Avik Roy 2919

L-3/T-1/EEE **Date : 29/09/2013**

BANGLADESH UNIVERSITY OF ENGINEERING AND TECHNOLOGY, DHAKA

L-3/T-1 B. Sc. Engineering Examinations 2011-2012

Sub : **EEE 307** (Electrical Properties of Materials)

Full Marks : 210 Time : 3 Hours

The figures in the margin indicate full marks.

USE SEPARATE SCRIPTS FOR EACH SECTION

SECTION – A

There are **FOUR** questions in this Section. Answer any **THREE**.

1. (a) The average intensity of sunlight on earth's surface is about 1 kW/m^2. Assuming that all the photons have an 800 nm wavelength, calculate the number of photons arriving on earth's surface per unit time per unit area. What is the magnitude of electric field in the sunlight? **(8)**

   (b) An electron of kinetic energy 12.2 eV collides with a hydrogen atom in a gas discharge tube. Find the energy level to which the electron in the hydrogen atom gets excited. **(5)**

   (c) Diamond, Silicon and Germanium are covalent solids with the same crystal structure. Their relative permittivities are 5.8, 11.9 and 16, respectively. Explain why the relative permittivity increases from diamond to germanium? **(6)**

   (d) Why the typical relaxation peaks are broader in the dielectric constant versus frequency curve? **(6)**

   (e) Briefly explain the mechanism by which microwave oven heats food. **(5)**

   (f) Why the resistivity due to impurity scattering in metals is independent of temperature? **(5)**

2. (a) The density of copper is 8.96 g/cm^3 and its atomic mass is 63.56 g/mol. If the mean free time is 0.02 ps and the mean speed of conduction electron is 1.5×10^6 m/s, then estimate the drift mobility of electron and the conductivity of copper. What is the frequency and amplitude of atomic vibration at T = 300 K? **(10)**

   (b) Why the thermal conductivity of diamond is very high whereas that of polymer is very low? **(5)**

   (c) The thermal conductivity of mica is 0.75 W/m/K. Consider an insulating disk of mica with a thickness of 0.1 mm and a diameter of 10 mm. What is the thermal resistance of the disk? What is the temperature drop across the disk, if the heat flow through it is 25 W? **(6)**

   (d) Draw the necessary diagram and prove that the Hall coefficient for ambipolar conduction depends on both the drift mobility ratio and the concentrations of holes and electrons. **(14)**

22

Contd P/2

EEE 307

3. (a) Consider a one-dimensional potential function given by,

$$V(x) = \begin{cases} V_o , & -\infty < x < 0 \\ o , & o < x < a \\ -V_o , & x > a \end{cases}$$

Assume an electron is coming from $-\infty$ with an energy $E > V_o$. Write the wave solutions that apply in each region and derive the expression for the transmission coefficient. **(16)**

(b) The maximum wavelength for which an electromagnetic wave can eject electrons from a platinum surface is 196 nm. When radiation with a wavelength of 141 nm shines on the surface, what is the maximum speed of the ejected electrons? **(7)**

(c) The solution to Schrodinger's wave equation for a particular situation is given by

$$\psi(x) = \sqrt{\frac{2}{a_o}} \cdot e^{-x/a_o}$$

Determine the probability of finding the particle between the limits $0 \le x \le \frac{a_o}{4}$ **(7)**

(d) Consider an electron in a potential cube at energy level E_{234}. Is the energy level degenerate? Which other energy levels have the same energy as this one? **(5)**

4. (a) Derive the expression of orientational polarizability under ac field condition. **(12)**

(b) What is "dielectric resonance"? **(6)**

(c) Consider a polycarbonate capacitor at 50°C and 1 kHz. Its real and imaginary dielectric constants are 2.47 and 0.003, respectively. Calculate the power dissipation per unit capacitance if the voltage across the capacitor is 1V. **(7)**

(d) What is pyroelectricity? How the pressure fluctuations are compensated in a pyroelectric radiation detector? **(10)**

SECTION – B

There are **FOUR** questions in this Section. Answer any **THREE**.

5. (a) Explain briefly LCAO method. Determine and sketch different molecular orbitals when five hydrogen atoms (labeled A, B, C, D and E) are brought together. **(7)**

(b) Derive a quantum mechanical expression for conductivity in metals. From this, obtain the conductivity expression as derived from Drude's Model. **(12)**

(c) Explain the followings in terms of quantum mechanics: **(6)**

(i) Why Magnesium (Mg) has lower conductivity than that of Copper (Cu)?

(ii) Why Nickel (Ni) is a poorer conductor than copper (Cu)?

(iii) Why conductivity in metals is only weakly temperature dependent?

Contd P/3

EEE 307

Contd ... Q. No. 5

(d) Dysprosium (Dy, atomic number 66) has a density of 8.54 g cm^{-3} and atomic mass of 162.50 g mol^{-1}. **(10)**

(i) What is the spin magnetic moment in the isolated atom in terms of number of Bohr magnetrons?

(ii) If the saturation magnetization of Dy near absolute zero is 2.4 MAm^{-1}, what is the effective number of spins per atom in the ferromagnetic state?

(iii) How does this compare with the number of spins in the isolated atom?

(iv) What is the order of magnitude for the exchange interaction in eV per atom in Dy if the Curie temperature is 85 K?

6. (a) Discuss different types of crystal defects with necessary diagrams and hence explain the line "There is no such thing as a perfect crystal". **(20)**

(b) Niobium (Nb) has the BCC crystal with a lattice parameter, a = 0.3294 nm. Find the planar concentrations as the number of atoms per nm^2 of the (100), (110) and (111) planes. Which plane has the most concentration of atoms per unit area? **(9)**

(c) Define the following terms **(6)**

(i) Bravais lattice (ii) Primitive unit cell (iii) Closed-packed crystal structure

7. (a) Explain the origin of ferromagnetism using exchange interaction. **(15)**

(b) Explain paramagnetism and ferrimagnetism. **(10)**

(c) Differentiate between superconductor and perfect conductor. **(5)**

(d) Aluminum (Al) has a density of 2.70 gcm^{-3} and an atomic mass of 27. Calculate the Fermi energy at absolute zero. Compare your result with experimental value of 11.8 eV. Draw appropriate conclusion.[Given: $E_{FO} = \left(\frac{h^2}{8m_e}\right)\left(\frac{3n}{\pi}\right)^{2/3}$] **(5)**

8. (a) From the knowledge of band theory of solids explain why Magnesium behaves like a metal inspite of having filled 3s band. Also explain why Carbon behaves like a semiconductor instead of behaving like a metal. **(5)**

(b) Discuss the properties of Fermi-Dirac function. Also state the limitations of Fermi-Dirac distribution. **(12)**

(c) State two equivalent statements of Bloch theorem. What important conclusions can be made concerning the allowed values of 'k' from Bloch theorem? **(8)**

(d) (i) Considering one-dimensional motion of electrons derive an expression for effective mass.

(ii) What are the underlying assumptions in Kronig-Penney Model? **(10)**

L-3/T-1/EEE **Date : 06/10/2013**

BANGLADESH UNIVERSITY OF ENGINEERING AND TECHNOLOGY, DHAKA

L-3/T-1 B. Sc. Engineering Examinations 2011-2012

Sub : **EEE 301** (Continuous Signals and Linear Systems)

Full Marks : 210 Time : 3 Hours

The figures in the margin indicate full marks.

USE SEPARATE SCRIPTS FOR EACH SECTION

SECTION – A

There are **FOUR** questions in this Section. Answer any **THREE**.

1. (a) The following information are given about a signal x(t): **(18)**

(i) x(t) is real and odd.

(ii) x(t) is periodic with period T = 2 and has Fourier co-efficients c_K.

(iii) $c_K = 0$ for $|K|>1$

(iv) $\frac{1}{2}\int_0^2 |x(t)|^2 dt = 1$

Specify two different signals that satisfy these conditions.

(b) Consider a continuous-time LTI system whose frequency response function is **(17)**

$$H(\omega) = \int_{-\alpha}^{\alpha} h(t)e^{-j\omega t}dt = \frac{\sin(4\omega)}{\omega}.$$

If the input to this system is a periodic signal

$$x(t) = 2 + x_1(t) * \sum_{k=-\alpha}^{\alpha} \delta(t-8k)$$

where $x_1(t) = \begin{cases} 1, & 0 \le t < 4 \\ -1, & 4 \le t < 8, \end{cases}$

Then using the Fourier Series method determine the corresponding system output y(t).

2. (a) Let

$$g(t) = x(t)\cos^2 t * \frac{\sin t}{\pi t},$$

where '*' denotes the convolution operator. Assuming that x(t) is real and $X(\omega) = 0$ for $|\omega| \ge 1$, find the impulse response h(t) of an LTI system that can map x(t) to g(t), showing the relationship between $G(\omega)$ and $X(\omega)$. **(17)**

(b) In the system shown in Fig. for Q. 2(b) the sampling signal is an impulse train with alternating sign. The Fourier transform of the input signal is as indicated in the figure. For $T < \pi/(2\omega_m)$, determine a system that will recover x(t) from y(t), if there exists. Also plot the Fourier transform of $x_p(t)$ and y(t) for $T < \pi/(2\omega_m)$. **(18)**

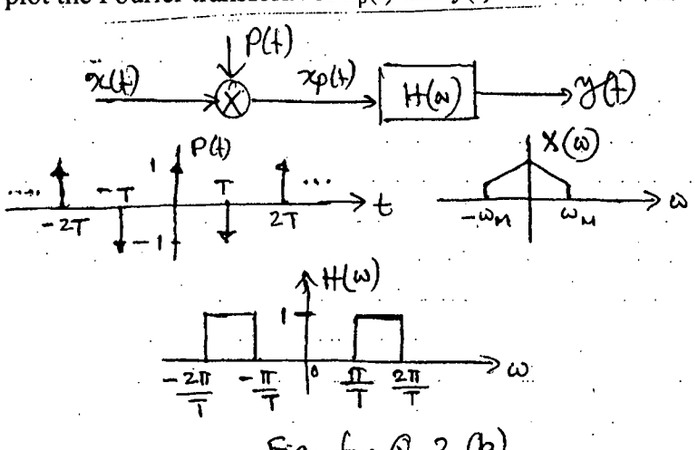


Fig. for Q. 2 (b)

Contd P/2

EEE 301

3. (a) Suppose that we are given the following information about an LTI system: **(18)**

(i) The system is causal

(ii) The system function is rational and has only two poles, at s = – 2 and s = 4.

(iii) If x(t) = 1, then y(t) = 0.

(iv)The value of the impulse response at $t = 0^+$ is 4.

Determine the system function H(s) of the system.

(b) The direct form II structure of a continuous time LTI system in the s-domain is shown in Fig. for Q. 3(b). Specify the differential equation that characterizes the system. Also compute the steady-state and transient responses resulting from the input x(t) = 2 cos 4t u(t), with no initial energy at t = 0. Use the unilateral Laplace transform method. **(17)**

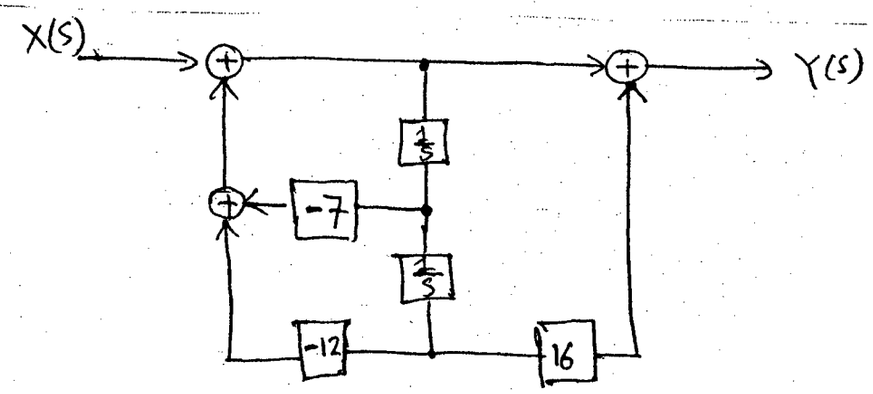


Fig. for Q. 3 (b)

4. (a) The input-output relationship of a non-causal continuous time LT1 system with one causal pole can be described by the differential equation **(18)**

$$\frac{d^2y(t)}{dt^2}+\frac{dy(t)}{dt}-6y(t)=\frac{dx(t)}{dt}-x(t)$$

If the input to the system, x(t) is $x(t) = e^{-t}u(t) + e^{t}u(-t-2)$,

determine the ROC of Y(s), the bilateral Laplace transform of y(t), and the system response y(t). Use the bilateral Laplace transform method.

(b) An ideal $(-\pi/2)$ radian (or – 90°) phase shifter is defined by the frequency response

$$H(\omega)=\begin{cases} e^{-j\pi/2}, & \omega>0 \\ e^{j\pi/2}, & \omega<0 \end{cases}$$

Find the impulse response h(t) of this phase shifter and, the output y(t) where $x(t) = \cos\omega_0 t$ using the Fourier transform method. **(17)**

SECTION – B

There are **FOUR** questions in this Section. Answer any **THREE.**

5. (a) The input output state-space representation of an N-dimensional LTI system is given by **(7)**

$$V'(t) = A\,V(t) + \text{bx}(t) \ldots (1)$$

$$y(t) = \text{cV}(t) + d\,x(t),$$

Contd P/3

EEE 301

Contd ... Q. No. 5

where A, $\mathbf{b}$, $\mathbf{c}$ and d are state-space coefficients and V(t) is N-dimensional state vector. Show that the solution of state differential equation (1) is

$$V(t) = \Phi(t - t_0)V_0 + \int_{t_0}^{t} \Phi(t-\tau)\mathbf{b}x(\tau)d\tau$$

where state transition matrix $\Phi(t) = \exp[At]$ and initial state $V_o = V(t_o)$.

(b) For the RLC circuit shown in Fig. for Q. No. 5(b), considering voltage across the capacitor and current through the ~~indicator~~ inductor as two state variable $v_1(t)$ and $v_2(t)$, respectively find the input output state-space representation. **(10)**

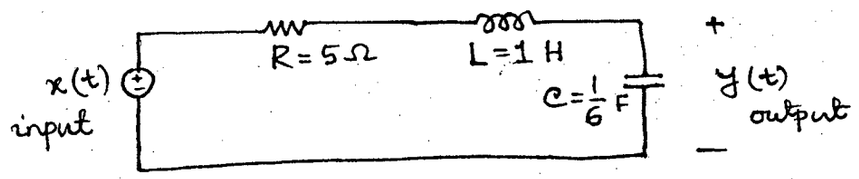


Fig. for Q. No. 5(b)

(c) By using the Cayley-Hamilton theorem, determine the state transition matrix $\Phi(t)$ from the state space coefficients obtained in part (b). **(10)**

(d) Considering that the initial state $\mathbf{V}_o$ is zero, find the impulse response of the system using the state-space coefficients and $\Phi(t)$ obtained in parts (b) and (c), respectively. **(8)**

6. (a) Is the following signal periodic? Justify. **(7)**

$$x(t) = exp(j\frac{7\pi}{6}t) + exp(j\frac{5\pi}{6}t)$$

If your answer is yes, find the fundamental period of x(t).

(b) Determine whether the following signal is energy or power signal or neither of these two types. **(7)**

$$x(t) = \begin{cases} 1, & t < 0 \\ e^{3t}, & t \geq 0 \end{cases}$$

(c) Write down the basic properties of Dirac delta function δ(t). Evaluate the following integral **(8)**

$$\int_{\alpha}^{\alpha} e^{-5t+1}\delta'(t-5)dt$$

(d) For the function x(t) shown in Fig. for Q. No. 6(d) sketch y(t) = x(– 2t – 2) and write the analytical expression of y(t). **(13)**

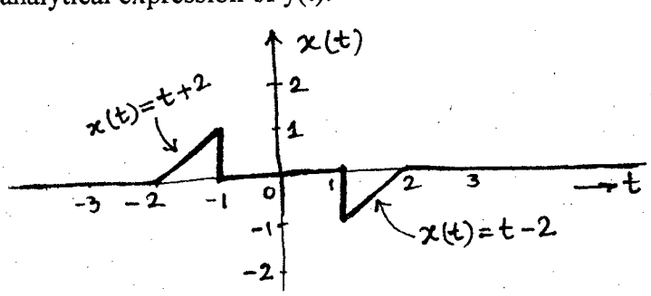


Fig. for Q. No. 6(d)

Contd P/4

EEE 301

7. (a) Determine whether the system shown in Fig. for Q. No. 7(a) is (i) linear, (ii) time-invariant, (iii) causal, and (iv) stable. **(8)**

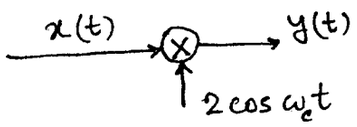


Fig. for Q. No. 7(a)

(b) Input output relationship of an LTI system is given by

$$y'''(t) + 3\,y''(t) - y'(t) - 2y(t) = 3x''(t) - x(t)$$ **(10)**

(i) Draw the simulation diagram for this LTI system based on canonical form-I.

(ii) How many adders, multipliers and integrators are used in your diagram?

(iii) Will it be possible to design an alternate simulation diagram for the same-system with reduced number of integrators?

(c) For an LTI system, output y(t) can be obtained from the convolution between input x(t) and the impulse response h(t). Mention the importance of this property in real life applications. **(4)**

(d) Consider the system defined in Fig. for Q. no. 7(d). **(13)**

(i) sketch g(t)

(ii) sketch y(t) and write the analytical expression of y(t). (Use graphical method of convolution integral.)

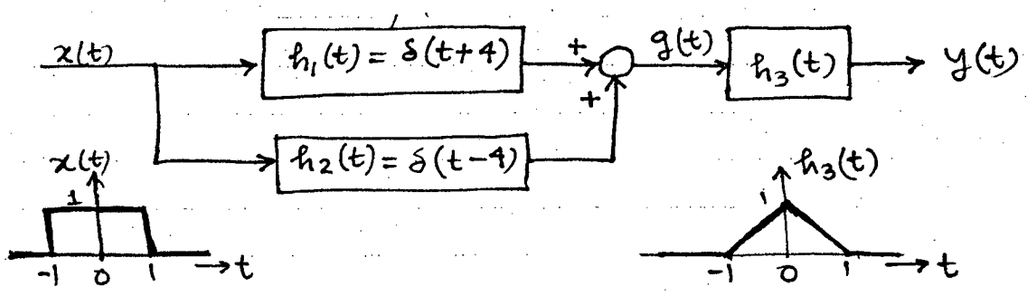


Fig. for Q. No. 7(d)

8. (a) Input output relationship of an LTI system is given by **(17)**

$$y''(t) + 5\,y'(t) + 6\,y(t) = x''(t) + 5\,x'(t) + 5\,x(t).$$

For an impulse input $\delta(t)$ to the system, following differential equation is obtained

$$h''(t) + 5\,h'(t) + 6\,h(t) = \delta''(t) + 5\,\delta'(t) + 5\,\delta(t).$$

Considering that the system is initially relaxed, determine h(t).

Contd P/5

EEE 301

Contd ... Q. No. 8

(b) Draw an analogous mechanical system for the electrical circuit shown in Fig. for Q. No. 8(b) **(8)**

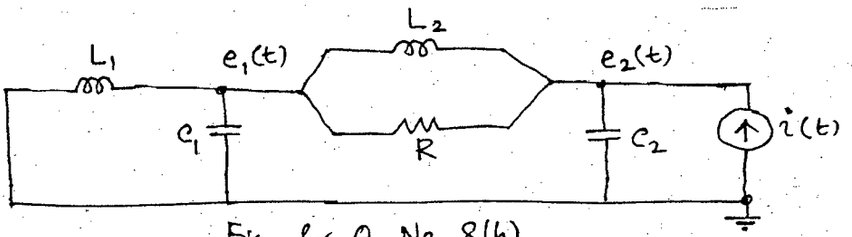


Fig. for Q. No. 8(b)

(c) Draw the f – i analogous electrical circuit of the mechanical system shown in Fig. for Q. No. 8(c). Assume that the bar is rigid but massless and that the ~~functions~~ junctions are restricted to have vertical motions only. **(10)**

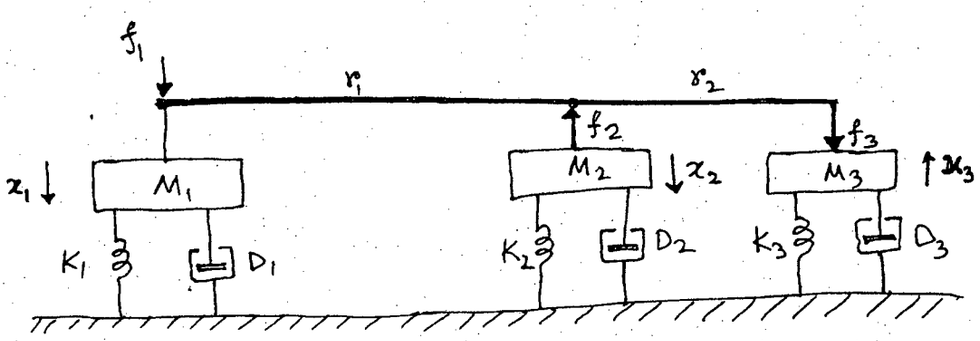


Fig. for Q. No. 8(c)

Sharmin
23.9.13

L-3/T-1/EEE **Date : 23/09/2013**

BANGLADESH UNIVERSITY OF ENGINEERING AND TECHNOLOGY, DHAKA

L-3/T-1 B. Sc. Engineering Examinations 2011-2012

Sub : **HUM 279** (Financial and Managerial Accounting)

Full Marks: 210 Time : 3 Hours

USE SEPARATE SCRIPTS FOR EACH SECTION

The figures in the margin indicate full marks.

SECTION – A

There are **FOUR** questions in this section. Answer any **THREE**.

1. (a) According to conceptual framework give two examples of conservatism. **(2)**

(b) Can a business enter into a transaction in which only the left side of the basic accounting equation is affected? If so, give an example. **(3)**

(c) Mr. Mihir started "Mihir Enterprise" by contributing Tk. 800,000 as capital on 1st July, 2012. The following transactions occured during the first month of operation: **(30)**

July 1 : Borrowed Tk. 80,000 from HSBC bank by issuing a note payable in two years.

July 5 : Hired an office space for business for rent Tk. 10,000 per month.

July 7 : Purchased office equipment from an outside supplier for Tk. 20,000 to be paid in next 60 days.

July 9 : Earned revenue of Tk. 20,000 cash for service provided.

July 12 : Paid salaries Tk. 3,000 cash to the employee.

July 14 : Purchased supplies Tk. 500 for cash.

July 22 : Service provided to a customer on account for Tk. 12,000.

July 25 : Incurred utility expense for the month on account Tk. 2,000.

July 28 : Withdrew Tk. 1,000 cash from the business for personal use.

July 30 : Paid rent for office space related to July 5.

Required:

(i) Journalize each transaction

(ii) Prepare ledger of only "Cash Account".

2. (a) "An adjusting entry may affect more than one balance sheet or income statement account." Do you agree? Why or why not? **(5)**

Contd P/2

HUM 279

Contd... Q. No. 2

(b) **(30)**

River Resort Company

Trial Balance

June 30, 2012

Accounts Name	Debit	Credit
Cash	6,500	
Accounts receivable	4,000	
Prepaid insurance	2,400	
Supplies	1,500	
Office furniture	15,000	
Accounts payable		3,500
Unearned service revenue		6,000
Capital		20,000
Service revenue		3,900
Salaries expense	2,000	
Rent expense	1,000	
Drawings	1,000	
Total	33,400	33,400

Analysis reveals the following additional data:

→ Accrued salaries Tk. 500

→ Rent expense incurred but not paid on June 30, ~~2-12~~ 2012 Tk. 600

→ Tk. 1500 of service performed during the month has not been recorded as of June 30.

→ Unearned service revenue of Tk. 1,000 has been earned.

→ Insurance expires at the rate of Tk. 200 per month.

→ Tk. 500 of supplies has been used during the month.

→ Office equipment is being depreciated at Tk. 250 per month.

Required:

(i) Prepare necessary adjusting entries of June 30, 2012.

(ii) Prepare an adjusted trial balance at June 30, 2012.

Contd P/3

HUM 279

3. (a) Why is it possible to prepare financial statements directly from an adjusted trial balance? **(5)**

(b) **(30)**

Polar Icecream

Trial Balance

31st December 2012

Particulars	Debit (Tk.)	Credit (Tk.)
Cash	20,500	
Accounts Receivable	15,000	
Accounts payable		12,000
Mortgage payable		3,700
Merchandise inventory (01.01.2012)	5,800	
Purchase	20,100	
Sales		40,500
Sales returns	1,200	
Purchase discount		500
Polar capital		36,200
Drawings	2,300	
Salaries	3,400	
Prepaid insurance	3,600	
Machinery	16,000	
Rent expense	5,000	
Copyright	20,000	
Bond payable		20,000
Total	112,900	112,900

Adjustments:

* Merchandise inventory on December 31st 2012 is Tk. 6,700.
* Rent is 40% administrative and 60% selling.
* Salary of the sales person is payable Tk. 600.

Required:

(i) Prepare a multiple step income statement,

(ii) Prepare a statement of owners equity and

(iii) A classified balance sheet as on December 31st, 2012.

4. (a) State what are the standard for comparison in Ratio Analysis? **(5)**

Contd P/4

HUM 279

Contd... Q. No. 4

(b) **(12)**

Solar Corporation
Balance Sheets
December 31

	2010	2009
Cash	Tk. 4,300	Tk. 3,700
Account receivable	~~21,000~~	23,400
Inventory	10,000	7,000
Land	20,000	26,000
Building	70,000	70,000
Accumulated depreciation	(15,000)	(10,000)
Total	110,500	120,100
Accounts payable	12,370	31,100
Stockholders Equity:		
Common stock equity	75,000	69,000
Retained earnings	23,130	20,000
Total	110,500	120,100

Solars 2010 income statement included net sales of Tk. 100,000, cost of goods sold Tk. 60,000 and net income Tk. 15,000.

Required:

Compute the following ratios for 2010.

(i) Current ratio.
(ii) Acid-test or quick ratio.
(iii) Receivable turnover.
(iv) Inventory turnover.
(v) Profit margin.
(vi) Return on stockholders equity.

(c) A firm is considering the following two mutually exclusive investments: **(18)**

	Cash Flows (Tk.)			
Projects	C_0	C_1	C_2	C_3
A	–25,000	+5,000	+5,000	+25,640
B	–28,000	+12,672	+12,672	+12,672

The cost of capital is 12%.

Required:

(i) Compute NPV for each project.
(ii) Compute IRR for each project.

The Table Value may be used as given below:

	Factors Value						
Year	14%	15%	16%	17%	18%	19%	20%
3	2.322	2.283	2.246	2.210	2.174	2.140	2.106

(iii) Which project should be undertaken and why?

Contd P/5

HUM 279

SECTION – B

There are **FOUR** questions in this section. Answer any **THREE**.

5. (a) X Company manufacturers home furnishing. It has the following operational data for the year 2012 (figures are in Taka): **(25)**

Materials, January 1, 2012	12,000
Work-in-process, January 1, 2012	5,000
Finished goods, January 1, 2012	6,000
Materials, December 31, 2012	10,000
Work-in-process, December 31, 2012	3,000
Finished goods, December 31, 2012	3,000
Materials purchased on account	15,000
Direct Labor	12,000
Factory Supplies	7,000
Factory Utilities	5,000
Selling expense	6,000
Administrative expense	8,000
Supplies:	
Production Supervisor	5,000
Salesperson	3,000
Depreciation:	
Production Machine	6,000
Office Equipment	7,000
Sales	50,000

Requirements:

(i) Prepare a Cost Statement for the year 2012.

(ii) Calculate the net income for the year 2012.

(b) Robin Partners provides management consulting service. It has two support departments-Finance (Fin) and Information Technology (IT) and two operating departments-Government Consulting (GOVT) and Corporate Consulting (CORP). For the year 2012, its cost records indicate the following: **(10)**

	Support		Operating		Total
	Fin	IT	GOVT	CORP	
Budgeted Overhead Costs before allocation (Tk.)	6,00,000	24,00,000	80,00,000	12,00,000	1,22,00,000
Support work supplied by Fin	–	25%	40%	35%	100%
Support work supplied by IT	10%	–	30%	60%	100%

Required: (i) Do the allocations under Reciprocal Method.

Contd P/6

-nager of XYZ Company wants to estimate cost of machine maintenance for
re is given a table which shows the Machine Maintenance Cost (in Taka) and
d chine Hours for the years 2001 to 2012. **(30)**

Year	Machine Maintenance Cost	Machine Hours
2001	37,000	3700
2002	23,000	1600
2003	37,000	4100
2004	47,000	4900
2005	33,000	3300
2006	39,000	4400
2007	32,000	3500
2008	33,000	4000
2009	17,000	1200
2010	18,000	1300
2011	22,000	1800
2012	20,000	1600

ıents:

Design a mixed cost function using High-low method and calculate what will be the estimated cost in 2013 if the estimated machine hour is 1700 hours.

Design a mixed cost function using Regression method and calculate what will be the estimated cost in 2013 if the estimated machine hour is 1700 hours.

-nanagement of XYZ Company estimates it would need 3 units of raw material ;e each unit of finished goods. Its standard price for raw material purchase is Tk -t. However, it actually purchased and used 4000 units of raw material at Tk 3.6. ıd of the period its finished goods were 1500 units. Calculate the Material Price and Material Quantity Variance. **(5)**

does Margin of safety mean? Distinguish between Fixed Cost and Variable h examples. **(5)**

ı below is the data of a bicycle company, Z Company. **(30)**

Sales in units 500.

Selling price per unit Tk 500

Variable Cost per unit Tk 300.

Fixed expense Tk 80,000.

Contd P/7

HUM 279

Contd... Q. No. 7(b)

Requirements:

(i) Compute the Net Operating Income.

(ii) Calculate Variable expense ratio and Contribution Margin ratio.

(iii) What are the BEP in units and BEP in sales? Use the equation method. If now it sells 600 units, what will be its Net Operating Income? Use CM method to answer.

(iv) Refer to the original data, the company wants to earn Net Operating Income of Tk 50,000. How many units shall it sell?

(v) Refer to the original data, if the company manager decides to use a higher quality component, it estimates an increase of Tk 100 variable expense however it expects to increase sales in units by 10%. Should the decision be made?

8. (a) What are the differences between Variable Costing Method and Absorption Costing Method? Explain. **(5)**

(b) Given below in the financial data of Y Company. **(30)**

	January	February
Units in beginning inventory		2000
Units produced	20000	22000
Units sold	18000	21000
Units in ending inventory	2000	3000

Variable Standard Costs:

Direct material Tk 5 per unit

Direct labor Tk 4 per unit

Factory overhead Tk 3 per unit

Fixed Factory overhead is Tk 25,000 per month or Tk 1.25 per unit of normal capacity (normal capacity 20000 units).

Fixed Selling and Administrative expenses are Tk 4000 per month.

Variable Selling and Administrative expenses are:

Tk 2500 for January

Tk 3000 for February

Selling price per unit is Tk 10.

Requirements:

(i) Prepare Income Statement for the months of January and February under both Absorption Costing Method and Variable Costing Method and show how the differences in Net Income occur.

Shafayat 16.09.13

L-3/T-1/EEE **Date : 25/07/2013**

BANGLADESH UNIVERSITY OF ENGINEERING AND TECHNOLOGY, DHAKA

L-3/T-1 B. Sc. Engineering Examinations 2011-2012

Sub : **EEE 305** (Power System I)

Full Marks: 210 Time : 3 Hours

USE SEPARATE SCRIPTS FOR EACH SECTION

The figures in the margin indicate full marks.

SECTION – A

There are **FOUR** questions in this section. Answer any **THREE**.

All the symbols have their usual significance.

1. (a) Why is a power system important in the evolution of the modern civilization? How do the load flow analysis and fault analysis impact the planning, design and operation of a power system? **(10)**

   (b) Derive an approximate mathematical expression to show that the diversity of demands from the individuals and the diversity among the demands from groups of consumers are beneficial for a power system. **(15)**

   (c) Explain, using a simple diagram, how is a relay interfaced with a circuit breaker in a power system? **(5)**

   (d) Explain the zone settings of a distance relay. Why does it not respond to normal or emergency load current? **(5)**

2. (a) The yearly load duration curve of an industrial power plant drops linearly from 20 MW to 3 MW. To meet this load three turbo generators respectively rated 10 MW, 8 MW and 7 MW are installed. Determine installed capacity, plant factor, maximum demand, load factor and utilization factor. **(15)**

   (b) Three voltmeters connected across a balanced three phase load show the following readings. **(10)**

   $|V_{ab}| = 1840$ V, $|V_{bc}| = 2760$ V, $|V_{ca}| = 2300$ V

   Assume a base of 2300 V, 500 kVA and a phase angle of 180° for V_{ca}. Determine the per unit values of the three line to line voltage phasors-in polar coordinates.

   (c) (i) Prove that $a + a^2 + a^3 = 0$ when a is the operator = $1\angle 120°$. **(10)**

   (ii) Prove that the line currents into a Δ-connected circuits with symmetrical or unsymmetrical impedances do not have a zero sequence component.

3. (a) Derive an expression for the current into a L-G fault occurring at bus k through a fault impedance Z_f in phase a. **(13)**

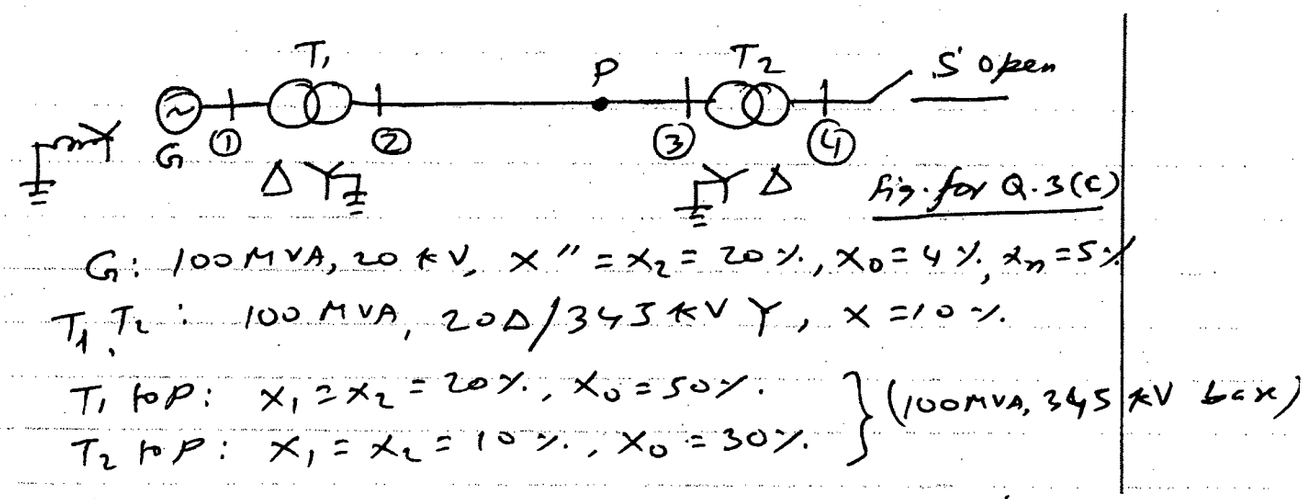
Contd P/2

EEE 305

Contd... Q. No. 3

(b) Prove that the current into a symmetrical three phase bolted fault is greater than the current into a L-G bolted fault at the same bus k only if $Z_{kk}^{(0)} > Z_{kk}^{(1)}$ and $Z_{kk}^{(1)} = Z_{kk}^{(2)}$. **(5)**

(c) Find the line currents I_A, I_B, I_C from T_2 to fault point P in the following system when a bolted L-G fault occurs at P. **(17)**



4. (a) Prove that the Thevenin's impedance at a bus in a power system in per unit is just the inverse of symmetrical three phase fault MVA in p.u. at that bus. **(8)**

(b) A 33 kV circuit breaker has the following specifications. **(7)**

k = 1.21

continuous current rating = 1200 A

maximum operating voltage = 36 kV

and the corresponding short circuit current = 20 kA

Find the symmetrical interrupting capability of the breaker at 34 kV.

(c) Determine the phase b power in a system with the following symmetrical components of voltage and currents. **(10)**

$V_{an}^{(1)} = 50\angle 0^\circ V$; $I_{an}^{(1)} = 10\angle 0^\circ A$

$V_{an}^{(2)} = 20\angle 90^\circ V$; $I_{an}^{(2)} = 4\angle 90^\circ A$

$V_{an}^{(0)} = 10\angle 180^\circ V$; $I_{an}^{(0)} = 2\angle 180^\circ A$

(d) Prove that the symmetrical components of unbalanced currents flowing in a balanced load produces voltage drops of like sequence only. **(10)**

Contd P/3

EEE 305

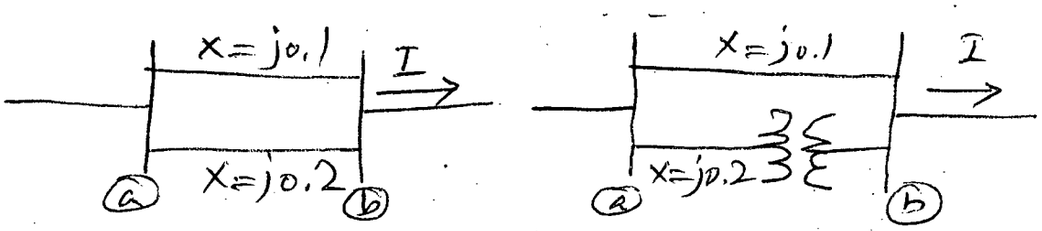
SECTION – B

There are **FOUR** questions in this section. Answer any **THREE**.

5. (a) Explain why power and VAR have the same base in per unit representation. **(5)**

(b) A 15 hp motor is operating at 440 V, full load, 90% efficiency and 0.80 power-factor lagging. It is drawing power from a source through a line having per phase impedance of 0.3+j0.1 Ω. Draw the single phase equivalent circuit of the system showing all values in per unit. Determine the source voltage in per unit and in volts. **(12)**

(c) Two buses 'a' and 'b' are connected to each other through impedances as shown in Fig. for Q. 5(c). Bus 'b' is a load bus supplying a current $I = 1.0\angle -30^\circ$ per unit at a bus voltage of $1.0\angle -0^\circ$. Find P and Q into bus 'b' through each of the parallel branches– (i) in the circuit described (ii) if a regulating transformer is connected in the line of higher reactance to give a boost of 3% in voltage magnitude toward the load (iii) if the regulating transformer advances the phase 2°. Assume V_a is adjusted for each part of the problem so that V_b remains constant. **(18)**



Case (i) Case (ii) & (iii)

fig. for Q. no 5(c)

6. (a) Show that the generalized circuit constants of all three transmission-line models satisfy the condition that **(12)**

$$AD - BC = 1$$

(b) Present an interpretation of the equations representing long transmission lines. **(10)**

(c) A 200-mile transmission line has the following parameters at 60 Hz: **(13)**

Resistance r = 0.21 Ω/mi per phase

Series reactance x = 0.78 Ω/mi per phase

Shunt susceptance b = 5.42×10^{-6} s/mi per phase

(i) Determine the attenuation constant α, wavelength λ, velocity of propagation of the line.

(ii) If the line is open-circuited at the receiving end and V_R = 100 kV line to line, determine the incident and reflected components of the sending end voltage.

Contd P/4

EEE 305

7. (a) What functions do the swing bus and PV buses in load flow calculations have? How should they be selected? **(5)**

(b) Give the flow chart of the Newton-Raphson method based load flow calculations. **(12)**

(c) Consider the 4-bus system shown in figure. Bus 1 is the swing bus. The bus admittance matrix is given in Table 7.1. A power-flow study of the system is to be made by the fast decoupled method. The initial mismatches corresponding to the iitial voltage estimation is by: **(18)**

$$\frac{\Delta P_2}{|V_2|} = -1.59661 \qquad \frac{\Delta P_3}{|V_3|} = -1.93953 \qquad \frac{\Delta P_4}{|V_4|} = 2.21286$$

Write the **B** matrix necessary to solve the problem. Calculate the first-iteration angle corrections in radians and the reactive mismatches.

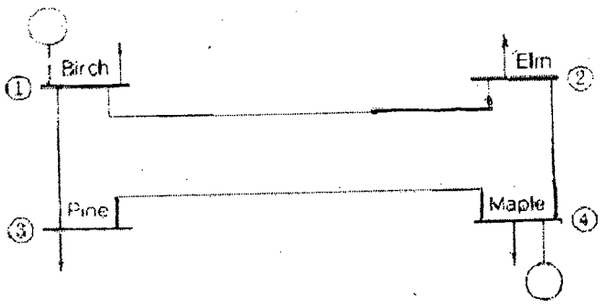


Figure for Q. no. 7(c)

Table 7.1 Admittance matrix

Bus no.	①	②	③	④
①	8.985190 $-j44.835953$	-3.815629 $+j19.078144$	-5.169561 $+j25.847809$	0
②	-3.815629 $+j19.078144$	8.985190 $-j44.835953$	0	-5.169561 $+j25.847809$
③	-5.169561 $+j25.847809$	0	8.193267 $-j40.863838$	-3.023705 $+j15.118528$
④	0	-5.169561 $+j25.847809$	-3.023705 $+j15.118528$	8.193267 $-j40.863838$

8. (a) Explain how fault calculation can be made using Z_{bus}. **(13)**

(b) Explain why synchronous machine impedance changes with time during fault. **(10)**

(c) A generator is connected to a synchronous motor through a transformer. On a common base, the subtransient reactances of generator and motor are 0.15 and 0.35 pu, respectively, and transformer leakage reactance is 0.10 p.u. A three-phase fault occurs at the terminals of the motor when the terminal voltage of the generator is 0.9 pu and output current is 1.0 pu at 0.8 p.f. leading. Find the subtransient current in the fault, generator and motor. **(12)**

Shafayat 10.09.13

L-3/T-1/EEE **Date : 08/07/2013**

BANGLADESH UNIVERSITY OF ENGINEERING AND TECHNOLOGY, DHAKA

L-3/T-1 B. Sc. Engineering Examinations 2011-2012

Sub : **EEE 303** (Digital Electronics)

Full Marks : 210 Time : 3 Hours

The figures in the margin indicate full marks.

All symbols have their usual meaning.

USE SEPARATE SCRIPTS FOR EACH SECTION

SECTION – A

There are **FOUR** questions in this section. Answer any **THREE**.

1. (a) A circuit with two outputs has to implement the following functions **(21)**

$f_1(x_1, x_2, x_3, x_4) = \Pi M(3, 4, 5, 7, 11, 13, 15) + D(6, 8, 10, 12)$

$g_1(x_1, x_2, x_3, x_4) = \Pi M(2, 7, 9, 10, 11, 12, 14, 15) + D(0, 4, 6, 8)$

Design the minimum cost circuit and compare its cost with combined cost of two circuits that implement f_1 and g_1 separately. Assume that input variables are available in both uncomplemented and complemented forms.

(b) Write the verilog code for the circuit in Q. 1(a) using continuous assignment. **(8)**

(c) What is HDL? What are the basic differences between VHDL and verilog HDL? **(6)**

2. (a) Design a one bit BCD adder and write the verilog code for it. **(8+7)**

(b) Convert the decimal number 75, 1205 and –1530 into signed 12-bit number in the following representation **(12)**

(i) Sign and Magnitude

(ii) 2's complement

(c) Write the verilog code of a ripple-carry adder using generate statement. **(8)**

3. (a) A 100 kHz clock signal is applied to a J-K flip-flop with J = K = 1. **(6)**

(i) If the flip-flop has active high J and K inputs and is negative edge triggered, determine the frequency of the Q and $\overline{Q}$ outputs.

(ii) If the flip-flop has active low J and K inputs and is positive edge trigged, what should be the frequency of the Q and $\overline{Q}$ outputs? Assume that Q is initially '0'.

(b) With the help of a schematic arrangement, explain how J-K flip-flop can be used as a (i) D flip-flop and (ii) T flip-flop. Also explain how D flip-flop can be used as T flip-flop. **(18)**

(c) What is the difference between a flip-flop and latch? Design a simple edge triggering circuit. **(5+6)**

Contd P/2

EEE 303

4. (a) Explain the problem of propagation delay in an asynchronous counter. **(6)**

(b) A 4 bit asynchronous binary counter is designed with J-K flip-flop. Each flip-flop has a propagation delay of 5 ns. Determine the total propagation delay time from the triggering edge of a clock pulse until a corresponding change can occur in the MSB. Also determine the maximum clock frequency at which the counter can be operated. **(6)**

(c) Design a 4 bit counter with parallel load option. Also explain how this option can be used for synchronous reset of the flip-flop. **(15)**

(d) Write the verilog code for a Up/Down counter with parallel load option. **(8)**

SECTION – B

There are **FOUR** questions in this section. Answer any **THREE**.

5. (a) Compare the performances of NMOS pass transistor, PMOS pass transistor and CMOS pass gate in passing 1s and 0s through it. **(9)**

(b) Derive a CMOS complex gate for the logic function Y = A(B + CD) + E. Use as few transistors as possible. **(10)**

(c) Write a Verilog code for Q. No. 5(b) using gate level primitives. **(6)**

(d) Elaborate the following terms with a brief introduction and illustration (in necessary): **(10)**

PLA, PAL, PLD, CPLD, FPGA and LUT

6. (a) Draw the general structure of a PLA. Implement the following functions in NMOS technology. Use NOR-NOR plane. **(15)**

$Z_1 = \overline{C}D + \overline{B}C + ABC$

$Z_2 = BAC + AB\overline{C} + C\overline{B}$

$Z_3 = B\overline{C}A + CDE$

$Z_4 = BD + D\overline{C} + \overline{C}AB$

(b) Write a Verilog code for Q. No. 6(a) using the continuous assignment. **(5)**

(c) Explain the noise margin of logic level. Also define with necessary illustration the following terms: propagation delay, rise time and fall time of voltage waveforms for logic gates. **(8)**

(d) Estimate the dynamic power dissipation of a CMOS inverter and show the effect of fan-in and fan out on inverter's dynamic operation. **(7)**

Contd P/3

EEE 303

7. (a) "A transmission gate virtually ANDs the input with its gate-clock" – comment on this statement. Design a CMOS transmission gate based 8-to-1 line multiplexer. **(15)**

   (b) Implement the function $Y = AB + B\overline{C} + A\overline{B}C$ using 2-to-1 line mux and other logic gates. **(10)**

   (c) What is the problem with binary encoder? Derive the circuit for a 16-to-4 priority encoder and also write the Verilog code. **(10)**

8. (a) Draw and explain the operation of a 6-bit comparator circuit. **(8)**

   (b) Design a 7-to-1 mux using a decoder and tri-state buffers. **(7)**

   (c) Draw the circuit for a 3-bit universal shift register that can shift in both the left-to-right and right-to-left directions, and it has parallel-load capability. **(12)**

   (d) What are blocking and non-blocking assignments? Write the Verilog code for an n-bit universal shift register. **(8)**
