

**University of Asia Pacific**  
**Department of Civil Engineering**  
**Final Examination Spring 2018**  
**Program: B.Sc. Engineering (Civil)**

Course Title: Engineering Materials  
 Time: 3 hours

Course Code: CE 201  
 Full Marks: 100 (= 40 + 6 X 10)

*Answer all questions.*

**Question 1:**

Lightweight Concrete (LWC) has recently gained popularity not only in abroad but also in Bangladesh due to reduction in the dead load of the building and providing more space due to the reduction in size of the structural members. Due to the aforementioned issues, an industrial concrete slab having with length 30m, width 15m, and thickness 0.2m will be constructed. In order to better investigation and to finalize the mix design, the materials are collected and different physical tests are performed. The test data of sieve analysis of fine sands are given below:

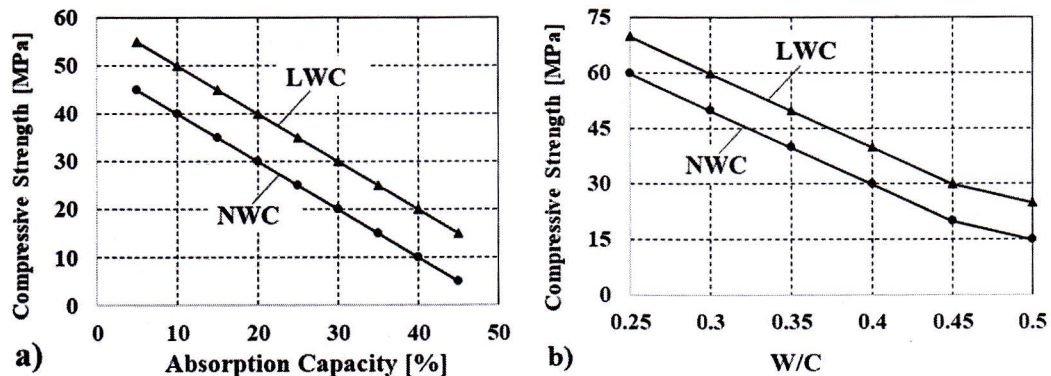
ASTM Sieve	Sieve opening (mm)	Materials Retained (gm)	
		Sand-A	Sand-B
3 inch	76.2	0	0
1.5 inch	38.1	0	0
3/4 inch	19.05	0	0
3/8 inch	9.5	0	0
# 4	4.75	0	0
# 8	2.36	50	0
# 12	1.7	100	0
# 16	1.19	100	0
# 30	0.59	50	200
# 40	0.425	50	300
# 50	0.3	50	0
# 100	0.15	75	0
# 200	0.075	25	0
Pan	-	0	0

- a. (i) Calculate Fineness Modulus (FM) of fine aggregate (sand) samples. [12]
- (ii) Draw the grading curve of sand samples. Based on the grading curve of two sand samples, proposed the suitable sand for LWC and justify your selection.

- b. LWC is more prone to fire spalling compared to the Normal Weight Concrete (NWC) due to an increased absorbed water in the lightweight aggregate particles. Hence, the design **absorption capacity of LWC is 30%** has been chosen to avoid fire spalling of LWC. In order to do the mix design, **water to cement ratio (W/C)** will be taken from Figure 1 with respect to the absorption capacity of LWC. No chemical admixture will be used during the concrete mixing. The following necessary data are provided for the LWC mix design: [18]

Sand to total aggregate volume ratio = 0.48  
 Specific gravity of proposed fine aggregate (sand) = 2.56  
 Specific gravity of coarse aggregate = 2.81  
 Cement type = Ordinary Portland cement (OPC)  
 Amount of cement =  $350 \text{ kg/m}^3$   
 Air content = 2% (air entraining admixture will not be used)  
 The weight basis mix design has been considered.

- (i) Calculate the amount of cement, coarse aggregate, fine aggregate, and water per unit cubic meter of concrete.  
 (ii) Estimate the quantity of cement, coarse aggregate, fine aggregate, and water required for the casting of the slab (30m x 15m x 0.2m) and 18 cylinders (diameter = 100mm and height = 200mm) to monitor the strength of LWC at 7, 14, 28, 60, 90, and 120 days (3 cylinders/test age). Assume 30% extra volume is necessary due to total loss of concrete during casting of the slab and cylinders.



**Figure 1:** Absorption capacity (a) and water to cement ratio (W/C) (b) as a function of compressive strength of both LWC and NWC.

**Note:** LWC = Lightweight Concrete, NWC = Normal Weight Concrete

- c. Plastering of the slab is necessary to provide extra protection from the environmental actions at all seasons. Hence, 5mm thick mortar plaster will be applied to the interior surface of the slab (30m x 15m). [10]  
 Assume sand to cement ratio (weight basis) = 3, water to cement ratio = 0.45,  
 Air content = 3%, specific gravity of sand = 2.5, and cement type = OPC.

- (i) Estimate the amount of each ingredient (cement, sand, and water) of mortar necessary for the plastering work of the interior surface of the slab. Assume 30% extra volume of material is necessary due to total loss of mortar during application on the slab surface.

**Question 2:**

- a. Draw qualitative stress-strain curves of aggregate, concrete, and cement past in a same graph and make comparison among them. [3]  
Or  
Using schematic diagram and comments, write the main difference between ductility and brittleness of the materials.
- b. "English bond is considered as the strongest and most widely used brick bond in construction work". Do you agree or disagree with this statement? Justify your comment. [3]  
Or  
"Brick gets strength during burning". Justify this statement with proper explanation.
- c. Distinguish between clamp burning and kiln burning of bricks. [2]
- d. Based on your understanding, what are the causes of efflorescence of brick. [2]

**Question 3:**

- a. Sketch the schematic diagram of structure of hydrated silicates of cement and explain water held in hydrated cement paste. [4]  
Or  
Draw the development of strength of pure compounds of cement:  $C_2S$ ,  $C_3S$ ,  $C_3A$ , and  $C_4AF$ . Explain hydration of Silicate with chemical reaction. Which is the main strength giving compound and what is the shape and size of that compound?
- b. Identify the factors that affect the normal consistency of cement. [2]
- c. List the main advantages of using blended cement. [2]
- d. According to your knowledge, what are the function of gypsum in cement hydration. [2]

**Question 4:**

- a. Illustrate the mechanism for bulking of sand. [2]
- b. Why is grading of aggregate important with regard to the properties of fresh and hardened concrete? [4]  
Or  
Explain different moisture condition of coarse aggregate.
- c. Based on your understanding, what is the main difference between mortar and plaster. [2]
- d. Without changing the water content, what other strategies would you use to change the workability of concrete? [2]

**Question 5:**

- a. "There is a growing trend toward the use of Fair-Faced Concrete in Bangladesh". Explain this statement with proper explanation. [5]  
Or  
"The incorporating of steel fibers in concrete improve the mechanical and durability performance of the concrete structures". Justify this statement.
- b. Report the factors influencing shrinkage in concrete. [2]
- c. Summarize causes of bleeding of concrete and the effects on concrete performance due to bleeding. [3]

**Question 6:**

- a. Using schematic diagram, explain the mechanism of superplasticizer to improve the workability of concrete. [4]
- b. Give an overview on the effect of incorporation of fly ash in cement on the hardened properties of concrete. [3]
- c. Define ferrocement. List the advantages of using ferrocement. [3]

**Question 7:**

- a. Explain briefly, deterioration of concrete due to sulfate attack. [4]
- b. Sketch a typical cross-section of a timber and show different parts of it. [3]
- c. Describe vulcanization of rubber. [3]

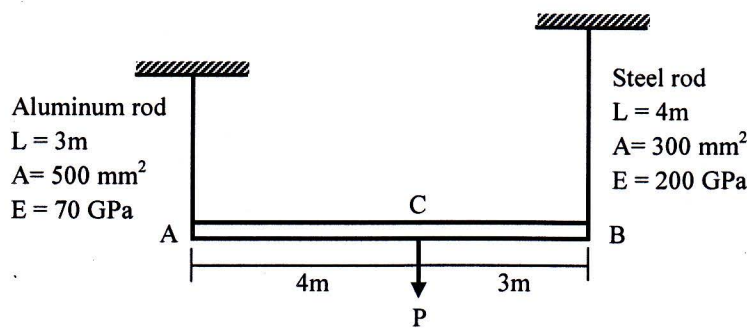
**University of Asia Pacific**  
**Department of Civil Engineering**  
**Final Examination Spring 2018**  
**Program: B.Sc. in Civil Engineering**

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

Course Code: CE 211  
 Full Marks:  $10 \times 10 = 100$

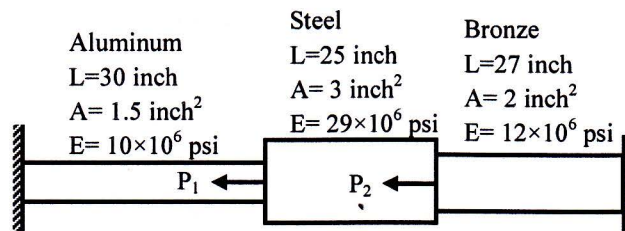
*Answer any 10 (Ten) of the following 13 (Thirteen) Questions*  
*The symbols have their usual meanings.*  
*[Assume Reasonable Values for Any Missing Data]*

1. The rigid bar AB, attached to two vertical rods as shown in *Fig. 1* is horizontal before the load P is applied. Determine the vertical movement of P if its magnitude is 60 kN.



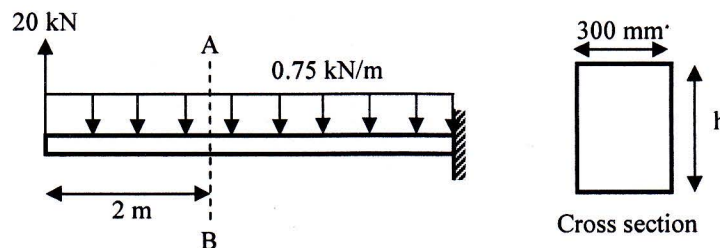
*Fig. 1*

2. The composite rod shown in *Fig. 2* is stress-free before the axial loads  $P_1$  and  $P_2$  are applied. Assuming that the walls are rigid, calculate the stress in each material if  $P_1 = 50$  kip and  $P_2 = 25$  kip.



*Fig. 2*

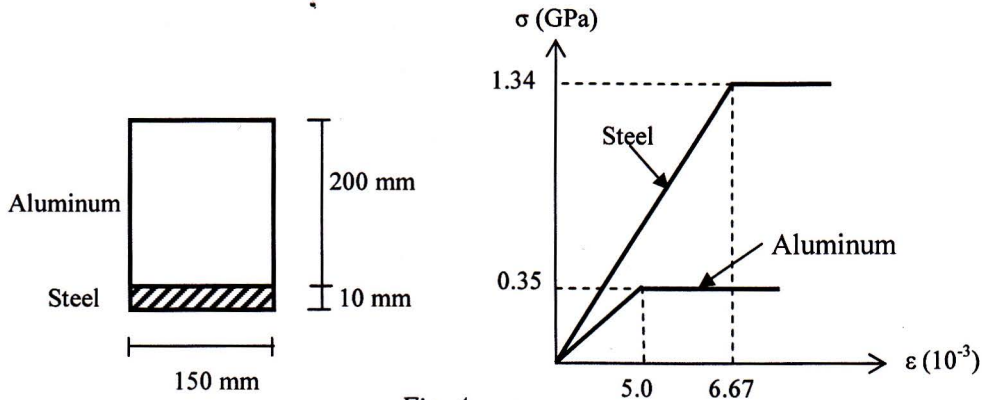
3. A wooden cantilever beam of 300 mm width carries a superimposed dead load of 0.75 kN/m and an upward force of 20 kN at the free end, as shown in *Fig. 3*. Calculate 'h' if the allowable bending stress is 15 MPa at section A-B located 2 m away from the free end. Assume that, self-weight of the wooden beam is negligible.



*Fig. 3*

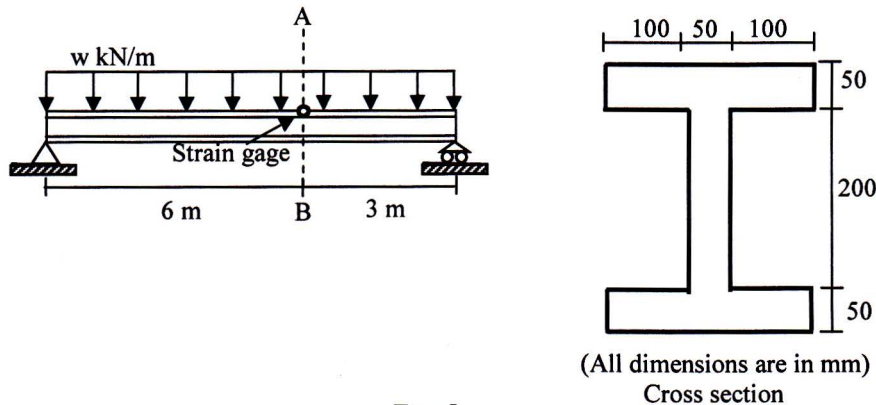
4. Consider a composite beam of the cross-sectional dimensions shown in *Fig. 4*. The upper 150 mm  $\times$  200 mm part is aluminum while the lower 150 mm  $\times$  10 mm strap is steel. If the beam is subjected to a positive bending moment of 30 kN-m around horizontal axis, what are the maximum stresses in the steel and aluminum?

Note: Modulus of elasticity for steel and aluminum can be found from the stress-strain diagram provided.



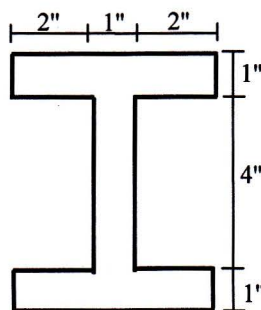
*Fig. 4*

5. A steel I-beam shown in *Fig. 5* is simply supported and a strain gage is attached at the top of upper flange at section A-B. What is the magnitude of the uniformly distributed load 'w' if the strain gage measures 0.0002 mm/mm when the load is applied? Given that,  $E = 200$  GPa.



*Fig. 5*

6. Cross-section of an I-beam is shown in *Fig. 6*. Compute (a) maximum shear stress, (b) shear stress at junction of flange and web and (c) percentage of shear resisted by web alone. Given that, vertical shear,  $V = 15$  kips.



*Fig. 6*

7. (a) Compute and draw the shear flow diagram for the thin-walled channel section shown in Fig. 7 at the longitudinal section where shear force is maximum. (5)  
 (b) Determine and locate the shear center of the section. (5)

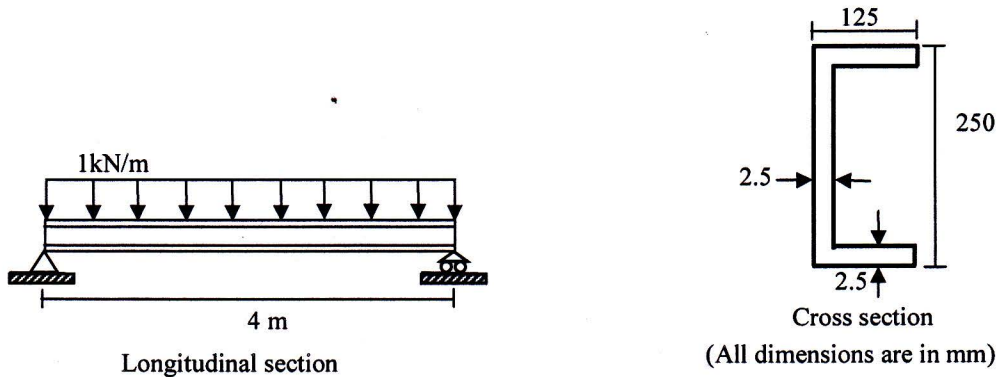


Fig. 7

8. Draw SFD and BMD for the beam with loading shown in Fig. 8.

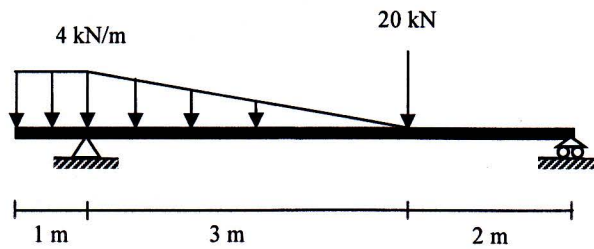


Fig. 8

9. Derive the complete equations of Shear Force and Bending Moment of the beam shown in Fig. 9.

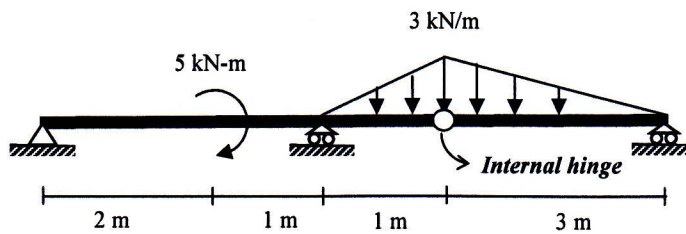


Fig. 9

10. Using singularity function, determine the value of shear and moment at  $x = 0, 2, 6$  and  $8$  m of the beam loaded as shown in Fig. 10.

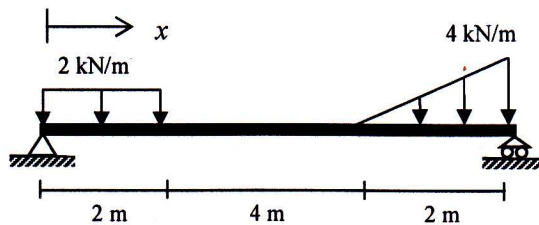
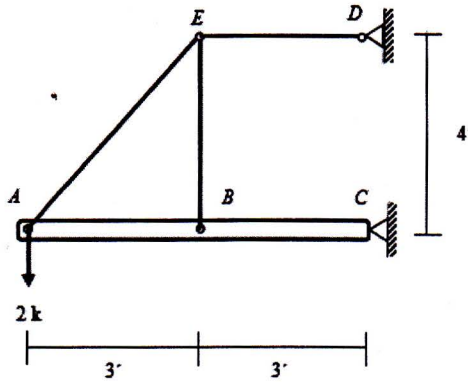


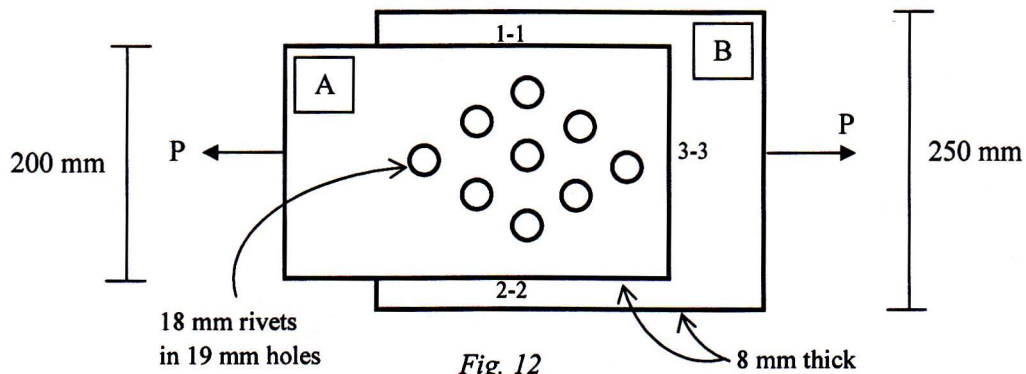
Fig. 10

11. A beam  $AC$  is supported by steel members  $AE$  and  $BE$  and a pin at  $C$  as shown in *Fig. 11*. Member  $AE$  is made up of  $6 \times 200$  mm flat bar. Determine the axial stress in bar  $AE$ .



*Fig. 11*

12. Determine the safe load,  $P$  on the lap connection shown in *Fig. 12* if the rivets are of  $18\text{-mm}$  diameter (assume  $19\text{-mm}$  holes) and both plates  $A$  and  $B$ , are  $8\text{ mm}$  thick. Plate  $A$  is  $200\text{ mm}$  and Plate  $B$  is  $250\text{ mm}$  wide. Use allowable shearing stress of  $95\text{ MPa}$ , tearing stress of  $140\text{ MPa}$  and bearing stress of  $220\text{ MPa}$ .



*Fig. 12*

13. In *Fig. 12*, calculate the length of  $9.5\text{ mm}$  weld joints, instead of rivets, required on sides  
 (i)  $1-1$  and  $2-2$  only,  
 (ii)  $1-1$ ,  $2-2$  and  $3-3$  to connect the  $12.5\text{ mm}$  thick plate section  $A$  to the  $16\text{ mm}$  thick plate  $B$ . Axial force of  $220\text{ kN}$  passes through centroid of  $A$  and  $B$ .  
 [Given: Allowable shear stress =  $110\text{ MPa}$ ].



# University of Asia Pacific

## Department of Civil Engineering

### Semester Final Examination, Spring-2018

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

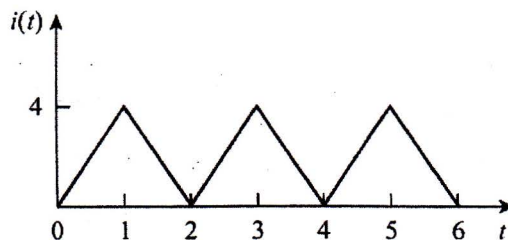
Course Title: Basic Electrical Engineering Course No. ECE (CE) 201 Credits: 3.00

Time: 3.00 Hours.

Full Marks: 150

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

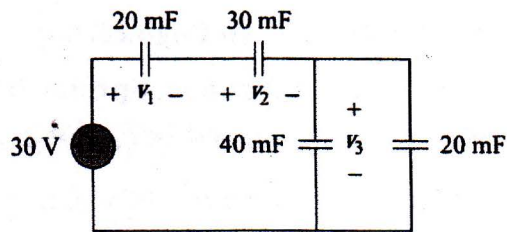
1. (a) Find the phase angle between  $i_1 = -4 \sin(377t + 25^\circ)$  and  $i_2 = 5 \cos(377t - 40^\circ)$  Does  $i_1$  lead or lag  $i_2$ ? 10
- (b) The voltage  $v = 12 \cos(60t + 45^\circ)$  is applied to a 0.1-H inductor. Find the steady-state current through the inductor 7
- (c) Find the amplitude, phase, period, and frequency of the sinusoid  $v(t) = 12 \cos(50t + 10^\circ)$  8
2. (a) Determine the rms value of the current waveform in following figure. 12



Waveform for question 2(a)

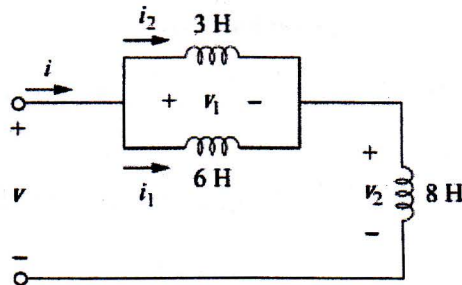
- If the current is passed through a  $9\text{-}\Omega$  resistor, find the average power absorbed by the resistor.
- (b) Obtain the power factor and the apparent power of a load whose impedance is  $Z = 60 + j40 \Omega$  when the applied voltage is  $v(t) = 150 \cos(377t + 10^\circ)$  V. Also, determine the element values that form the series-connected load. 13
  3. (a) Prove with necessary figure that the equivalent capacitance of series connected capacitors is the reciprocal of the sum of the reciprocals of the individual capacitances 12

- (b) For the circuit in following figure, find the voltage across each capacitor 13



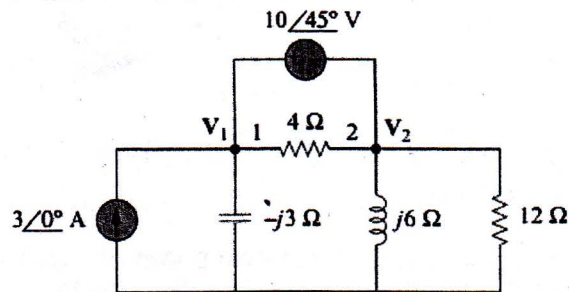
Circuit diagram for question 3(b)

4. (a) The current through a 0.1-H inductor is  $i(t) = 10te^{-5t}$  A. Find the voltage across the inductor and the energy stored 8
- (b) In the circuit of following figure,  $i_1(t) = 0.6e^{-2t}$  A. If  $i(0) = 1.4$  A, find: 17  
 (a)  $i_2(0)$ ; (b)  $i_2(t)$  and  $i(t)$ ; (c)  $v(t)$ ,  $v_1(t)$ , and  $v_2(t)$



Circuit diagram for question 4(b)

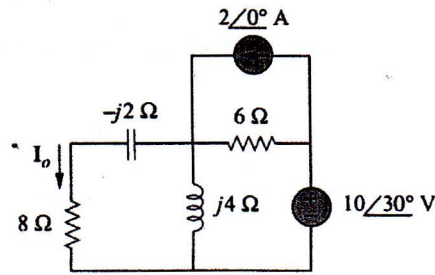
5. (a) Compute  $V_1$  and  $V_2$  using nodal analysis in the circuit of following figure. 12



Circuit diagram for question 5(a)

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

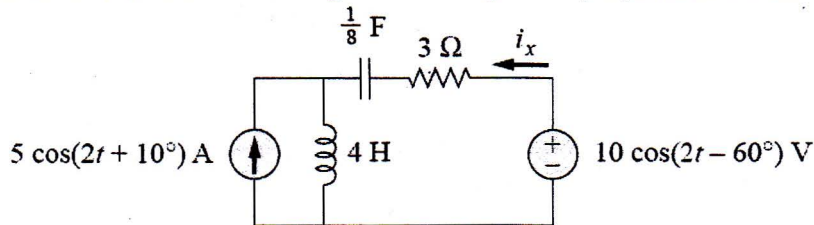
13



Circuit diagram for question 5(b)

6. (a) Calculate  $i_x$  in the following circuit using the superposition theorem.

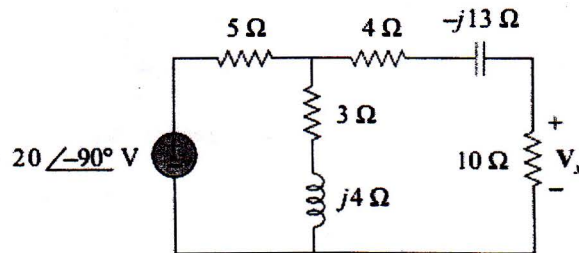
13



Circuit diagram for question 6(a)

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

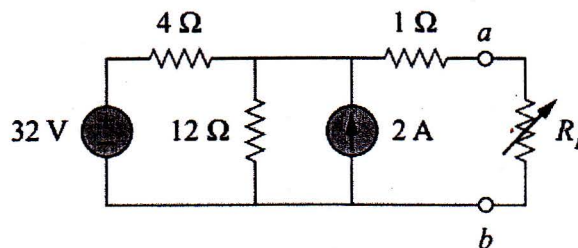
12



Circuit diagram for question 6(b)

7. (a) Find the Thevenin equivalent circuit of the following circuit shown in following figure, to the left of the terminals  $a-b$ . Then find the current through  $R_L = 6, 16, \text{ and } 36 \Omega$

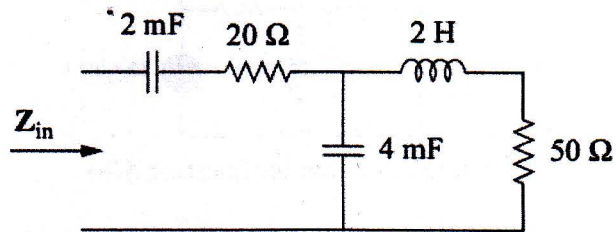
13



Circuit diagram for question 7(a)

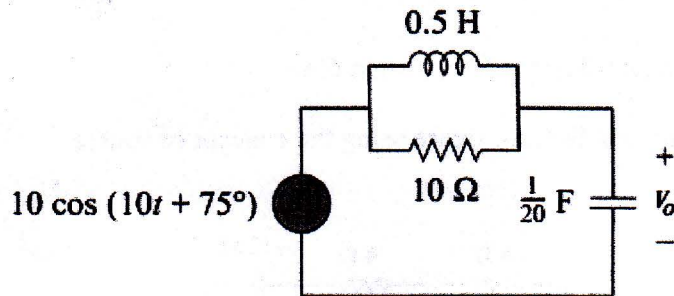
(b) State and prove Maximum Power Transfer Theorem. 12

8. (a) Determine the input impedance of the circuit in the following figure at  $\omega = 10$  rad/s. 13



Circuit diagram for question 8(a)

(b) Calculate  $V_o$  in the circuit of the following figure. 12



Circuit diagram for question 8(b)

**University of Asia Pacific**  
**Department of Basic Sciences and Humanities**  
**Final Examination, Spring 2018**  
**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

There are **Six** questions. Answer **ANY FOUR** (4 X 25)

1. "Society is the complex of organized association and institution with a community"  
(G. D. M. Cole). Explain. 25
  
2. a. Define scientific method. 5  
b. Explain how the scientific method can be applied to the study of society. 20
  
3. a. Define family and marriage. 10  
b. Describe the impact of globalization on family and marriage in the context of your own society. 15
  
4. Critically discuss Durkheim's views about 'Suicide'. 25
  
5. a. Define culture. 5  
b. State different elements of culture in relation to your own society. 20
  
6. a. Define socialization. 5  
b. Discuss the role of Mass Media and technology in the process of socialization. 20

**University of Asia Pacific**  
**Department of Basic Sciences and Humanities**  
**Final Examination, Spring 2018**  
**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

There are Six Questions. Answer any Four. All questions are of equal value. Figures in the right margin indicate marks.

1. a. Discuss Diwani Right and Duel System. 10  
b. Explain the impact of Duel System. 15
2. a. Describe the objective of the British rulers to initiate the permanent Settlement act in 1793. 15  
b. Note down the impact of the Permanent Settlement on the society 10
3. a. Point out the salient features of the Faraizi Movement. 15  
b. Give reasons for the success of the peasant movements in Bengal. 10
4. a. Explain the reasons behind the partition of Bengal in 1905. 15  
b. Discuss the reactions of the partition (1905) in two parts of Bengal. 10
5. a. Give the socio-political difference between the two parts of Pakistan. 15  
b. Note down the importance of the Language Movement of 1952. 10
6. a. Describe the six points of Six Point Program of 1966. 15  
b. Give the significance of the Six Point Program. 10

**University of Asia Pacific**  
**Department of Basic Sciences and Humanities**  
**Final Examination, Spring -2018**  
**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 **Three** questions from each group. Figures given in the right margin indicate the marks of the respective questions.

**Group: A**

1. (a) Test whether the set  $W = \{(a, b, c, d) | a + b = 0, c + d = 0\}$  is a subspaces of  $\mathbb{R}^4$  or not. 10
- (b) Let  $U$  and  $W$  be the following subspaces of  $\mathbb{R}^4$ : 15  
 $U = \{(a, b, c, d) | b + c + d = 0\}$ ,  $W = \{(a, b, c, d) | a + b = 0, c = 2d\}$ .  
 Find a basis and the dimension of (i)  $U$  (ii)  $W$  (iii)  $U \cap W$ .
2. (a) Define linear transformation. Determine whether or not the transformation  $T: \mathbb{R}^2 \rightarrow \mathbb{R}^2$  defined by  $T(x, y) = (x + y, x)$  is linear. 10
- (b) Find the matrix representation of the linear operator  $T$  on  $\mathbb{R}^2$  defined by  $T(x, y) = (2y, 3x - y)$  relative to the basis  $\{f_1 = (1, 3), f_2 = (2, 5)\}$ . 15  
 Also verify that  $[T]_f[v]_f = [T(v)]_f$  for any vector  $v \in \mathbb{R}^2$ .
3. (a) Let  $T: \mathbb{R}^2 \rightarrow \mathbb{R}^2$  be linear operator defined by  $T(x, y) = (y, 2x - y)$ . Find a formula for  $T^{-1}(x, y)$ . 13
- (b) Let  $E = \{(1, -2), (3, -4)\}$  and  $B = \{(1, 3), (3, 8)\}$  be two bases of  $\mathbb{R}^2$ . Then find the transition matrix  $Q$  from  $B$  to  $E$ . 12
4. (a) A coin is tossed two times. Let  $X$  equals the number of heads observed. Construct the probability distribution of  $X$ . Hence find the probability function of  $X$ . Also find the expected value of  $X$  and variance of  $X$ . 10
- (b) Let  $X$  be a continuous random variable with probability density function (p.d.f) 15  

$$f(x) = \begin{cases} \frac{1}{m} e^{-x/m}, & x > 0 \\ 0, & \text{otherwise} \end{cases}$$
 Find mean  $\mu = E(X)$ , variance  $\sigma^2 = Var(X)$  and  $E(X^3)$ .

**Group: B**

5. (a) Calculate mean (step deviation method), median, mode and lower quartile for the distribution of the weights of 100 articles from the data given below: 15

Weight (in kg):	0--10	10--20	20--30	30--40	40--50	50--60
No. of articles:	14	12	20	21	19	14

Locate mode graphically.

- (b) Suppose box  $B_1$  contains 3W & 5R balls and box  $B_2$  contains 4W & 6R balls. A ball is drawn at random from box  $B_1$  and transferred to box  $B_2$  without noting its color. Then a ball is drawn from box  $B_2$ . Find the probability that the ball is red. 10

6. (a) A purchasing agent obtained samples of 60 watt bulbs from two companies. He had the samples tested in his own laboratory for length of life with the result: 15

Length of life (in hr)	Samples from	
	company A	company B
1700--1900	10	3
1900--2100	16	40
2100--2300	20	12
2300--2500	8	3
2500--2700	6	2

- (i) Which company's bulbs are better in terms of average life?  
 (ii) If price of both types are same, which company's bulbs should be bought and why?

- (b) State Bayes theorem. Apply this to solve the following problem 10

There are three identical bags. Bag  $B_1$  contains 3D & 2ND resistors, Bag  $B_2$  contains 4D & 5ND resistors and Bag  $B_3$  contains 2D & 4ND resistors. Suppose that a bag is selected at random and then a resistor is drawn from the selected bag at random. If the selected resistor is defective, what is the probability that it came from bag  $B_2$ ? (D=defective, ND=non-defective)

7. (a) The following distribution shows the kilowatt hours of electricity consumed by 100 persons in a city: 15

Consumption:	0--10	10--20	20--30	30--40	40--50
No. of users:	6	25	36	20	13

Calculate the first four raw moments about the point 25. Convert the result into the moments about the mean. Compute the values  $\gamma_1$  and  $\gamma_2$  and comment on the result.

- (b) Let  $X$  be a continuous random variable with probability density function (p.d.f) 10

$$f(x) = \begin{cases} \frac{1}{\beta^\alpha \Gamma(\alpha)} x^{\alpha-1} e^{-x/\beta}, & x \geq 0 \\ 0, & \text{otherwise} \end{cases}$$

Find  $E(X)$  and  $Var(X)$ .

8. (a) Given that  $f(x) = ax(10 - x)$ ,  $0 < x < 10$ . 10

- (i) find the value of 'a' that  $f(x)$  is a p.d.f.  
 (ii) find the probability of  $X$  that lies between 2 and 3.

- (b) A carton of 10 light bulbs contains 4 defective bulbs. If 3 light bulbs are selected at random without replacement, find the probability function and its distribution for the number of defected bulbs selected. 10

- (c) The probability density function of a continuous random variable is given by  $f(x) = \frac{x}{50}$ ,  $0 < x \leq 50$ . Find  $E(2X^2 + X + 1)$ . 5