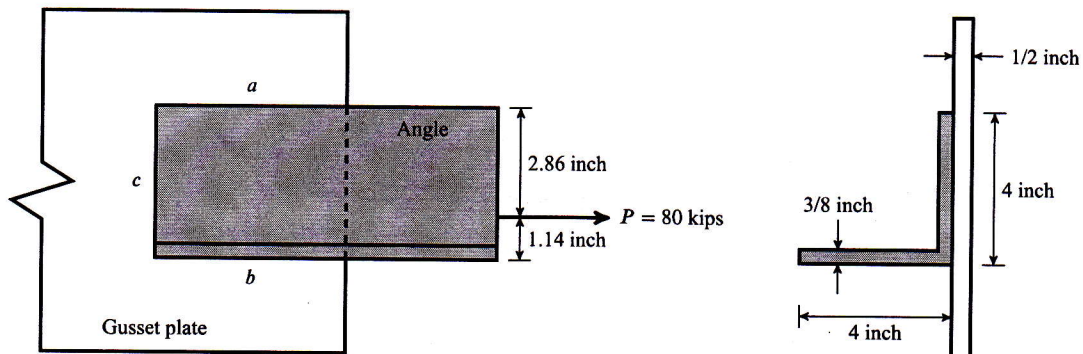


Fig. 12

**University of Asia Pacific**  
**Department of Civil Engineering**  
**Final Examination, Spring-2017**

**Program: B.Sc Engineering (2<sup>nd</sup> Year / 1<sup>st</sup> Semester)**

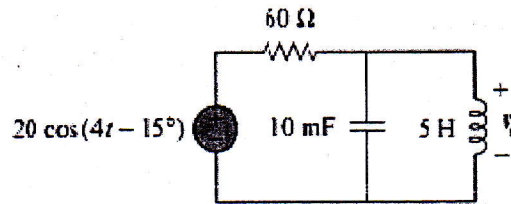
Course Title: Basic Electrical Engineering    Course No. ECE (CE) 201    Credits: 3.00  
 Time: 3.00 Hours.    Full Marks: 150

There are **Eight** Questions. Answer any **Six**. Figures in the right margin indicate marks.

1. (a) Find the amplitude, phase, period, angular frequency and frequency of the sinusoid (12)

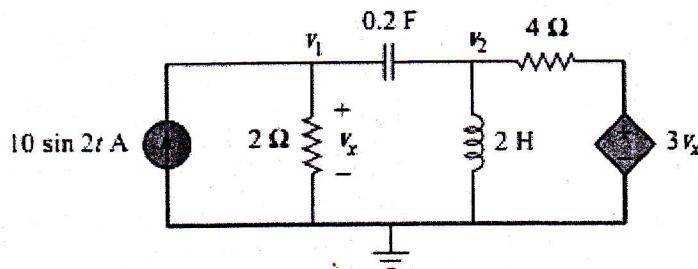
$$v = 12 \cos(60t + 45^\circ)$$

- (b) Determine  $v_o(t)$  in the following circuit. (13)



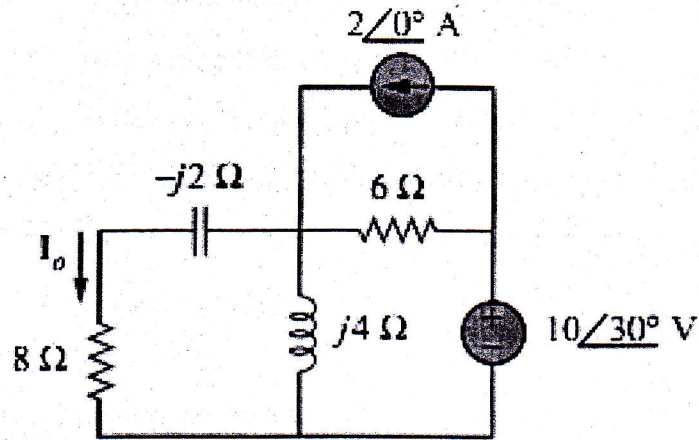
Circuit diagram for question 1(b)

2. (a) Using nodal analysis, find  $v_1$  and  $v_2$  in the following circuit. (12)



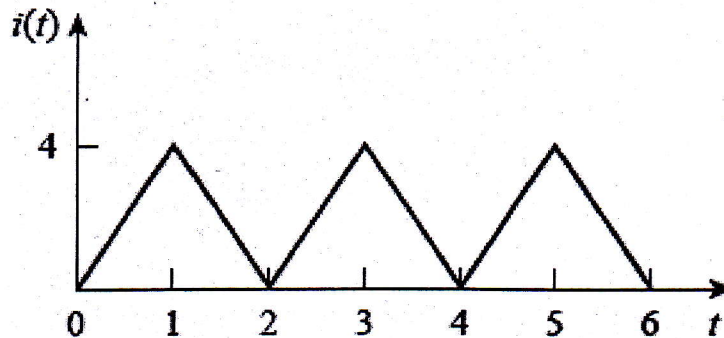
Circuit diagram for question 2(a)

- (b) Find  $I_o$  in the following circuit using mesh analysis. (13)



Circuit diagram for question 2(b)

3. (a) Find the rms value of the current waveform of following figure. If the current flows through a  $9\text{-}\Omega$  resistor, calculate the average power absorbed by the resistor. (13)

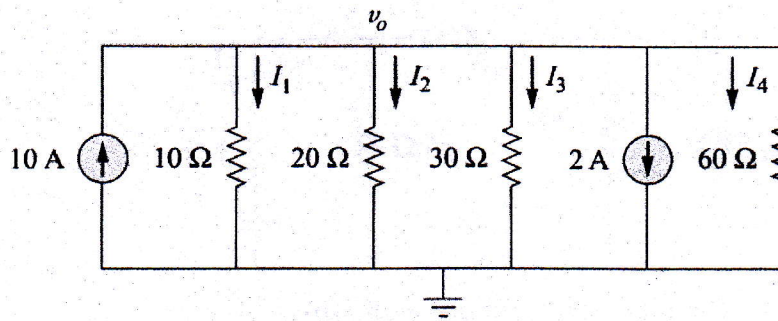


Circuit diagram for question 3(a)

(12)

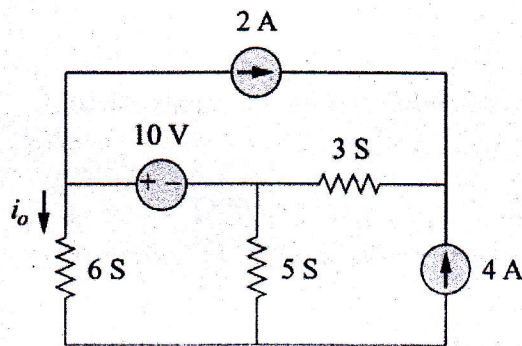
- (b) A series connected load draws a current  $i(t) = 5 \cos(377\pi t - 10^\circ)$  A when the applied voltage is  $v(t) = 100 \cos(377\pi t + 20^\circ)$  V. Find the apparent power and the power factor of the load. Determine the impedance, resistance and inductance that form the series-connected load.

4. (a) Find the currents  $I_1$ ,  $I_2$ ,  $I_3$  and  $I_4$  (13)



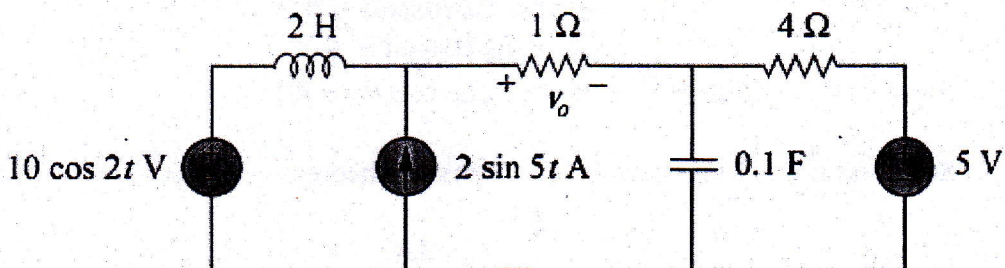
Circuit diagram for question 4(a)

- (b) Find out the current  $i_o$ . (12)



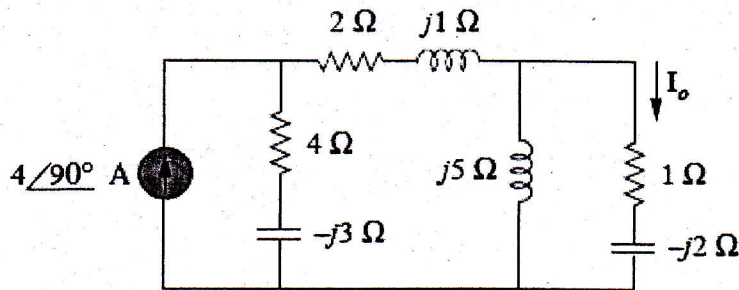
Circuit diagram for question 4(b)

5. (a) Calculate  $v_o$  in the following circuit using the nodal analysis. (13)



Circuit diagram for question 5(a)

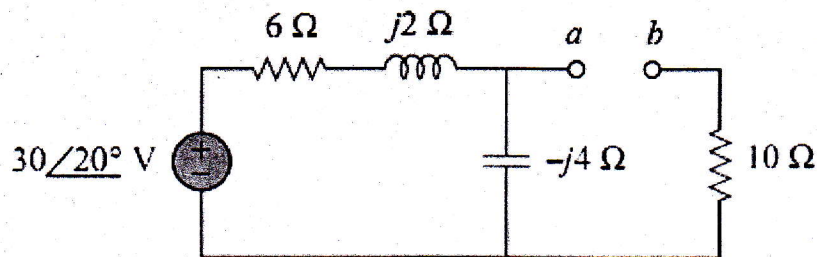
- (b) Find  $I_o$  in the following circuit using the concept of source transformation. (12)



Circuit diagram for question 5(b)

6. (a) What is three phase circuit? Why three phase system is preferred over two phase system? (12)

- (b) Find the Thevenin equivalent at terminals a-b of the following circuit.



Circuit diagram for question 6(b)

(13)

7. (a) If the voltage and current at the terminals of a circuit are

$$v(t) = V_m \cos(\omega t + \theta_v)$$

$$i(t) = I_m \cos(\omega t + \theta_i)$$

Show that, average power,  $P = \frac{1}{2} V_m I_m \cos(\theta_v - \theta_i)$

- (b) State and prove Maximum Power Transfer Theorem.

8. (a) Find the value of  $I$  required to establish a magnetic flux of  $\phi = 0.75 \times 10^{-4}$  Wb in the series magnetic circuit of following figure.

- (b) Also find out  $I$  when air gap is doubled. (12)



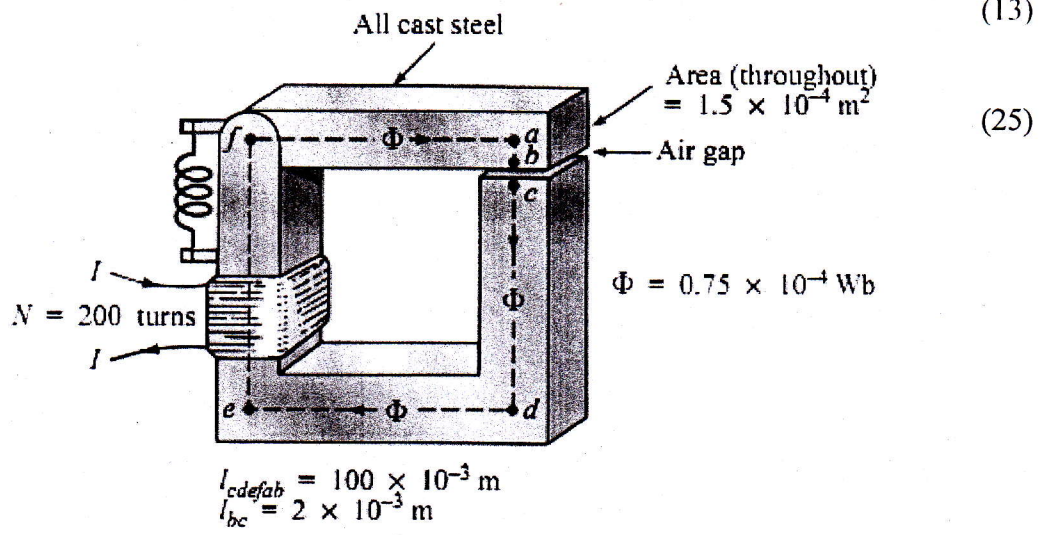
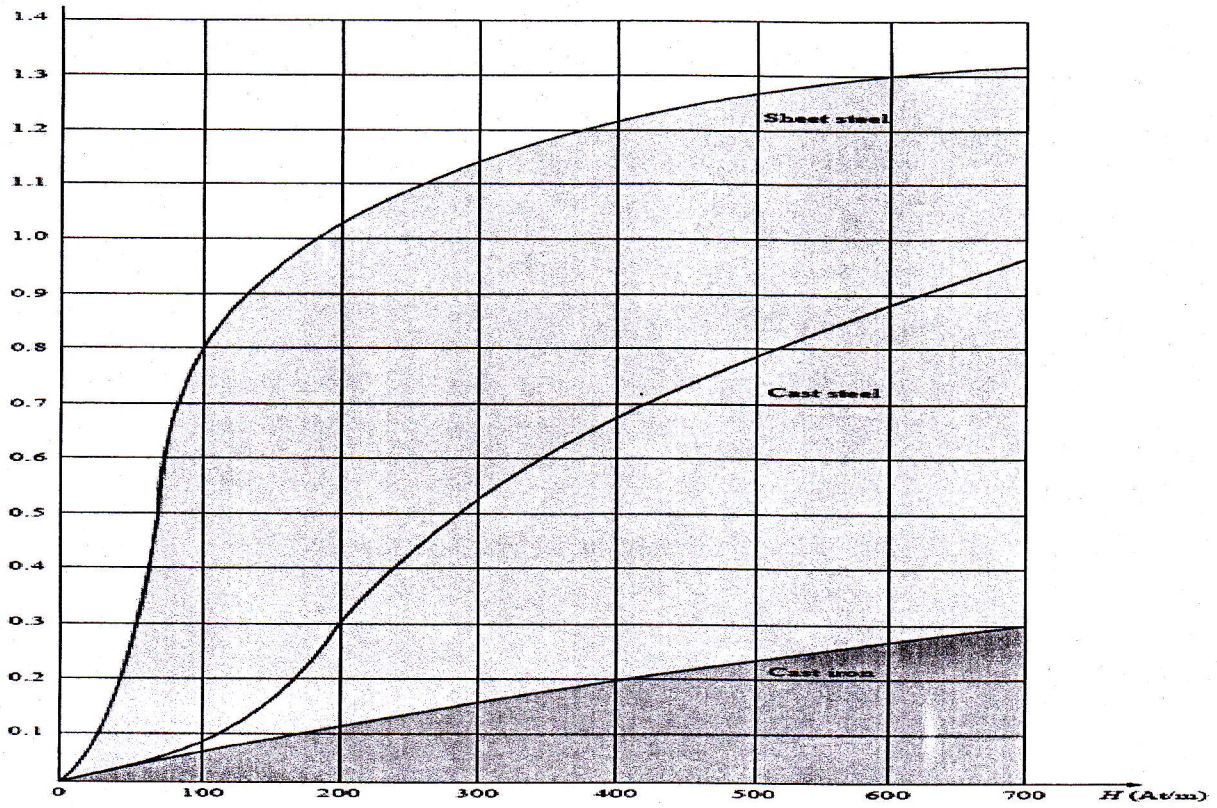


Figure for question 8(a)



**University of Asia Pacific**  
**Department of Civil Engineering**  
**Final Examination Spring 2017**  
**Program: B.Sc. Engineering (Civil)**

Course Title: Engineering Materials  
Time: 3 hours

Course Code: CE 201  
Full Marks: 150

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*Part 1: Answer all the questions*

1. Use the ACI Volume method to design a concrete mix which is required to have a specified mean strength of 30 MPa at 28 days. The presence of reinforcement requires a slump in the range of 75-100 mm and a maximum size of coarse aggregate of 10 mm. The fine aggregates are of normal weight and their grading conforms to the appropriate standard with a fineness modulus of 2.6. [40]
- Determine the first lab trial mix as per ACI volume method with following information as well as necessary tables (Tables 1-6) and formula.
- i. Cement is Portland Composite cement and coarse aggregates are stone chips.
  - ii. A water reducing admixture is to be used in the process. The specific gravity of admixture is 1.3 and the recommended dose is 500 ml/100 kg cement with expected 10% water reduction.
  - iii. For first trial mix, three cylinders with ACI standard dimensions are cast. Assume 20% loss in cylinder casting.
- 2.(a) Discuss the effect of the following factors on compressive strength of concrete: [4]
- (i) FM of sand
  - (ii) Temperature
  - (iii) Grading of aggregate
  - (iv) Compaction
- (b) Why is it important to control the workability of concrete on site? What are the workability requirements of concrete with congested reinforcement? [2+2=4]
- (c) What is the significance of bleeding in construction which proceeds in several lifts? How can pozzolana cements control bleeding? [2+2=4]
- (d) What are the advantages and disadvantages of using Calcium Chloride as an accelerator in Portland Cement concrete? Explain. [3]
- (e) Discuss the changes in the properties of fresh concrete for the following situations: [4.5]
- (i) Dry brick chips are used instead of SSD brick chips.
  - (ii) Entrained air is used.
  - (iii) Superplasticizer is added with removal of certain amount of water content and cement.
- (f) Describe the effects of incorporating fibers in concrete. [2.5]

**Part 2: Answer any 2(Two) out of 3(Three) questions (3-5)**

- 3.(a) What qualities should be present in good quality sand? Explain the organic matter identification process of sand. [3+2=5]
- (b) Write short notes on CEM II A-V, and CEM II B-M cement as per BDS EN 197-1:2003. [3]
- (c) What consideration should be taken before selection of a brick field? Discuss the major factors that affect the quality of brick. [3+3=6]
- (d) 'Kiln burning is better than clamp burning in every aspect' Do you agree or disagree? Please elaborate your reasons for the argument. [3]
- (e) What are the tests that are carried out in the field to determine the quality of good bricks? Write the functions of frog mark on brick. [3+2=5]
- 4.(a) What is hydration of cement? What are the functions of various ingredients of cement? [6]
- (b) Draw typical stress-strain curves of steel for different grades. How do you determine Young's modulus of concrete from stress-strain curve? [3+2=5]
- (c) Define the following mechanical properties of a material: [6]  
 (i) Malleability  
 (ii) Creep  
 (iii) Toughness
- (d) What are the possible reasons of defects in plaster works? [3]
- (e) Compare flash setting and false setting of cement. [2]
5. For a culvert construction project, the recommended FM is 2.5 for sand. From a market, a sand sample was collected and sent to a nearby Concrete Laboratory for sieve analysis. The sieve analysis data is given below: [22]

ASTM Sieve	Amount Retained (g)
3 inch	0
1.5 inch	0
¾ inch	0
3/8 inch	0
#4	0
#8	50
#16	100
#30	100
#40	80
#50	40
#100	40
#200	45
Pan	45

- (i) Calculate the FM of the sand sample,
- (ii) Draw the grading curve for the sand sample,
- (iii) Discuss the possible ways to improve the FM of the samples to the recommended values,
- (iv) From other source, another sand sample was collected and FM was found to be 2.9. In what proportions, the sand samples are to be mixed to achieve the required FM of sand?

**Part 3: Answer any 2(Two) out of 3(three) questions (6 – 8)**

- 6.(a) What is self-compacting concrete? How does it differ from normal flowing concrete? [3]  
(b) Explain why is porosity important with respect to strength and durability of concrete? [3]  
(c) Explain the influence of w/c ratio on strength of concrete. [4]  
(d) Write a short note on following topics: [2+2=4]  
(i) Hard and Soft Wood, (ii) Spalling of concrete  
(e) Distinguish between (i) distemper and varnish, (ii) entrapped and entrained air [4]  
(f) Identify the following chemicals as different components of paint and briefly discuss their functions in paint. [4]  
(i) Red Lead, (ii) Linseed oil, (iii) Turpentine oil, (iv) Manganese Powder
- 7.(a) Define Compare Ferrocement mortar with cement mortar used in masonry. [2]  
(b) “Workability is the inverse of compaction energy” – explain the statement. Mention the slump value of concrete for normal design standard. [2+1=3]  
(c) Define creep. Compare plastic shrinkage and drying shrinkage of concrete. [1+4=5]  
(d) Explain the influence of proper compaction and adequate curing on the concrete durability. [3]  
(e) Briefly describe the process of annual ring formation of an exogenous tree. [3]  
(f) Why is curing required? What are the advantages of steam curing compared to normal moist curing? [2+2=4]  
(g) What is Lean mix? How does lean mix leads to high strength? Explain. [2]
- 8.(a) Write the possible measures to stop early corrosion of steel bars in marine environment and atmospheric environment. [4]  
(b) Write a short note on the following: [4]  
(i) Laitance  
(ii) Porous concrete  
(iii) Heavyweight concrete  
(c) Explain the process of initiation of corrosion of steel due to carbonation and chloride. [3]  
(d) Write a short note on the following topics: [8]  
(i) Ferrocement Retrofitting  
(ii) Vulcanization  
(iii) Distemper  
(iv) Cold joint and construction joint  
(e) What is the mechanism of sulfate attack on concrete? Which cement minimizes sulfate attack on concrete and why? [1.5+1.5=3]

**Necessary Tables for Question No. 1**

Table 1: Properties of Fine Aggregate

Sl. No.	Property	Test Method	Value	Unit
1	Bulk Specific Gravity (OD basis)	ASTM C127	2.52	-
2	Apparent Specific Gravity (OD basis)	ASTM C127	2.60	-
3	Absorption Capacity	ASTM C127	1.50	%
4	Dry Rodded Unit Weight	ASTM C29	1570	kg/m <sup>3</sup>
5	Moisture Content of FA in Laboratory		3.50	%
7	Loose Unit weight		1300	kg/m <sup>3</sup>

Table 2: Properties of Coarse Aggregate

Sl. No.	Property	Test Method	Value	Unit
1	Bulk Specific Gravity (OD basis)	ASTM C127	2.62	-
2	Apparent Specific Gravity (OD basis)	ASTM C127	2.68	-
3	Absorption Capacity	ASTM C127	1.00	%
4	Dry Rodded Unit Weight	ASTM C29	1600	kg/m <sup>3</sup>
5	Moisture Content of CA in Laboratory	-	0.5	%
6	Maximum Size	-	25	mm
7	Loose Unit weight		1400	kg/m <sup>3</sup>

Table 3: Properties of cement

Sl. No.	Property	Value	Unit
1	Brand name	supercrete (composite)	-
2	Clinker	85	%
3	Fly Ash	15	%
4	Compacted Unit Weight	1400	kg/m <sup>3</sup>
5	Loose Unit Weight	1100	kg/m <sup>3</sup>
6	Specific Gravity of clinker	3.15	
7	Specific Gravity of fly ash	2.40	

Table 4: ACI recommended dry rodded bulk volume of coarse aggregate per unit volume of concrete

Max size of agg mm	FM of fine aggregate			
	2.40	2.60	2.80	3.00
9.5	0.50	0.48	0.46	0.44
12.5	0.59	0.57	0.55	0.53
19	0.66	0.64	0.62	0.60
25	0.71	0.69	0.67	0.65
37.5	0.75	0.73	0.71	0.69
50	0.78	0.76	0.74	0.72
75	0.82	0.80	0.78	0.76
150	0.87	0.85	0.83	0.81

Table 5: ACI recommended mixing water content for 1 m<sup>3</sup> fresh concrete

Max size of aggregate (mm)	10	12.5	20	25	40	50	70	150
<b>Slump Value (mm)</b>	<b>Amount of mixing water in kg per 1 m<sup>3</sup> concrete</b>							
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	205	190	178	160	-
<b>Entrapped air (%)</b>	3	2.5	2	1.5	1	0.5	0.3	0.2

Table 6: First Trial Mix Result

<b>Water Added</b>	200g less water was added than calculated for first trial mix
<b>Slump measured</b>	95 mm
<b>Measured density of fresh concrete Cylinder</b>	2370 kg/m <sup>3</sup>

### Estimating w/c ratio

ACI recommended w/c ratio for normal strength concrete,  $w/c = 1.1734e^{-0.0259f'_T}$ ,

where,  $f'_T$  = Target Mean Strength

**University of Asia Pacific**  
**Department of Basic Sciences and Humanities**  
**Final Examination, Spring 2017**  
**Program: B. Sc. Engineering (Civil)**  
**(2<sup>nd</sup> Year 1<sup>st</sup> Semester)**

Course code: HSS 211(b)  
Total Time: 2.00 hrs.

Course Title: Bangladesh Studies: History

Credit: 2.00  
Full Marks: 100

**Answer any four (4x25=100)**

1. What was Dual Government? Explain its impact over the political and economical situation of Bengal. 10+15
2. Briefly narrate the causes and consequences of Titumir's rebellion and Indigo Revolt. 25
3. Who was Raja Ram Mohan Roy? Evaluate his contribution as a social reformer in colonial Bengal. 5+20
4. What were the main causes behind the partition of Bengal in 1905? Why did the British government annul this order later? 15+10
5. Analyze the political, social and economical disparities existed between East and West Pakistan during the years of 1947-1971. 25
6. Mention the major phases of the Liberation War of Bangladesh in 1971. Analyze the basic features of these phases. 10+15

**University of Asia Pacific**  
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**Final Examination, Spring 2017**  
**Programme: B.Sc. Engineering (Civil)**  
**(2<sup>nd</sup> Year 1<sup>st</sup> Semester)**

**Course Title: Bangladesh Studies: Society and Culture**

**Course Code: HSS 211(a)**

**Credit: 2.00**

**Time: 2 Hours**

**Full Marks: 100**

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**Answer ANY FOUR (4x25)**

- |                                                                         |    |
|-------------------------------------------------------------------------|----|
| 1. a) What is sociological imagination?                                 | 5  |
| b) Discuss functional and conflict perspective of sociology.            | 20 |
| 2. a) Name four major sociologists which you read in your course.       | 5  |
| b) Discuss the major contribution of two sociologists.                  | 20 |
| 3. Discuss G. Lenski's different types of society with examples.        | 25 |
| 4. a) What is socialization?                                            | 5  |
| b) Explain different agencies of socialization. Cite examples.          | 20 |
| 5. a) What is culture?                                                  | 5  |
| b) State different elements of culture in relation to your own society. | 20 |
| 6. Discuss in some details of the following:                            | 25 |
| I. Permanent settlement act                                             |    |
| II. Language movement                                                   |    |
| III. Folk culture of Bangladesh                                         |    |



**University of Asia Pacific**  
**Department of Basic Sciences & Humanities**  
**Final Examination Spring-2017**  
**Program: B. Sc. in Civil Engineering**

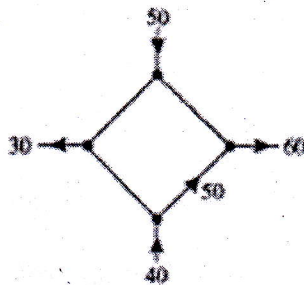
Course Title: Mathematics-III  
Time: 3.00 Hours.

Course Code: MTH 201  
Full Marks: 150

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

1. (a) Define a matrix. Write two  $3 \times 3$  matrices  $A$  and  $B$  which are the examples of a diagonal and a lower triangular matrix respectively. **3**
- (b) If  $C = \begin{pmatrix} 1 & 5 & 3 \\ 4 & 8 & 1 \\ 2 & 8 & 7 \end{pmatrix}$  and  $D = \begin{pmatrix} 5 & 4 & 8 \\ 1 & 5 & 6 \\ -1 & 5 & 7 \end{pmatrix}$ . Calculate  $(CD)_{32}$  and  $(DC)_{21}$ . **4**
- (c) Define trace of a matrix. For the matrices in (b) show that  $tr(CD) = tr(DC)$ . **10**
- (d) Show that  $C + C^T$  is symmetric and  $D - D^T$  is skew-symmetric. **8**
2. (a) Define singular matrix. Calculate the inverse (if exists) of the following matrix using cofactor expansion. **10**
- $$P = \begin{pmatrix} 1 & 5 & 3 \\ 4 & 8 & 1 \\ 2 & 8 & 7 \end{pmatrix}$$
- (b) In the previous problem if  $P$  is a coefficient matrix of a linear system and  $b = \begin{pmatrix} 9 \\ 13 \\ 17 \end{pmatrix}$  is the right side constants matrix then solve the system by using Gaussian elimination method. **15**
3. (a) Calculate inverse of  $Q = \begin{pmatrix} -1 & -2 \\ 3 & -5 \end{pmatrix}$  using augmented matrix. **13**
- (b) Examine the consistency of the following system of linear equations and solve the one which is consistent. **12**
- (i)  $2x - 3y + 5z = 1$ ,  $3x + y - z = 2$ ,  $x + 4y - 6z = 1$ .
- (ii)  $x - 4y + 5z = 8$ ,  $3x + 7y - z = 3$ ,  $x + 15y - 11z = -14$ .

4. (a) Define rank of a matrix. Calculate the rank of  $\begin{pmatrix} 1 & 5 & 3 \\ 4 & 8 & 1 \\ 2 & 8 & 7 \end{pmatrix}$ . 10
- (b) Show that the vector  $\mathbf{v} = (5, 6, 0)$  is a linear combination of the vectors  $\mathbf{v}_1 = (-1, 2, 0)$ ,  $\mathbf{v}_2 = (3, 1, 2)$ ,  $\mathbf{v}_3 = (4, -1, 0)$ . 15
5. (a) Find a linear polynomial whose graph passes through  $(1, 3)$ ,  $(2, -2)$ . 10
- (b) Define vector space. Prove that the set of all polynomials of the form  $P(t) = a_0 + a_1t + a_2t^2 + \dots + a_st^s$ , where all the coefficients are real constants form a vector space over the field  $\mathbb{R}$ . 15
6. (a) Define Eigenvalue and Eigenvector of a matrix. Find the eigenvalue and eigenvector of the matrix  $\begin{pmatrix} 3 & -4 \\ 2 & -6 \end{pmatrix}$ . 15
- (b) Show that  $\mathbf{v}_1 = (1, 1, 0)$ ,  $\mathbf{v}_2 = (1, 3, 2)$ ,  $\mathbf{v}_3 = (4, 9, 5)$  are linearly dependent. 10
7. (a) Determine whether or not the vectors  $(1, 1, 1)$ ,  $(1, 2, 3)$ ,  $(2, -1, 1)$  form a basis of  $\mathbb{R}^3$ . 10
- (b) The accompanying figure shows a network in which the flow rate and direction of flow in certain branches are known. Find the flow rates and direction of flow in the remaining branches. 15



8. (a) Show that the following transformation  $T: \mathbb{R}^2 \rightarrow \mathbb{R}^2$  is not a linear transformation. 10
- $$T(x, y) = (xy, x)$$
- (b) Show that the following linear operator on  $\mathbb{R}^3$  defined by 15
- $$T(x, y, z) = (x - 3y - 2z, y - 4z, z)$$
- is invertible also find  $T^{-1}$ .