

University of Asia Pacific
Department of Civil Engineering
Final Examination Fall 2014
Program: B.Sc. Engineering (Civil)

Course Title: Engineering Materials
Time: 3 Hours

Course Code: CE 201 (B)
Full Marks: 150

There are **EIGHT** questions. Answer any **SIX** questions including **Question #1** and **Question# 2**.
QUESTIONS 1 and 2 are compulsory.

1. Concrete mix design is required for slabs of a building project on the following data: **(40)**

Volume ratio of sand to total aggregate = 0.40
Air Content = 2% (air entraining admixture is not used)
Specific gravity of cement 2.9 (CEM II B-M)
Specific gravity of coarse aggregate (SSD) = 2.6
Specific gravity of fine aggregate (SSD) = 2.5
Design compressive strength (28 days) = 4000 Psi
Minimum required slump = 100 mm
Maximum aggregate size = 3/4 inch, Aggregate type = Stone chips
Dosage of superplasticizer = 5 ml/kg of cement if w/c is less than 0.45

The following graphs are provided:

- Variation of compressive strength (28 day with w/c)
- Variation of cement content with compressive strength (28 day) for different aggregate size and slump value.

Calculate the following:

- (i) Calculate unit contents based on the given data.
- (ii) Calculate the unit weight of the proposed mix.
- (iii) Prepare a mixture proportion table of the proposed mix. Typical form of mixture proportion table is attached.
- (iv) Calculate the volume ratio of the mix. Assume unit weights of cement, sand (SSD) and coarse aggregate (SSD) with void are 1400 kg/m³, 1550 kg/m³ and 1200 kg/m³ respectively
- (v) Estimate the materials in weight and volume (cement, water, sand, and coarse aggregate) required to make a slab of 20 feet length, 18 feet width, and 6 inch depth.
- (vi) Why you need to consider the compaction factor in mix design? Calculate the compaction factor of the mix.
- (vii) What consideration will you make if the temperature is very high during concrete mixing?
- (viii) Explain the advantages and disadvantages of volumetric and weight based mix design.

2. For a culvert construction project, the recommended FM is 2.7 for sand and 6.8 for brick chips. The samples were collected from nearby market and tested in Concrete laboratory of University of Asia Pacific (UAP) for sieve analysis. The Sieve analysis data are given below: (22)

| ASTM Sieve | Amount Retained (g) | |
|------------|---------------------|-------------|
| | Sand | Brick Chips |
| 3" | 0 | 0 |
| 1.5" | 0 | 0 |
| 1.0" | 0 | 0 |
| 3/4" | 0 | 300 |
| 1/2" | 0 | 2500 |
| 3/8" | 0 | 1700 |
| # 4 | 0 | 400 |
| # 8 | 0 | 0 |
| # 12 | 80 | 0 |
| # 16 | 140 | 0 |
| # 30 | 10 | 0 |
| # 40 | 50 | 0 |
| # 50 | 90 | 0 |
| # 100 | 40 | 0 |
| # 200 | 45 | 0 |
| Pan | 45 | 100 |

- (i) Calculate the FM of the sample.
(ii) Draw the grading curve of the samples,
(iii) Discuss the possible ways to improve the FM to the recommended value.
(iv) Comment on the samples based on the sieve analysis data and grading curves.
3. (a) Draw typical stress-strain curves of concrete, steel reinforcement, rubber, CFRP, and glass. (2.5)
(b) Write short note on: (i) Creep, (ii) Relaxation, (iii) Ductility. (3)
(c) Explain the strength development process of brick during burning. How bricks are classified in Bangladesh? (4)
(d) Distinguish between clamp burning and kiln burning of bricks. (2)
(e) What are the benefits of brick aggregate over stone aggregate in concrete construction works? (2.5)
(f) Explain different field tests that are commonly used to check the quality of bricks in the construction site. (4)
(g) What is efflorescence? What will happen if the bricks used in wall have significant efflorescence? (4)
4. (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) Define normal consistency, initial setting, and final setting time of cement. (3)
- (d) 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)
- (e) How will you consider ignition loss in cement? (2)
5. (a) Discuss the following factors associated with the strength of concrete: (7.5)
- (i) Cement content
 - (ii) Cement type
 - (iii) Aggregate gradation
 - (iv) Cement fineness
 - (v) Curing
- (b) Define workability of concrete? How it is measured? (3)
- (c) Write short notes on the followings: (7.5)
- (i) Recycled concrete
 - (ii) Pervious concrete
 - (iii) Self-compacting concrete
 - (iv) Fiber reinforced concrete
 - (v) High performance concrete
- (d) What is plaster? Discuss the uses of plaster in civil engineering. (4)
6. (a) Distinguish between segregation and bleeding. (3)
- (b) Write a short note about: (i) Honey comb, (b) Laitance. (3)
- (c) "Compressive strength of cube is higher than cylinder compressive strength for same mix batch"-Why? (3)
- (d) Discuss the following factors associated with the workability of concrete: (6)
- (i) Cement type
 - (ii) Fineness of cement
 - (iii) Fine aggregate to total aggregate ratio
 - (iv) Shape of aggregate
- (e) Explain different methods of curing of concrete. (3)
- (f) What is shrinkage? Explain different types of shrinkage of concrete. (4)
7. (a) Explain the seawater attack (chloride, sulphate, and CO_2) of concrete with chemical reactions. (8)
- (b) "W/C ratio is the key parameter related to strength and durability of concrete"-explain briefly. (3)
- (c) How is corrosion cell formed over the steel bar inside concrete? Explain with anodic and cathodic reactions. (4)
- (d) What is carbonation? What will happen if concrete is carbonated? (4)
- (e) Write a short note about electroplating. (3)

8. (a) What are the uses of rubber in civil engineering construction? (3)
- (b) Draw typical cross-section of a exogenous tree. Write the objectives of seasoning of timber. (5)
- (c) Explain natural and artificial defects in a tree. Show sketch where necessary. (8)
- (d) Determine the time to start corrosion of steel inside concrete in a beam with clear cover =25 mm. [Given, Coefficient of carbonation= 3.75] (3)
- (e) What is Ferro-cement? Explain the use of ferrocement in civil engineering works. (3)

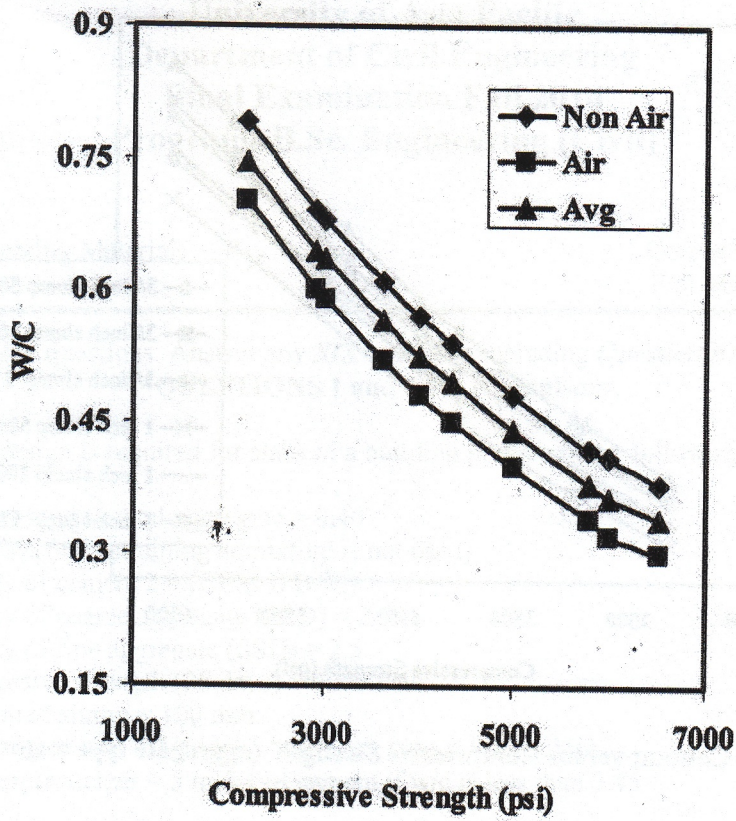


Fig. W/C versus Compressive Strength (aggregate type = stone chips)

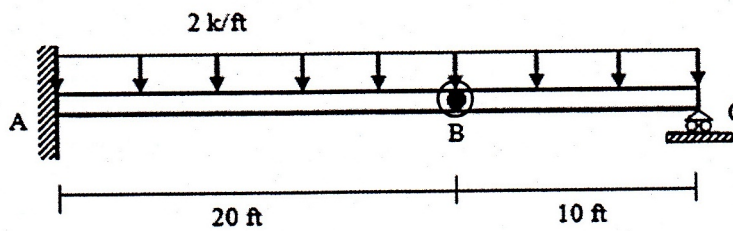
University of Asia Pacific
Department of Civil Engineering
Final Examination Fall 2014
Program: B.Sc Engineering (Civil)

Course Title: Mechanics of Solids I
 Time: 3:00 hours

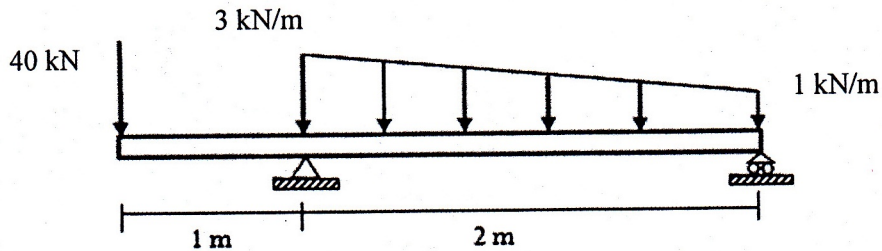
Course Code: CE 211
 Full Marks: 10 x 10 = 100

*Answer any 10 (Ten) of the following 14 Questions
 The symbols have their usual meanings.*

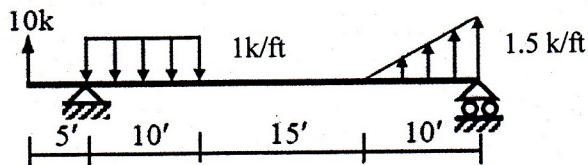
1. Draw SFD and BMD for the beam with loading shown below. B is an internal hinge.



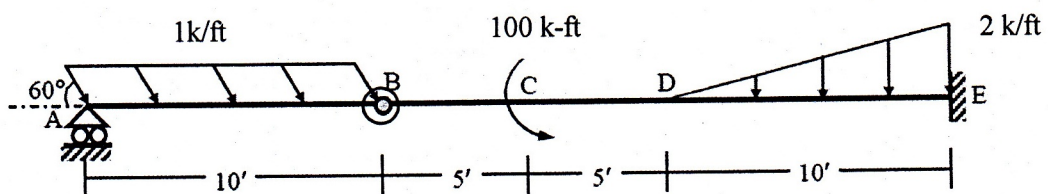
2. Derive the complete equations of Shear Force and Bending Moment of the beam shown below.



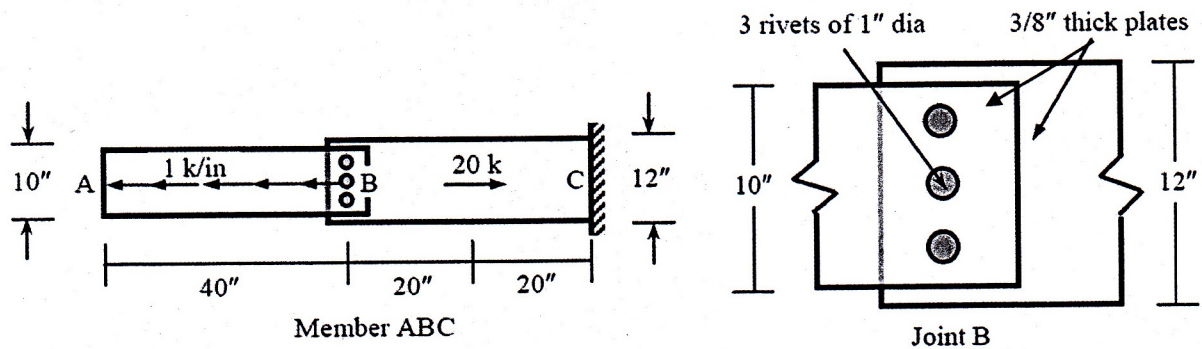
3. Use singularity functions to write equations of SF and BM of the beam loaded as shown below.



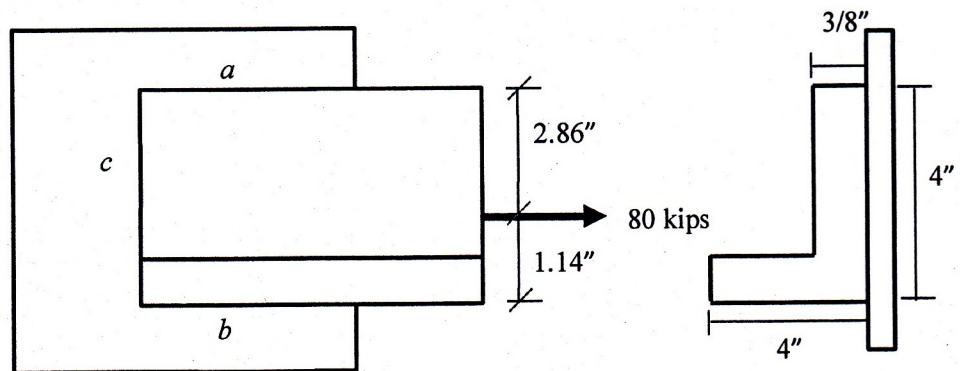
4. Draw AFD, SFD and BMD for the beam with loading shown below. B is an internal hinge.



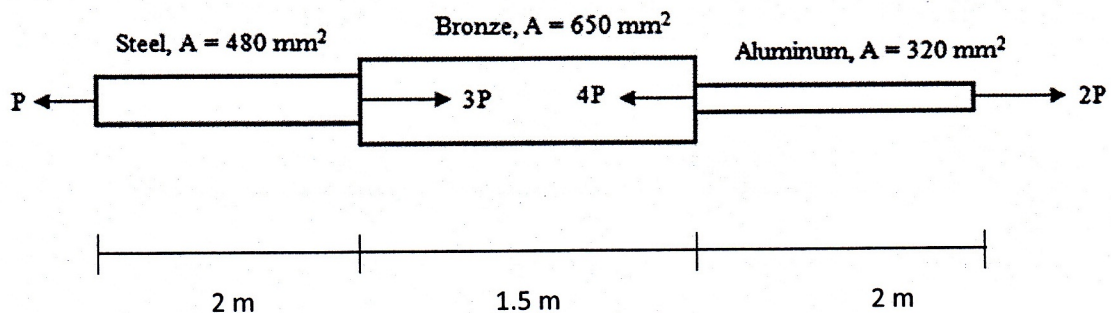
5. Calculate the shearing stress in the rivets and the maximum tearing and bearing stresses in the plates at joint B of the structural member ABC loaded as shown below.



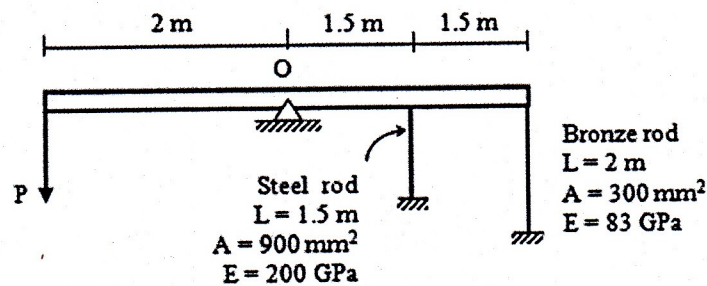
6. A 4 x 4 x 3/8 in. angle, which is to be welded to a gusset plate, carries a load of 80 kips applied along its centroidal axis. Assuming the allowable shearing stress through the throat of each weld is 21 ksi and maximum weld size of 5/16 in., determine the minimum length of welds along 3 sides (a, b, and c) of the angle.



7. A bronze bar is fastened between a steel bar and aluminum bar as shown below. Axial loads are applied at the positions indicated. Determine the largest value of P that will cause no more than 3.0 mm overall deformation or the following stresses: 140 MPa in steel, 120 MPa in bronze and 80 MPa in the aluminum. Use $E_{st} = 200$ GPa, $E_{al} = 70$ GPa and $E_b = 83$ GPa.

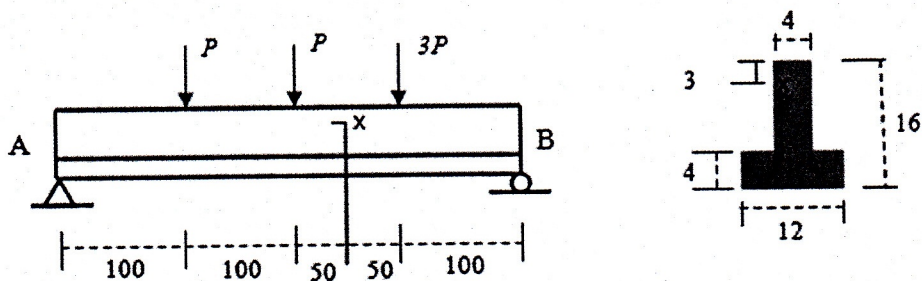


8. As shown below, a rigid bar with negligible mass is pinned at O and attached to two vertical rods. Assuming that the rods were initially stress-free, what maximum load P can be applied without exceeding stresses of 150 MPa in the steel rod and 70 MPa in the bronze rod?

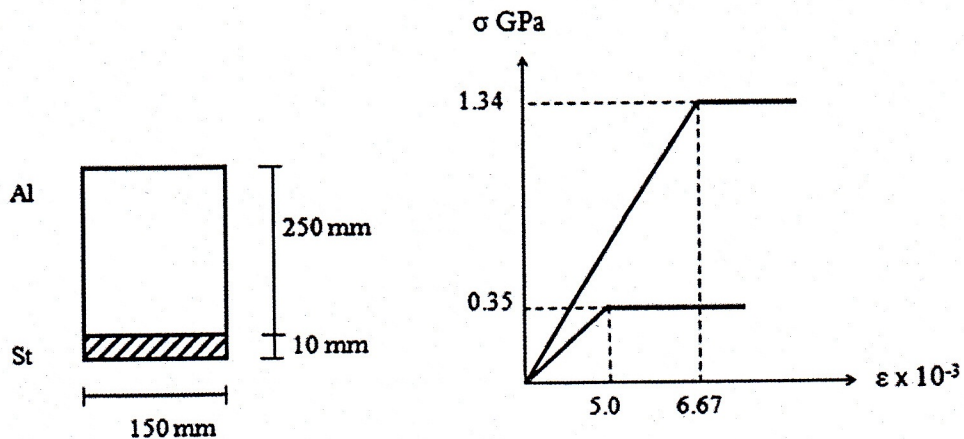


9. A cylindrical pressure vessel is fabricated from steel plate that has a thickness of 20 mm. The diameter of the pressure vessel is 450 mm and its length is 2.0 m. Determine the maximum internal pressure that can be applied if the longitudinal stress is limited to 140 MPa and circumferential stress is limited to 60 MPa.

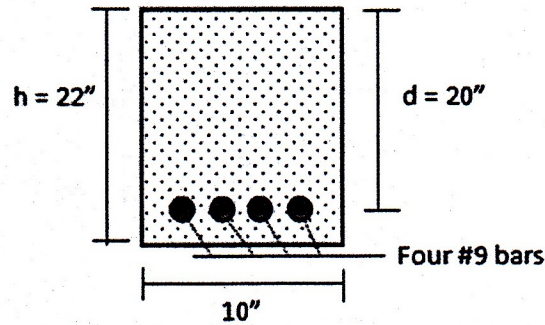
10. An inverted small steel T beam is supported at A and B as shown below. What is the value of P if a strain gage attached at x point measures 0.0002 mm/mm when the load is applied. All dimensions are in mm. $E = 200 \text{ GPa}$. Units are in mm.



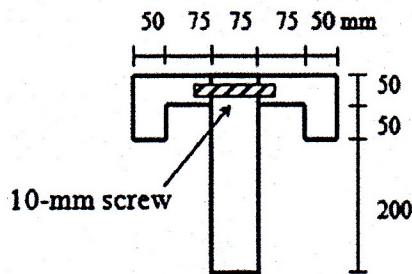
11. Consider a composite beam of the cross-sectional dimensions shown below. The upper 150x250 mm part is aluminum with the lower 10x150 mm strap is steel. If the beam is subjected to a bending moment of 30 kN-m about horizontal axis, what are the maximum stresses in the steel and aluminum?



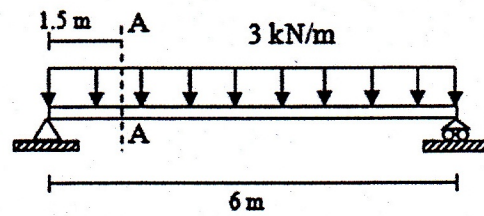
12. Determine the maximum stress in the concrete and the steel for a reinforced concrete beam with the section shown below if it is subjected to a positive bending moment of 50 kip-ft. The reinforcement consists of four #9 steel bars. Assume cracked section and $n = 15$.



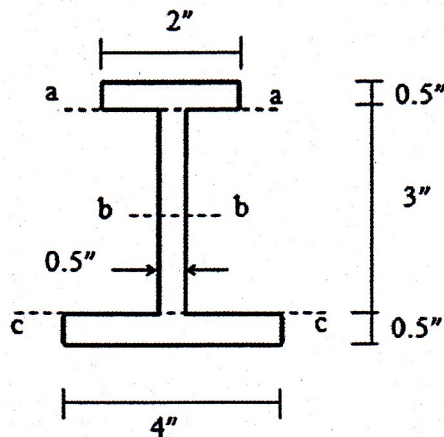
13. A simple beam on 6-m span carries a load of 3 kN/m including its own weight. Specify the spacing of 10-mm screw (as shown) necessary to fasten the parts together. Assume that allowable shear capacity for 10-mm screw is 2 kN.



Section A-A



14. A beam having the cross section with dimension shown below, transmits a vertical shear $V = 7$ kip. Determine the shear stress at section a-a, b-b and c-c. Section b-b is at neutral axis.

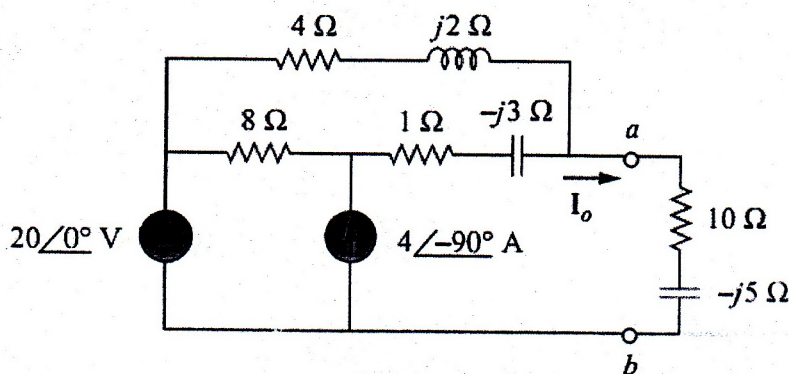


University of Asia Pacific
Department of Civil Engineering
Semester Final Examination, Fall-2014
Program: B. Sc Engineering (2nd Year / 1st Semester)

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

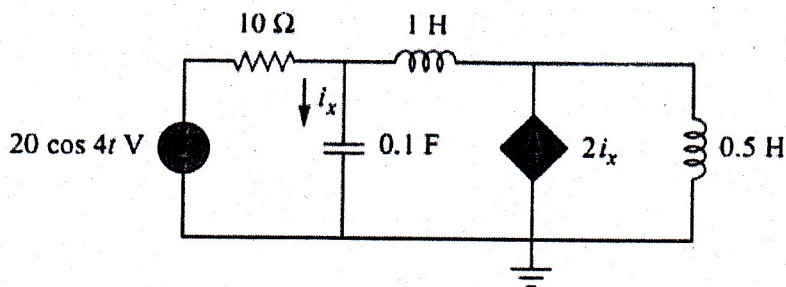
There are **Eight** Questions. Answer any **Six**. Figures in the right margin indicate marks.

1. (a) Determine the Norton equivalent of the following circuit as seen from terminals a-b. Use the equivalent to find I_o . (13)



Circuit diagram for question 1(a)

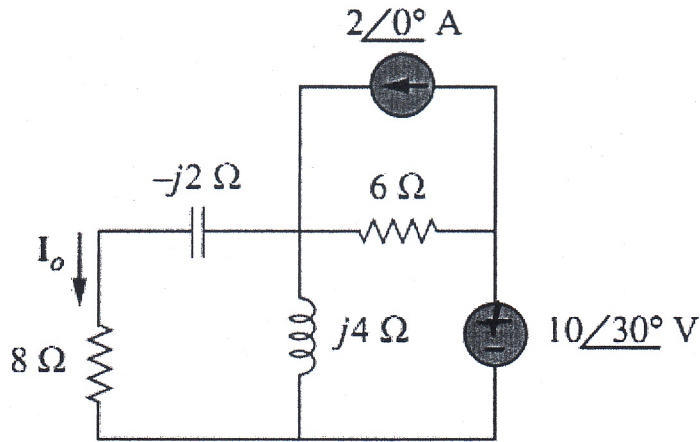
- (b) State and prove Maximum Power Transfer Theorem. (12)
2. (a) Find i_x in the following circuit using nodal analysis. (12)



Circuit diagram for question 2(a)

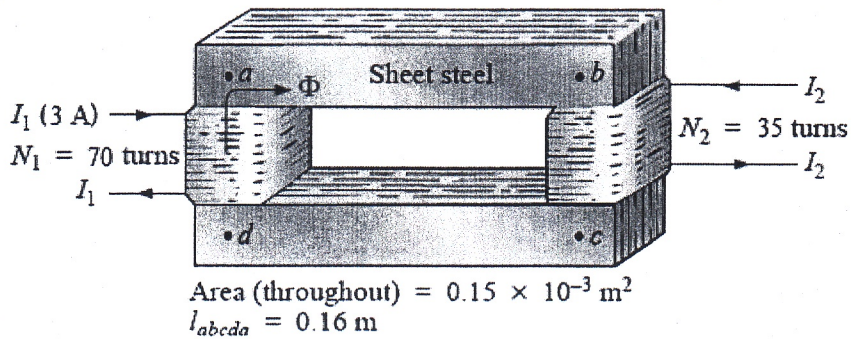
(b) Find I_o in the following circuit using mesh analysis.

(13)



Circuit diagram for question 2(b)

3. (a) Determine the secondary current I_2 for the transformer of the following figure if the resultant clockwise flux in the core is 2.5×10^{-5} Wb. (13)



Circuit diagram for question 3(a)

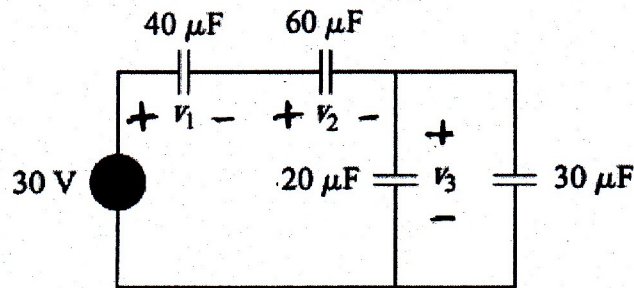
Required B-H table:

| | | | | |
|-----------|-----|-------|-----|------|
| B (T) | 0.1 | 0.167 | 0.2 | 0.25 |
| H (A-t/m) | 20 | 30 | 40 | 45 |

(b) Given $v_1=20\sin(\omega t + 60^\circ)$ and $v_2=60\cos(\omega t - 10^\circ)$. Determine the phase angle between the two sinusoids and which one lags the other?

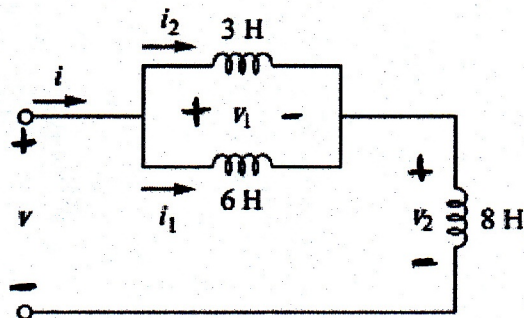
If voltage $v=6\cos(100t-30^\circ)$ is applied to $50\mu\text{F}$ capacitor, calculate the current through the capacitor. (8+5)

6. (a) For the following circuit, find the voltages across each capacitor. (13)



Circuit diagram for question 6(a)

(b) In the following circuit $i_1(t)=0.6e^{-2t}$. If $i_1(0)=1.4\text{A}$, find (i) $i_2(0)$ (ii) $i_2(t)$ (iii) $i(t)$ (iv) $v(t)$ (v) $v_1(t)$ (vi) $v_2(t)$ (12)

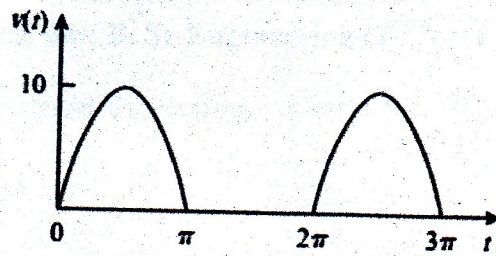


Circuit diagram for question 6(b)

7. (a) Show that the voltage current relationship in frequency domain for inductor is $V=j\omega LI$ when assume the current through the inductor is $i=I_m \cos(\omega t + \phi)$ (13)

(b) Prove that for the sinusoid $i(t)=I_m \cos\omega t$, the rms or effective value is $I_{\text{rms}}=I_m/\sqrt{2}$ (12)

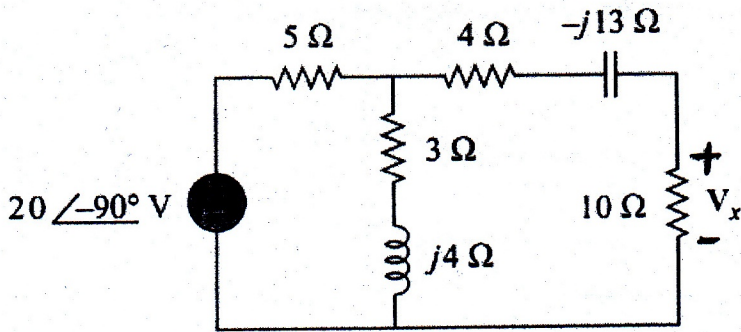
(a) The waveform shown in the following figure is a half wave rectified sine wave. Find the rms value and average power dissipated in 10Ω resistor. (13)



Circuit diagram for question 8(a)

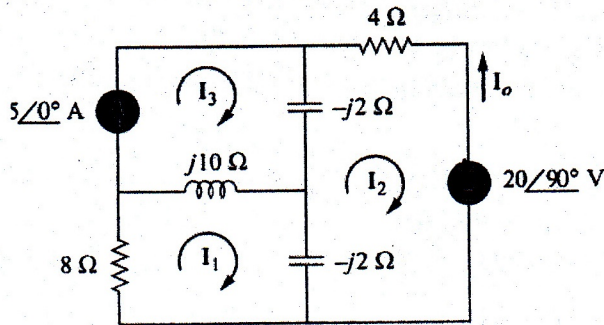
(b) A series connected load draws a current $i(t)=4\cos(100\pi t + 10^\circ)$ A when applied voltage is $v(t)=120\cos(100\pi t - 20^\circ)$. Find the apparent power and power factor of the load. Determine the element values that form the series connected load. (12)

(b) Calculate V_x in the following circuit using the method of source transformation. (12)



Circuit diagram for question 3(b)

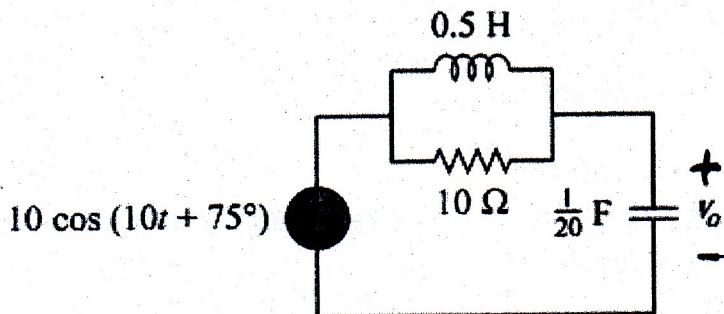
4. (a) Use the superposition theorem to find I_o in the following circuit. (18)



Circuit diagram for question 4(a)

(b) Show that the equivalent capacitance of N parallel-connected capacitors is the sum of individual capacitances. (7)

5. (a) Calculate V_o in the following circuit. (12)



Circuit diagram for question 5(a)

University of Asia Pacific
Department of Basic Sciences and Humanities
Semester Final Examination, Fall 2014
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)

Figures in the right margin indicate marks.

1. Define social stratification. What are the characteristics of social stratification? "No society is classless or un-stratified" describe the different types of social stratification?
8+7+10
2. What is the difference between crime and deviance? What are the different schools of crime? Briefly describe Sutherland's theory.
5+5+15
3. Define social mobility. What are the vertical, horizontal, intergenerational and intragenerational social mobility? What are the causes of social mobility in Bangladesh?
7+8+10
4. What is economic institution? What are the differences between food collecting and food producing economy? What are the characteristics of horticultural, agricultural and industrial societies?
5+5+15
5. Define culture and civilization. What are the characteristics of culture? "Culture is what we are and civilization is what we use"-- justify the statement.
5+10+10
6. What is political institution? What are the functions of rural and urban local government in Bangladesh?
5+10+10

University of Asia Pacific
Department of Basic Sciences and Humanities
Semester Final Examination, Fall 2014
Program: B.Sc. Engineering (Civil)
2nd year 1st semester

Course Title: Bangladesh Studies: History
Credit: 2.00

Course Code: HSS 211(b)

Total Time: 2 Hours

Full Marks: 100

Answer ANY FOUR (4 x 25)

1. What was *permanent settlement*? Why did Lord Cornwallis introduce it in Bengal?
2. How did *Pandit Ishwar Chandra Vidyasagar* contribute to the society?
3. Why did Lord Curzon *Partition Bengal* in 1905? How did the Muslims and Hindus react?
4. Describe the background of *Lahore Resolution*. How did the term '*States*' replace by '*State*'?
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 & Humanities
Final Examination Fall 2014
Program: B. Sc. Engineering (Civil)
2nd year/ 1st semester

Course Title: Math III
Time: 3 (Three) hours

Credit: 3.00

Course Code: MTH 201
Full Marks: 150

Section- A

Answer any 3 (Three) of the following questions:

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
 $S(u, v) = (3u + 2v, -6u + v)$ and $T(u, v) = (2u + v, u - v)$.
Find (i) $(ST)(u, v)$ (ii) $S^2(u, v)$ 10
- (b) State dimension theorem. Find the rank and nullity of the matrix
 $A = \begin{pmatrix} 1 & 3 & 1 & -2 & -3 \\ 1 & 4 & 3 & -1 & -4 \\ 2 & 3 & -4 & -7 & -3 \\ 3 & 8 & 1 & -7 & -8 \end{pmatrix}$ and verify the dimension theorem. 15
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
 $T(x, y, s, t) = (x - y + s + t, x + 2s - t, x + y + 3s - 3t)$.
Find a basis and the dimension of the kernel of T and the image of T . 15
- (b) Determine a basis and the dimension for the solution space of the homogeneous system of equations 10
- $$\begin{aligned} x_1 + x_2 - x_3 &= 0 \\ -2x_1 - x_2 + 2x_3 &= 0 \\ -x_1 + x_3 &= 0 \end{aligned}$$
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 $A = \begin{pmatrix} 1 & 4 \\ 9 & 1 \end{pmatrix}$ also using the theorem find A^{-1} . 10

Section- B

Answer any 3 (Three) of the following questions:

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:

| 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. 15

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
(i) Exactly 2 times (ii) At least seven times (iii) At least once. 10

The End