

University of Asia Pacific
Department of Civil Engineering
Final Examination Spring 2015
Program: B.Sc. Engineering (Civil)

Course Title: Engineering Materials
Time: 3:00 hours

Course Code: CE 201 (B)
Full Marks: 100

Part 1: Answer the following question

Question 1:

A concrete mix is required for a 1.0 m thick mat foundation. Design compressive strength of concrete is 20 MPa at 28 days. Slump value of concrete must be in between 100-150 mm. Determine the first lab trial mix as per ACI volume method with information and necessary tables (Tables 1-6) provided at the end. [20]

- i. Cement is ordinary Portland cement.
- ii. A water reducing admixture (specific gravity 1.25) will be used so that you can reduce 15% water content. Recommended dose 800 ml per 100 kg cement

For first trial mix, three cylinders with ACI standard dimensions are cast. Assume 30% loss in cylinder casting. Measured density and slump value of first lab trial mix was found 2430 kg/m³ and 85 mm respectively when 0.4 kg additional water was mixed in excess of the required water.

Part 2: Answer any 3(Three) out of 4 questions (2-5)

Question 2:

- a. Describe the typical stress-strain response of concrete, steel reinforcement, rubber, CFRP, and glass. [7]
- b. Describe the functions of chief ingredients of Brick. [5]
- c. Explain the Field tests of Brick. [3]
- d. Explain the bulking of sand. [3]
- e. Distinguish between clamp burning and kiln burning of bricks. [2]

Question 3:

- a. What do you mean by hydration of cement? Write the hydration reactions of cement and discuss the morphology of the hydration product. [5]
- b. Write short notes on CEM I, CEM II A-M, CEM II B-M, CEM II A-L, and CEM II B-S cement as per BDS EN 197-1:2003. [5]
- c. Draw the flow diagram of cement manufacturing process. Also, draw a schematic diagram of rotary kiln (used in cement manufacturing) and discuss the physical and chemical changes that happen in the different zones of the kiln. [7]
- d. What are the functions of gypsum in cement hydration? [3]

Question 4:

- a. Classify aggregates according to geological origin, size, shapes, unit weight and texture. [6]
- b. Explain different moisture condition of coarse aggregate [5]
- c. What are the benefits of stone aggregate over brick aggregate in concrete construction works? [4]
- d. Following sample of aggregates to be blended with the percentage shown. Calculate the F.M of blended aggregates. [5]

Sieve Size	% passing	
	Aggregate 1	Aggregate 2
50 mm (2 in)	100	100
37.5 mm (1.5 in)	100	100
25.0 mm (1 in)	100	100
19.0 mm (3/4 in)	100	100
12.5 mm (1/2 in)	100	99
9.5 mm (3/8 in)	100	89
4.75 mm (No.4)	99	24
2.36 mm (No. 8)	85	3
1.18 mm (No. 16)	65	0
0.6 mm (No. 30)	38	-
0.3 mm (No. 50)	15	-
0.15 mm (No. 100)	4	-
0.075 mm (No. 200)	1	-
% by mass	65%	35%

Question 5:

- a. Discuss the types of bonds in brick masonry. [4]
- b. What are the differences between false and flash setting of cement? [3]
- c. Write short note on: (i) Malleability, (ii) Fatigue strength, (iii) Ductility, (iv) Creep. [8]
- d. What is efflorescence? What will happen if the bricks used in wall have significant efflorescence? [5]

Question 6:

- a. Describe the factors controlling the workability of concrete. [8]
- b. Explain segregation, bleeding and laitance of concrete [6]
- c. What are the differences of cube and cylinder concrete test specimen? [3]
- d. Write short note on curing of concrete [3]

Question 7:

- a. Classify the cracks and show the locations of different cracks in concrete structure. [5]
- b. Discuss plastic settlement cracks and drying shrinkage cracks. [6]
- c. Discuss the causes of concrete deterioration. [5]
- d. Write down the differences of dry and wet corrosion of steel. [4]

Question 8:

- a. What are the common tests of concrete durability? Briefly discuss. [5]
- b. Describe the preservation techniques of timber. [5]
- c. Discuss the vulcanization of rubber. What are the advantages of vulcanization? [5]
- d. Write down the characteristics of ideal paint. [5]

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 ³
5	Moisture Content of FA in Laboratory		3.50	%
6	Fineness Modulus (FM)	ASTM C136	2.80	

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	1530	kg/m ³
5	Moisture Content of CA in Laboratory	-	0.5	%
6	Maximum Size	-	25	mm

Table 3: Properties of cement

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

Table 4: ACI recommended w/c ratio for normal strength concrete

Mean Target Strength		W/C ratio
psi	MPa	
6000	41	0.41
5000	34	0.48
4000	28	0.57
3000	21	0.68
2000	14	0.82

Table 5: 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 6: ACI recommended mixing water content for 1 m³ fresh concrete

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

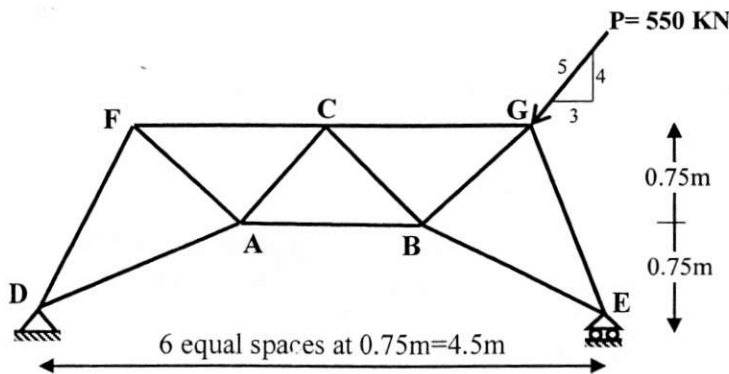
University of Asia Pacific
Department of Civil Engineering
Final Examination Spring 2015
Program: B.Sc. Engineering (Civil)

Course Title: Mechanics of Solids I
 Full Marks: 100 (=10×10)

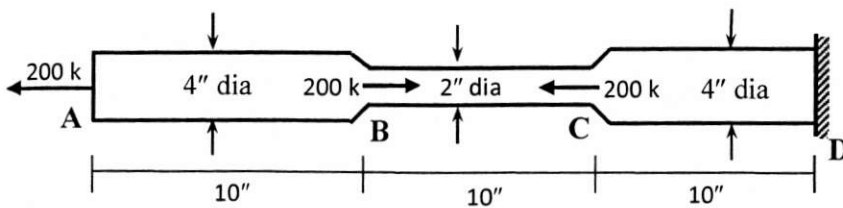
Course Code: CE 211
 Time: 3 hours

There are **FOURTEEN(14)** questions in this paper. Answer any **TEN(10)** of the following questions.
 Each question has equal marks.

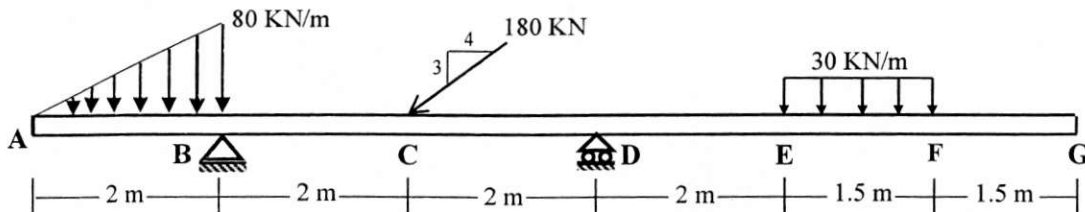
1. Calculate **area of members FC and CB** in the truss shown below to carry an inclined force P of 550 kN. Given the allowable tensile stress 120 MPa and the allowable compressive stress 140 MPa.



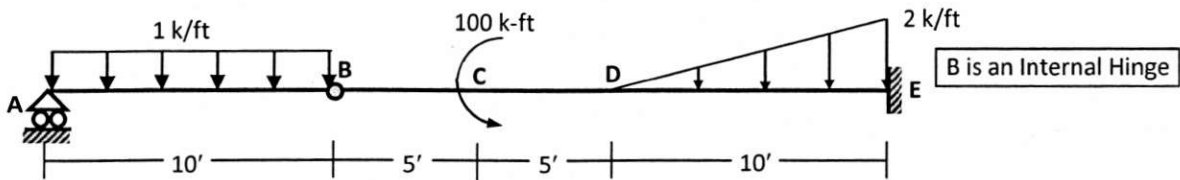
2. Determine **the relative displacement** of point D from A for the elastic steel bar of variable cross section shown below caused by the application of concentrated forces. Let $E = 200 \text{ GPa}$. Also draw the axial strain and axial displacement diagram.



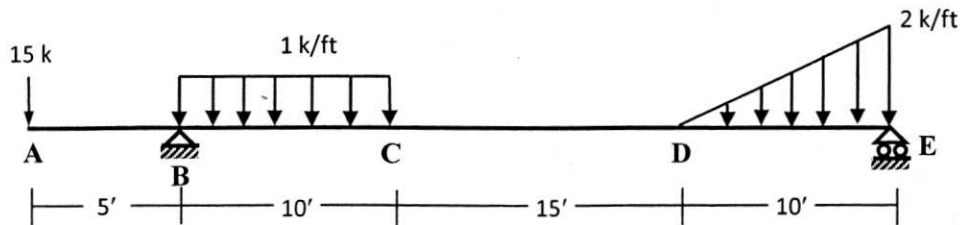
3. Draw **axial force, shear force and bending moment diagrams** for the beam loaded as shown below.



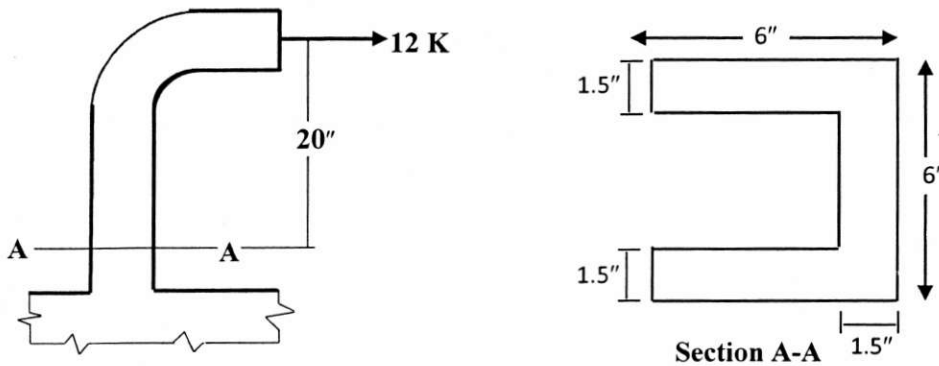
4. Draw **axial force, shear force and bending moment diagrams** for the beam loaded as shown below.



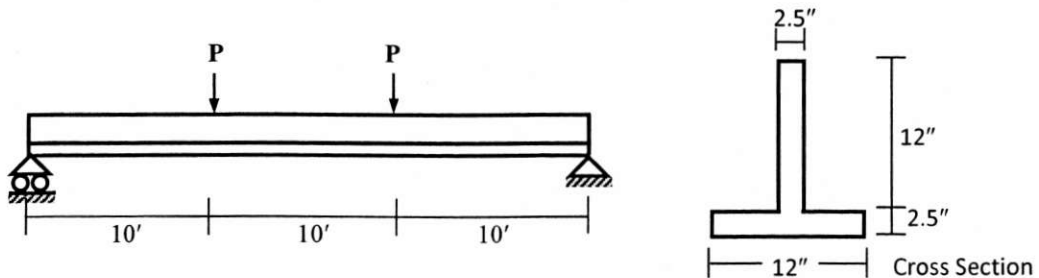
5. Derive the equations for the **Shear force and bending moment** for the beam loaded as shown below. Also determine the shear force and bending moment at C.



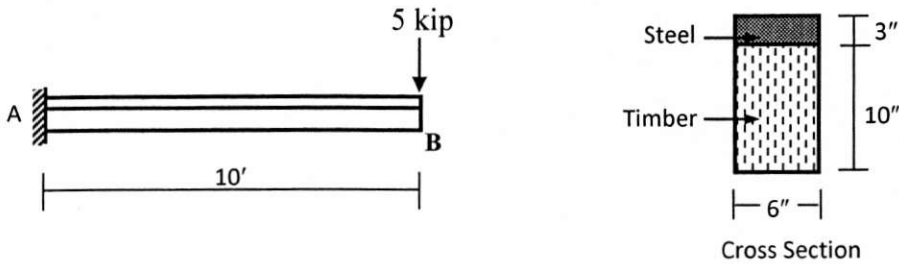
6. Find the **maximum tensile and compressive stresses** acting normal to section A-A of the machine bracket shown below caused by the applied force of 12 kips.



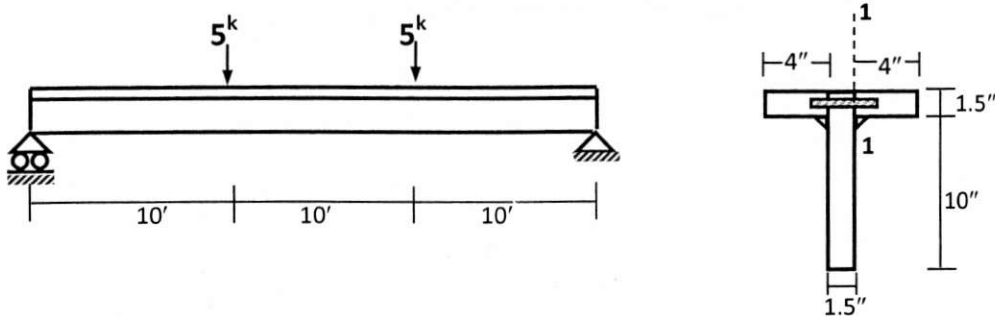
7. Calculate the **maximum allowable load P** in the simply supported beam loaded as shown below, if the allowable compressive stress in the cross-section is 25 ksi and allowable tensile stress 20 ksi.



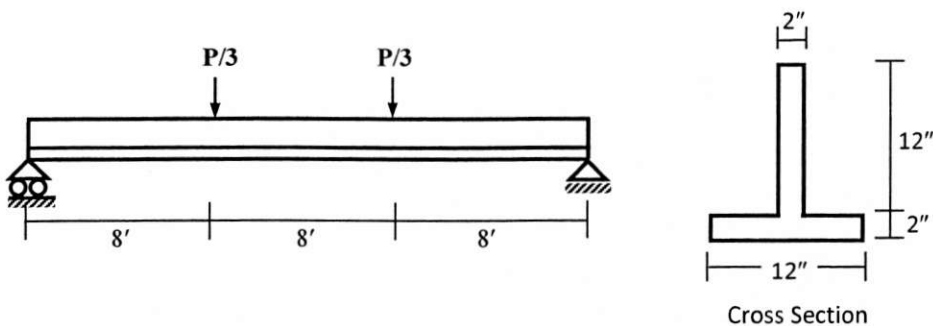
8. A 10' cantilever beam as shown in the figure below carries a downward concentrated force of 5 kip. The composite cross-section of the beam is made of steel and timber. What are the **maximum flexural stresses** in the steel and timber? [Given, the modulus of elasticity of steel = 30,000 ksi, modulus of elasticity of timber = 1500 ksi].



9. Calculate (i) **the flexural shear flow at Level 1-1** of the T-section joined as shown below if the beam is loaded as simply supported. (ii) Calculate **the spacing** of 0.75" bolts required at the joint to withstand this shear flow. (iii) Calculate **the size of welds** required at the joint. [Given: Allowable shear stress = 15 ksi for both bolts & welds].



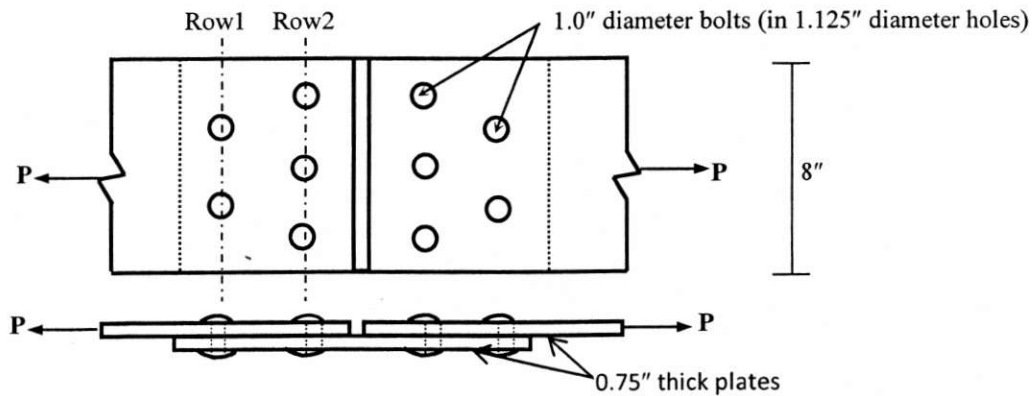
10. (i) Calculate **the maximum allowable load P** in the simply supported beam loaded as shown below, if the allowable shear stress in the cross-section is 12 ksi.
 (ii) For this value of P, draw the shear stress diagram over the section at support.



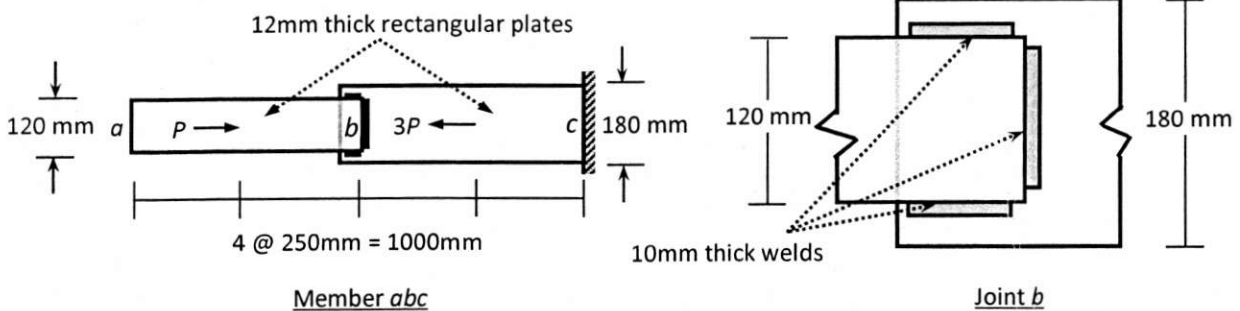
11. (a) Derive the expression $\Delta = \frac{PL}{EA}$ for axially loaded bar.
 (b) Prove that in a cylindrical thin walled pressure vessel, longitudinal stress is one half of hoop stress.

12. A cylindrical steel pressure vessel 500 mm in diameter with a wall thickness of 25 mm is subjected to an internal pressure of 5MPa. (i) Calculate **the hoop and longitudinal stresses and strains** in the steel. (ii) To **what value may the internal pressure be increased** if the allowable stress in steel is 100MPa. [Given: Modulus of elasticity of steel = 200 GPa, Poisson's ratio = 0.25]. (iii) Also write some **possible reasons** for failure of Pressure Vessels.

13. Calculate **the maximum allowable force P** for the connection shown below if the allowable shearing, tearing and bearing stresses are 15, 20 and 25 ksi respectively.



14. (i) Calculate **the maximum allowable value of P** for the axially loaded **member abc** shown below if the allowable stress in tension = 220 MPa and in compression = 180 MPa. (ii) For the force P calculated in (i), determine **the lengths of 10 mm welds** to connect the members **ab** and **bc** at joint b. [Given: Allowable stress in shear = 200 MPa].



University of Asia Pacific
Department of Civil Engineering
Semester Final Examination, Spring-2015
Program: B.Sc. Engineering (2nd Year / 1st Semester)

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

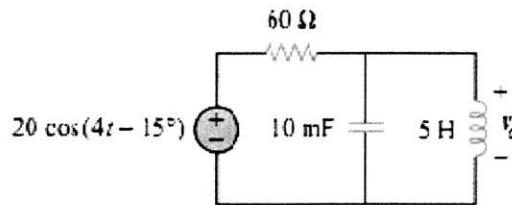
Credits: 3.00
 Full Marks: 150

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 (10)

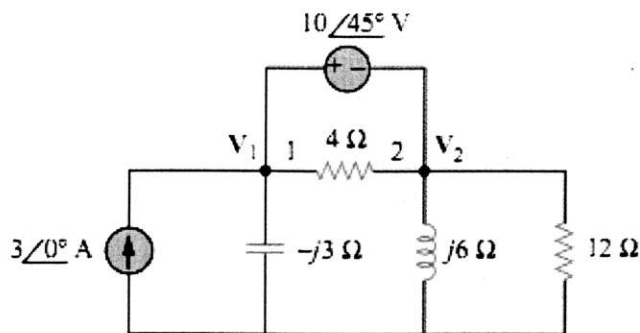
$$v(t) = 16 \cos(50t + 60^\circ)$$

- (b) Determine $v_o(t)$ in the following circuit. (15)



Circuit diagram for question 1(b)

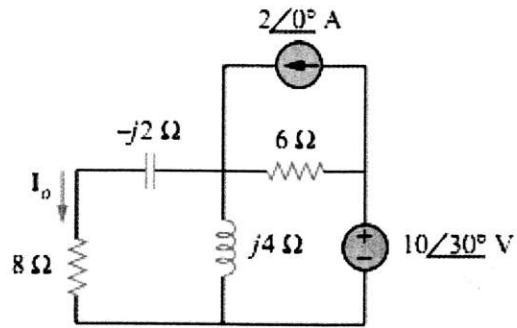
2. (a) Using nodal analysis, find v_1 and v_2 in the following circuit. (12)



Circuit diagram for question 2(a)

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

(13)

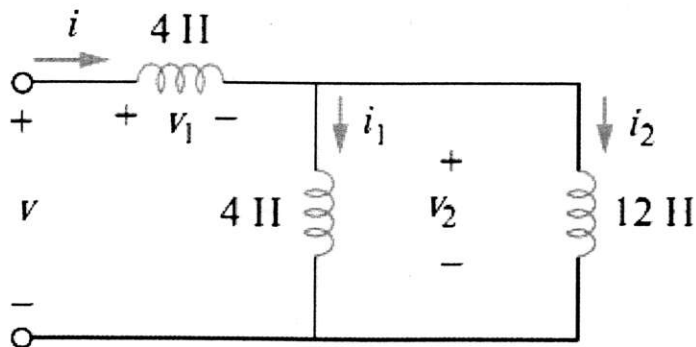


Circuit diagram for question 2(b)

3. (a) The current through a 0.1H inductor is $i(t) = 10te^{-5t}\text{A}$. Find the voltage across the inductor and the energy stored in it. (13)

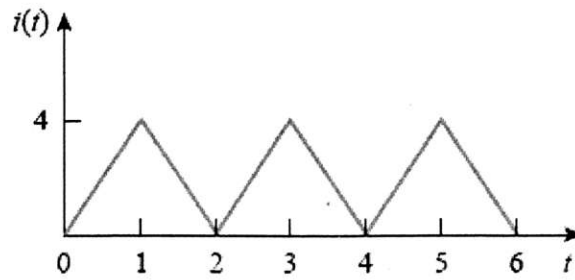
(b) For the following circuit, $i(t) = 4(2 - e^{-10t})\text{mA}$. If $i_2(0) = -1\text{mA}$, find: (12)

(a) $i_1(0)$ (b) $v(t), v_1(t)$ and $v_2(t)$ (c) $i_1(t)$ and $i_2(t)$



Circuit diagram for question 3(b)

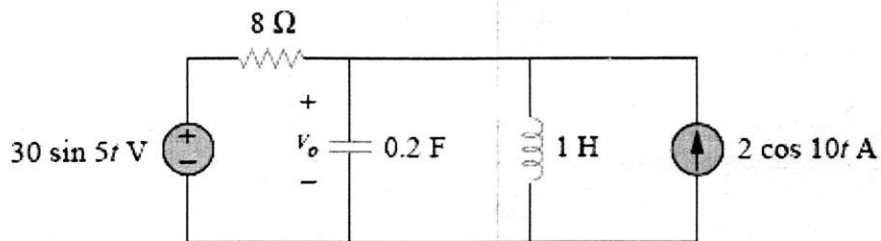
4. (a) Find the rms value of the current waveform of following figure. If the current flows through a $9\text{-}\Omega$ resistor, calculate the average power absorbed by the resistor. (13)



Circuit diagram for question 4(a)

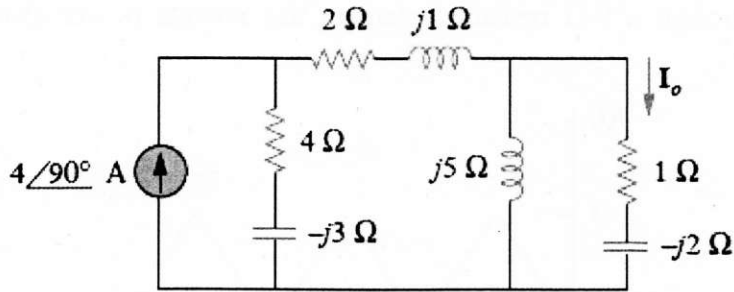
- (b) A series connected load draws a current $i(t) = 4 \cos(100\pi t - 10^\circ)\text{A}$ when the applied voltage is $v(t) = 120 \cos(100\pi t + 20^\circ)\text{V}$. Find the apparent power and the power factor of the load. Determine the impedance, resistance and inductance that form the series-connected load. (12)

5. (a) Calculate v_o in the following circuit using the superposition theorem. (13)



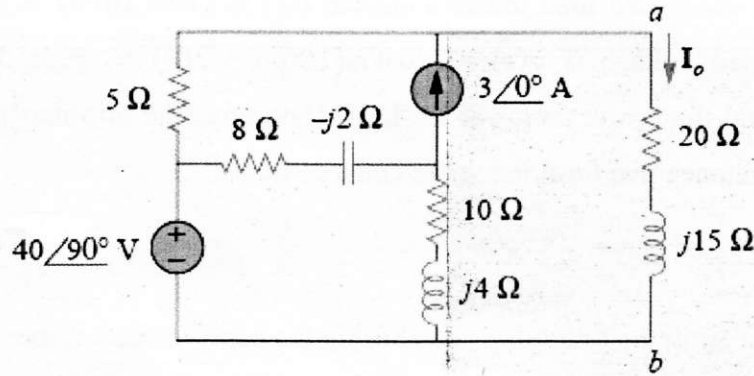
Circuit diagram for question 5(a)

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



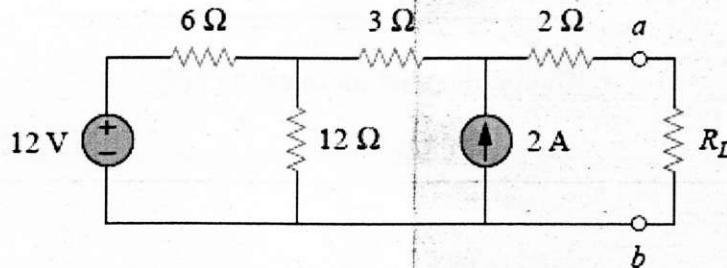
Circuit diagram for question 5(b)

6. (a) Obtain current I_o in the following figure using Norton's theorem. (12)



Circuit diagram for question 6(a)

- (b) Find the value R_L for maximum power transfer in the following circuit. Find the maximum power. (13)



Circuit diagram for question 6(b)

7. (a) If the voltage and current at the terminals of a circuit are (12)
 $v(t) = V_m \cos(\omega t + \theta_v)$
 $i(t) = I_m \cos(\omega t + \theta_i)$

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. (13)

8. (a) Find the value of I required to establish a magnetic flux of $\Phi = 0.75 \times 10^{-4} \text{ Wb}$ in the series magnetic circuit of following figure. (18)

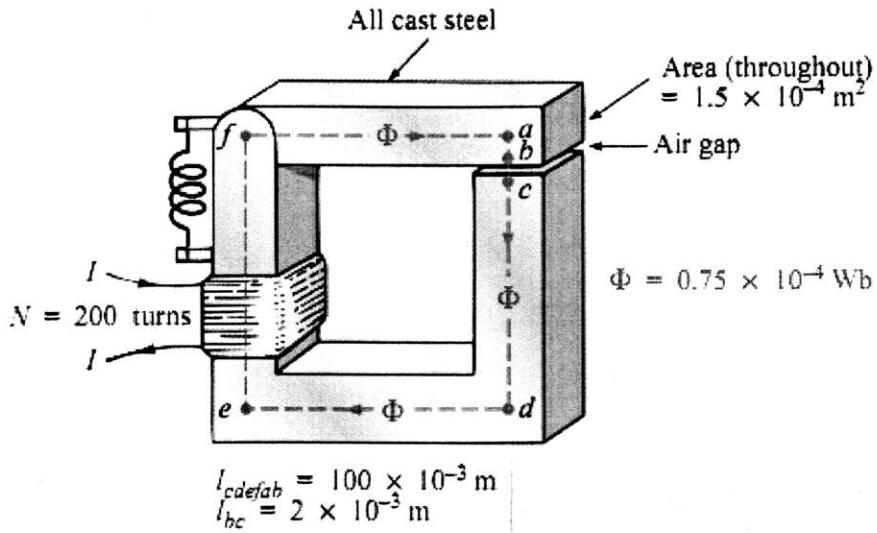


Figure for question 8(a)

Required B-H table

B(T)	0.1	0.2	0.3	0.4	0.5	0.6	0.7
H(At/m)	100	160	200	230	280	340	410

(b) Show that the equivalent capacitance of series-connected capacitors is the reciprocal of the sum of the reciprocals of individual capacitances. (7)

University of Asia Pacific
Department of Basic Sciences and Humanities
Semester Final Examination, Spring 2015
Program: B.Sc. Engineering (Civil)
2nd year 1st semester

Course Title: Bangladesh Studies: History Course Code: HSS 211(b) Credit: 2.00

Total Time: 2 Hours Full Marks: 100

There are **Six** Questions. Answer any **Four**. All questions are of equal value (4 x 25)

1. What was *permanent settlement*? What were its objectives?
2. Briefly describe the reforms of *Pandit Ishwar Chandra Vidyasagar*.
3. Why did Lord Curzon *partition Bengal* in 1905? How did the Muslims and Hindus react?
4. Describe the background and reaction of *Lahore Resolution*.
5. Describe the first phase and significance of *Language Movement*.
6. Explain the *Six Points* of Awami League.

University of Asia Pacific
Department of Basic Sciences and Humanities
Final Examination, Spring 2015
Programme: B. Sc. Engineering (Civil)
(2nd Year 1st Semester)

Course Title: Bangladesh Studies: Society and Culture **Course Code: HSS 211(a)**

Credit: 2.00

Time: 2 Hours

Full Marks: 100

There are SIX questions. Answer ANY FOUR (4x25)

1. Define social stratification. Briefly state the characteristics of social stratification. What are the major types of social stratification? Distinguish caste system from social class.
3+3+4+15
2. What are the major types of sociological research? Discuss any two of them. 5+20
3. Define culture and civilization. Show the differences between culture and civilization.
10+15
4. Define economic institution. Discuss different economic phases of human history.
5+20
5. Define political institution. What are the types of governments? Discuss with examples.
5+5+15
6. Define social disorganisation. What are the causes and factors of social disorganisation in Bangladesh? Discuss. 5+20

University of Asia Pacific
Department of Basic Sciences & Humanities
Final Examination, Spring - 2015
Program: B.Sc. Engineering (Civil Engineering)
2nd year/ 1st semester

Course Title: Mathematics III
 Time: 3 hr

Credit: 3.00

Course Code: MTH 201
 Full Marks: 150

N.B.: Answer 6 questions taking any 3 questions from each Section. Figures in the right margin indicate the marks of the respective questions.

Section- A

1. (a) Define basis and dimension of a vector space. Write down the standard basis and dimension of \mathbb{R}^4 , P_4 and $M_{4 \times 4}$. 12

(b) Let W be the subspace of \mathbb{R}^5 spanned by the vectors $(1, -2, 0, 0, 3)$, $(2, -5, -3, -2, 6)$, $(0, 5, 15, 10, 0)$ and $(2, 6, 18, 8, 6)$. Find a basis and dimension of W . 13

2. (a) Let S and T be the linear operators of \mathbb{R}^2 into \mathbb{R}^2 defined by 10
 $S(u, v) = (3u + 2v, -6u + v)$ and $T(u, v) = (2u + v, u - v)$.
 Find (i) $(ST)(u, v)$ (ii) $S^2(u, v)$

(b) State dimension theorem. Find the rank and nullity of the matrix 15

$$A = \begin{pmatrix} 1 & 3 & 1 & -2 & -3 \\ 1 & 4 & 3 & -1 & -4 \\ 2 & 3 & -4 & -7 & -3 \\ 3 & 8 & 1 & -7 & -8 \end{pmatrix} \text{ and verify the dimension theorem.}$$

3. (a) Define the kernel and the image of a linear transformation. Let $T: \mathbb{R}^4 \rightarrow \mathbb{R}^3$ be a linear transformation defined by 15

$$T(x, y, s, t) = (x - y + s + t, x + 2s - t, x + y + 3s - 3t).$$

Find a basis and the dimension of the kernel of T and the image of T .

(b) Determine a basis and the dimension for the solution space of the homogeneous system of equations 10

$$\begin{aligned} 2x_1 + 2x_2 - x_3 + x_5 &= 0 \\ -x_1 - x_2 + 2x_3 - 3x_4 + x_5 &= 0 \\ x_1 + x_2 - 2x_3 - x_5 &= 0 \\ \vdots & \\ x_3 + x_4 + x_5 &= 0 \end{aligned}$$

4. (a) Define eigenvalues and eigenvectors and write the characteristic equation of a matrix. Determine the eigenvalues and associated eigenvectors of the matrix 15

$$A = \begin{pmatrix} 1 & 2 & 2 \\ 1 & 2 & -1 \\ -1 & 1 & 4 \end{pmatrix}$$

(b) State Cayley-Hamilton theorem and verify this theorem for the matrix $A = \begin{pmatrix} 1 & 4 \\ 9 & 1 \end{pmatrix}$ 10
 also using the theorem find A^{-1} .

5. (a) For the following frequency distribution table calculate mean, median and mode. 10

Weekly rent (in \$)	200-400	400-600	600-800	800-1000	1000-1200	1200-1400
No. of persons paying the rent	6	9	11	14	20	15

- (b) An incomplete distribution is given below: 15

Variable	10-20	20-30	30-40	40-50	50-60	60-70	70-80
Frequency	12	30	?	65	?	25	18

If the total frequency is 229 and median value is 46 then using the median formula, fill up the missing frequencies and calculate the mean of the completed table.

6. (a) What is variance and standard deviation? Compute the standard deviation for the following frequency distribution. 13

Mass in Kg	60-62	63-65	66-68	69-71	72-74
No. of students	5	18	42	27	8

- (b) From the following data of age of employees, calculate coefficient of skewness and comments on the result: 12

Age below (yrs)	25	30	35	40	45	50	55
No. of employees	8	20	40	65	80	92	100

7. (a) The following table gives the age and blood pressure of 10 patients: 15

Age (yrs)	56	42	36	47	49	42	60	72	63	55
Pressure	147	125	118	128	145	140	155	160	149	150

Compute the coefficient of correlation between the age and blood pressure.

- (b) A student takes his examination in four subjects A, B, C and D. He estimates his chances of passing in A as $\frac{4}{5}$, in B as $\frac{3}{4}$, in C as $\frac{5}{6}$ and in D as $\frac{2}{3}$. To qualify, he must pass in B and at least two other subjects. What is the probability that he qualifies? 10

8. (a) The probability that a contractor will get a plumbing contract is $\frac{2}{3}$ and the probability that he will not get an electric contract is $\frac{4}{9}$. If the probability of getting at least one contract is $\frac{3}{5}$, what is the probability that he will get both? 5

- (b) What do you know about binomial distribution and Poisson distribution? The overall percentage of failures in a certain examination is 20. If six candidates appear in the examination, what is the probability that at least five pass the examination? 10

- (c) A die is thrown 8 times and it is required to find the probability that 3 will show 10
 (i) Exactly 2 times (ii) At least seven times (iii) At least once.

The End