

BANGLADESH UNIVERSITY OF ENGINEERING AND TECHNOLOGY, DHAKA

L-3/T-1 B. Sc. Engineering Examinations 2014-2015

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 – AThere are **FOUR** questions in this section. Answer any **THREE**.

Symbols bear their usual meanings.

1. (a) Consider the following signal
- (9)

$$x(t) = u(\cos t) - \delta(t - k\pi) \quad k = 0, \pm 1, \pm 2, \dots, \pm \infty$$

Is the signal periodic? Give reason. If periodic, determine the fundamental period. Finally, sketch the signal.

- (b) Determine whether the following signal is power or energy signal or neither. Justify our answer.
- (6)

$$x(t) = \sum_{k=-4}^{k=4} \delta(3t - k) \sin\left(\frac{\pi t}{3}\right) \text{sgn}(t)$$

- (c) Consider a signal given by
- (20)

$$x(t) = \begin{cases} -t+1 & -1 \leq t < 0 \\ t & 0 \leq t < 2 \\ 2 & 2 \leq t < 3 \\ 0 & \text{otherwise} \end{cases}$$

Find the analytical expressions of the odd and even parts of the signal. What are the average values of these parts of the signal?

2. (a) Determine whether the following systems are
- (18)

- linear/nonlinear
- time-invariant/time variant
- causal/non-causal
- memoryless/with memory
- invertible/non-invertible
- stable/unstable

(i) $y(t) = \sin(2t) \log_{10} [x(t)]$

(ii) $y(t) = e^{-j\omega t} \int_{-\infty}^{\infty} x(\tau) e^{-j\omega \tau} d\tau$

- (b) Determine the impulse response of the system that has an input-output relation given by
- (17)

$$y'(t) + 10y(t) = 2x(t)$$

Find and sketch the output of the system, when the input is

$$x(t) = (-1)^k \delta(t - 5k), \quad k = 0, \pm 1, \pm 2$$

Assume that $\lim_{t \rightarrow 5} h(t) = 0$, where $h(t)$ is the impulse response of the system.

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3. An LTI system is defined by the following differential equation (35)

$$y''(t) + 6y'(t) + 8y(t) = x'(t) - x(t)$$

- (i) Draw the simulation diagram of the system using the first canonical form.
- (ii) Find the state equation of the system.
- (iii) Determine the state-transition matrix of the system.
- (iv) Comment on the stability of the system.
- (v) Find the transformation matrix to convert the first canonical form into the second.

4. (a) The Fourier series coefficients of a periodic signal with period 20 ms are (18)

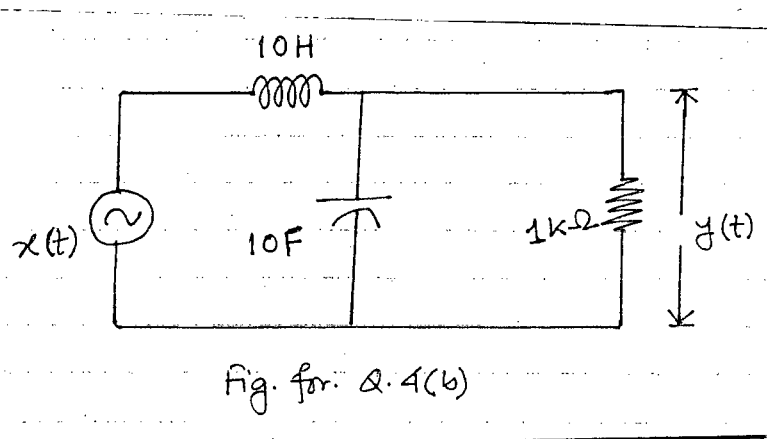
$$C_n = \frac{1}{2} [1 - (-1)^n] \quad n = 0, \pm 1, \pm 2, \dots, \pm \infty$$

- (i) Does this represent a real signal? Justify your answer.
- (ii) From the expression of C_n , deduce the time-domain signal. Sketch the signal.

(b) A voltage $x(t)$ is applied to the circuit shown in Fig. for Q. 4(b). The Fourier series coefficients of $x(t)$ are given by (17)

$$C_n = \frac{1}{n^2 + 1} \exp\left[\frac{jn\pi}{3}\right] \quad n = 0, \pm 1, \pm 2, \dots, \pm \infty$$

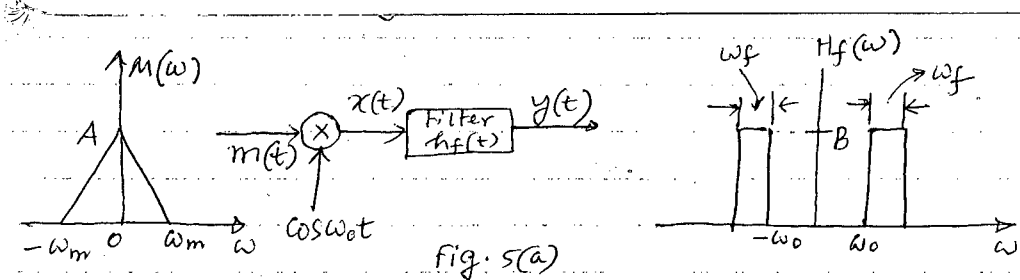
Determine the amplitude of the first four harmonics of the output signal $y(t)$. What is the average value of the output signal?



SECTION - B

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

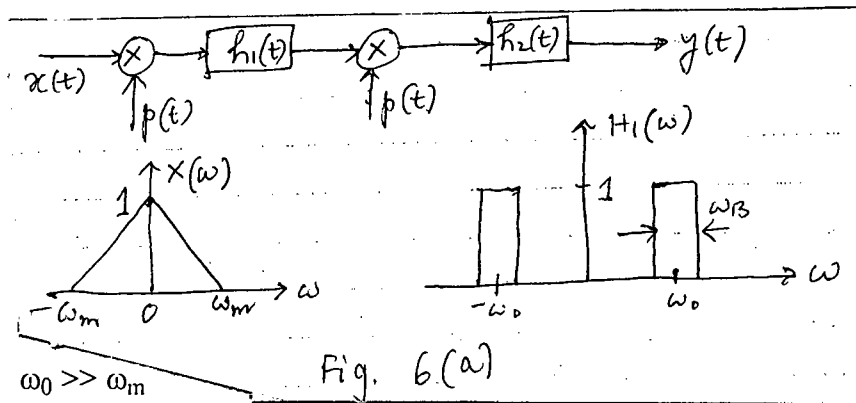
5. (a) A single-sideband amplitude-modulated signal is generated using the system shown below (15)



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Contd ... Q. No. 5(a)

- (i) Sketch the spectrum of $y(t)$ for $\omega_f = \omega_m$
- (ii) Write the mathematical expression of $h_f(t)$
- (b) Determine the Fourier transform of the pulse $x(t) = \alpha \text{rect}(\alpha t/\tau)$, $\alpha > 0$. Comment on this Fourier transform as $\alpha \rightarrow \infty$ and as $\alpha \rightarrow 0$. (7)
- (c) The input signal $x(t) = \exp[-\alpha t] u(t)$ is applied to a system whose impulse response $h(t)$ is $\sin(2t/(\pi t))$. Find the Fourier transform of the output. (13)
- 6. (a) The input to the system shown in Fig. 6(a) has the spectrum shown below: (16)



Let $p(t) = \cos \omega_0 t$,

$\omega_0 \gg \omega_m$

Fig. 6(a)

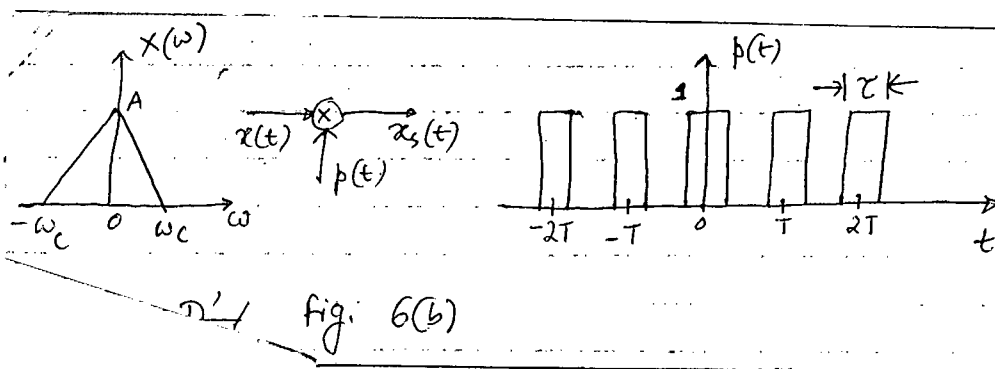
Find the spectrum $Y(\omega)$ of the output if $h_2(t) = \frac{\sin \omega_B t}{\pi t}$, Assume that $\omega_m > \omega_B$ and

$\omega_m \leq \omega_B$.

- (b) In natural sampling, the signal $x(t)$ is multiplied by a train of rectangular pulse as shown in Fig. 6(b). (15)
 - (i) Find and sketch the spectrum of $x_s(t)$.
 - (ii) Can $x(t)$ be recovered without any distortion? Explain.
- (c) State D' Alembert's principle. (4)
- 7. (a) Using Laplace transform method, find $y(t)$ for the following differential equation (15)

$$y''(t) + 4y'(t) + 3y(t) = \exp[-3t] u(t)$$

$$y(0^-) = 0, y'(0^-) = 1$$



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Contd ... Q. No. 7

(b) Find the bilateral Laplace transform and ROC of (7)
 $x(t) = \exp[bt] u(-t)$

(c) For the system shown in Fig. 7(c), find $Y(s)$. (13)

8. (a) For the circuit shown in fig. 8(a), $v_c(0^-) = 1$ volt, $i_L(0^-) = 2$ amperes and $x(t) = u(t)$. (13)
 Draw the Laplace transformed model incorporating the initial energy for the inductor and the capacitor. Find the expression of $Y(s)$ and $y(t)$.

(b) Consider the system described by (18)

$$v'(t) = \begin{bmatrix} -3 & 4 \\ -2 & 3 \end{bmatrix} v(t) + \begin{bmatrix} 1 \\ 3 \end{bmatrix} x(t)$$

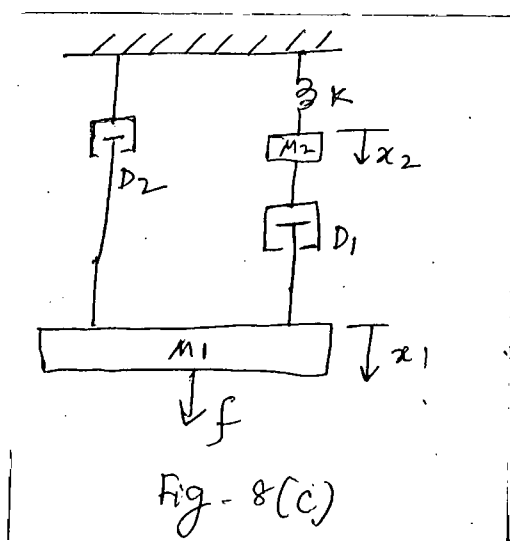
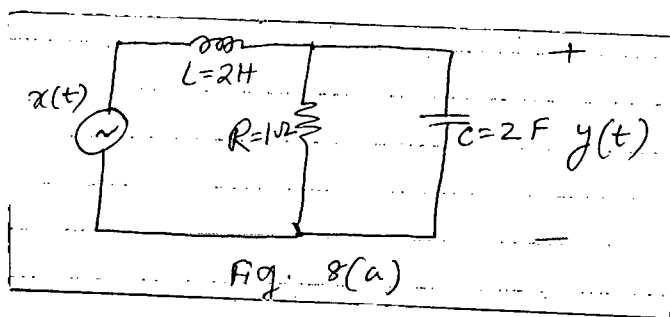
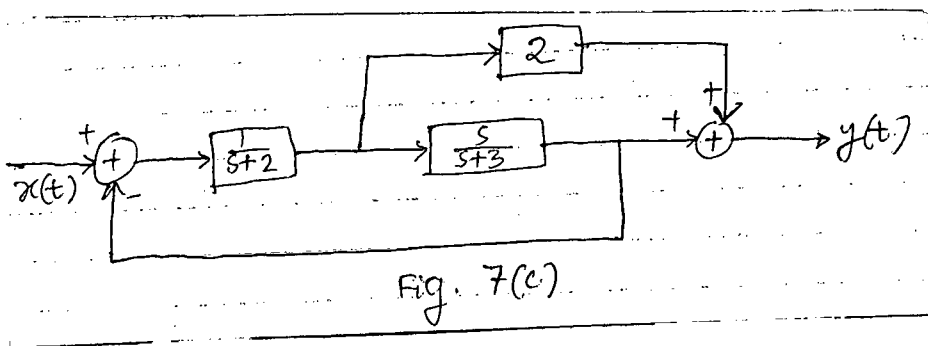
$$y(t) = [-1 \quad -1] v(t) + 2x(t)$$

State variable $v(t) = \begin{bmatrix} v_1(t) \\ v_2(t) \end{bmatrix}$ and $v(0^-) = \begin{bmatrix} -1 \\ 3 \end{bmatrix}$.

(i) Find $H(s)$ and comment on the stability of the system.

(ii) Find the step response of the system.

(c) Draw the analogous electrical circuit considering suitable analogy for the system shown in Fig. 8(c). (4)



SECTION - A

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

1. (a) Show that the complex power can be computed from the symmetrical components of the voltages to reference and line currents of an unbalanced three-phase circuit. (12)
- (b) Draw the zero sequence network for the following power system. (8)

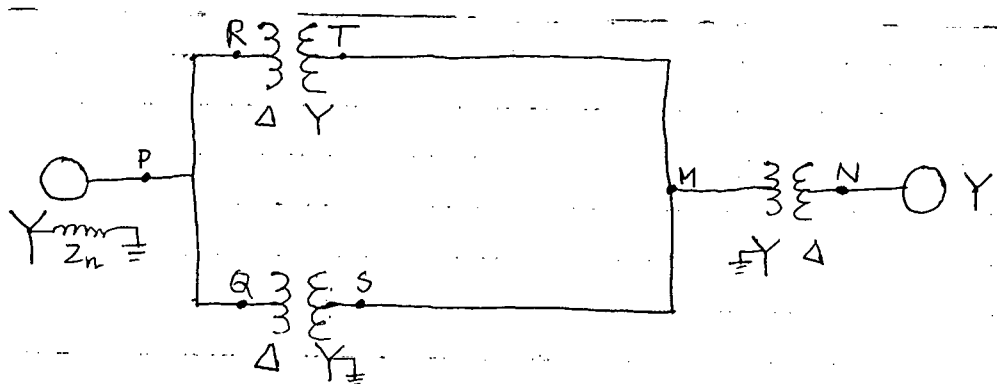


Figure for Q 1(b)

- (c) A salient-pole generator without dampers is rated 20 MVA, 13.8 kV and has a direct-axis subtransient reactance of 0.25 per unit. The negative and zero-sequence reactances are, respectively, 0.35 and 0.10 per unit. The neutral of the generator is solidly grounded. With the generator operating unloaded at rated voltage with $E_{an} = 1.0 \angle 0^\circ$ per unit, a single line-to-ground fault occurs at the machine terminals, which then have per-unit voltages to ground, (15)

$$V_a = 0 \quad V_b = 1.013 \angle -102.25^\circ \quad V_c = 1.013 \angle 102.25^\circ$$

Determine the subtransient current in the generator and line-to-line voltages for subtransient conditions due to the fault.

2. (a) A line-to-line (phase "b" to phase "c") fault occurs in an unloaded generator through an impedance, Z_f . Develop an expression for the negative sequence component of current of phase "a". Also, show the intersection among the sequence networks to simulate such a fault. (17)
- (b) Two synchronous machines are connected through three-phase transformers to the transmission line shown in Figure below. (18)

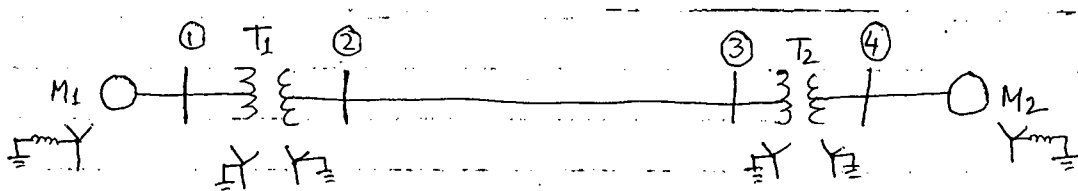


Figure for Q 2(b)

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Contd ... Q. No. 2(b)

The ratings and reactances of the machines and transformers are

Machines 1 and 2 : 100 MVA, 20 kV; $x_d'' = X_1 = X_2 = 20\%$

$X_0 = 4\%, X_n = 5\%$

Transformers T_1 and T_2 : 100 MVA, 20 Y/345 Y kV; $X = 8\%$

Both transformers are solidly grounded on two sides. On a chosen base of 100 MVA, 345 kV in the transmission-line circuit the line reactances are $X_1 = X_2 = 15\%$ and $X_0 = 50\%$. The system is operating at nominal voltage without pre-fault currents when a bolted ($Z_f = 0$) single line-to-ground fault occurs on phase A at bus (3). Using the bus impedance matrix for each of the three sequence networks, determine the subtransient current to ground at the fault, the line-to-ground voltages at the terminals of machine 2, and the subtransient current out of phase c of machine 2. Bus impedance matrices are:

$$Z_{bus}^{(1)} = Z_{bus}^{(2)} = \begin{matrix} & \begin{matrix} (1) & (2) & (3) & (4) \end{matrix} \\ \begin{matrix} (1) \\ (2) \\ (3) \\ (4) \end{matrix} & \begin{bmatrix} j0.1437 & j0.1211 & j0.0789 & j0.0563 \\ j0.1211 & j0.1696 & j0.1104 & j0.0789 \\ j0.0789 & j0.1104 & j0.1696 & j0.1211 \\ j0.0563 & j0.0789 & j0.1211 & j0.1437 \end{bmatrix} \end{matrix}$$

$$Z_{bus}^{(0)} = \begin{matrix} & \begin{matrix} (1) & (2) & (3) & (4) \end{matrix} \\ \begin{matrix} (1) \\ (2) \\ (3) \\ (4) \end{matrix} & \begin{bmatrix} j0.1553 & j0.1407 & j0.0493 & j0.0347 \\ j0.1407 & j0.1999 & j0.0701 & j0.0493 \\ j0.0493 & j0.0701 & j0.1999 & j0.1407 \\ j0.0347 & j0.0493 & j0.1407 & j0.1553 \end{bmatrix} \end{matrix}$$

- 3. (a) Discuss the fundamental requirements of protective relaying. (12)
- (b) Derive the equation for torque developed in an induction disc type relay. (12)
- (c) Explain the working principle of differential relay. (11)

- 4. (a) Define the following terms as applied to load curves analysis: demand factor, peak diversity factor, load factor, capacity factor and utilization factor. (10)
- (b) Write the guidelines of developing reactance diagram from the impedance diagram. (8)
- (c) Derive the expressions of the sequence components of the voltage drops between the two ends of a symmetrical three-phase line section with neutral conductor. (17)

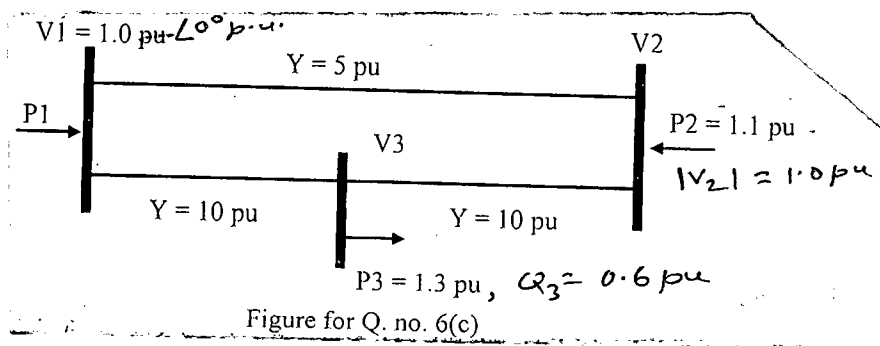
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SECTION - B

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

5. (a) Show that the voltage at any point along a long transmission line is the sum of two waves travelling in opposite directions. (13)
- (b) Identify the condition for which the impedance seen at the sending end is a constant regardless of line length. (5)
- (c) A 200 mile long transmission line has the following parameters at 50 Hz (12)
- $r = 0.21 \Omega/\text{mile per phase}$
- series reactance = $0.78 \Omega/\text{mile per phase}$
- shunt susceptance = $5.42 \times 10^{-6} \text{ S/mile per phase}$.
- (i) Determine the attenuation constant, wavelength and the velocity of propagation of the line at 50 Hz.
- (ii) If the line is open circuited at the receiving end and the receiving-end voltage is maintained at 100 kV line-to-line determine the incident and reflected components of the sending-end voltage and current.

6. (a) Explain why 'load bus' and 'generator bus' are treated differently in load flow solutions. (6)
- (b) Provide a complete list of the input data required for load flow solutions. (5)
- (c) Consider the system shown in Figure below. Bus 1 is the swing bus with voltage magnitude and the angle specified. Bus 2 is a generator bus and Bus 3 is a load bus. Using Gauss-Seidel iteration, obtain the load flow solution of the system. Show one iteration. (14)



- (d) Evaluate both diagonal and off-diagonal elements of the Jacobian element J_{11} . (10)
7. (a) A synchronous generator is supplying power to a synchronous motor through a transmission line. A three phase fault occurs at the motor terminal. Derive an expression for the fault current and show that it does not include the load current. (10)
- (b) Explain the method of fault calculations using Z_{bus} . (15)
- (c) The Z_{bus} of a five bus network is given below: (10)

$$Z_{bus} = \begin{bmatrix} j0.0793 & j0.0558 & j0.0382 & j0.0511 & j0.0608 \\ j0.0558 & j0.1338 & j0.0664 & j0.0630 & j0.0605 \\ j0.0382 & j0.0664 & j0.0875 & j0.0720 & j0.0603 \\ j0.0511 & j0.0630 & j0.0720 & j0.2321 & j0.1002 \\ j0.0608 & j0.0605 & j0.0603 & j0.1002 & j0.1301 \end{bmatrix}$$

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Contd ... Q. No. 7(c)

Find the current in a three phase fault at bus 4 and the currents coming to the faulted bus from buses 3 and 4 respectively. The impedance between buses 3 and 4 is $j0.336$ pu and that between buses 4 and 5 is $j0.252$ pu. Neglect pre-fault current and assume 1.0 pu voltage in all buses before the fault occurs.

8. (a) Draw and explain the typical current and voltage wave shapes in a circuit breaker during fault clearing. (8)
- (b) Define the following ratings of a circuit breaker: (10)
- (i) rated short-circuit breaking current
 - (ii) rated short-circuit making current
 - (iii) Rated power frequency withstand voltage
 - (iv) Lightning impulse withstand voltage
- (c) With necessary derivation show that circuit with high natural frequency give a high rate of rise of TRV. (8)
- (d) A three phase 11 kV generator is connected to a circuit breaker. The inductive reactance up to the circuit breaker is 5 ohm per phase. The distributed capacitance up to circuit breaker between phase and neutral is $0.01 \mu\text{F}$. Determine the following: (9)
- (i) Peak restriking voltage across circuit breaker
 - (ii) Frequency of restriking voltage transient
 - (iii) Maximum RRRV
-

SECTION – A

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

Answer sequentially.

1. (a) Discuss the characteristics of typical capacitor dielectric materials. Also explain their usefulness in power circuits. (15)
 (b) Lead zirconate titanate has a k-value of 0.72. Recommend some potential applications for this material. (8)
 (c) Explain, in detail, the various mechanisms of dielectric breakdown in solids, liquids and gases. Give some specific examples. (12)

2. (a) A long narrow rod has an atomic density of $5 \times 10^{28} \text{ m}^{-3}$. Each atom has a polarizability of 10^{-40} F.m^2 . Find the internal electric field (E_{loc}) when an axial field (E) of 1.0 V/m is applied. (14)
 (b) Among the following materials, explain which are what type of material and why; and mention their potential applications: (10)
 (i) PET, (ii) bird poop, (iii) chocolate, (iv) SF_6
 (c) Introduce the Langevin function and explain its use in the derivation of orientational polarizability. Show the complete derivation. (11)

3. (a) Explain the terms DNG, SNG and ENZ metamaterials. Discuss their potential applications in engineering sectors. (12)
 (b) Magnetic susceptibility (χ_m) values for water and bismuth are -0.91×10^{-5} and -16.6×10^{-5} , respectively. Explain why water shows diamagnetic properties despite having a low χ_m than bismuth. Suggest some applications of diamagnetic property in water based materials. (10)
 (c) Show that, in an iron core toroidal coil the hysteresis power loss per m^3 is given by kfB_m^2 [Symbols have their usual meanings]. Explain how the area enclosed within a B-H curve corresponds to energy dissipation. (13)

4. (a) Why type-II superconductors show promises for high-temperature super conductivity? (7)
 (b) Explain the physical origin of Debye Loss peak. Derive the equivalent circuit of a Debye dielectric. (5+7)
 (c) Consider a CsBr crystal ($a = 4.3 \text{ \AA}$). The α_e corresponding to Cs^+ and Br^- ions are 3.35×10^{-40} and $4.5 \times 10^{-40} \text{ F.m}^2$, respectively. Mean α_l per ion pair is $5.8 \times 10^{-40} \text{ F.m}^2$. Find the low frequency and optical frequency dielectric constant. (16)

EEE 307**SECTION – B**

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

All the symbols have their usual meanings.

5. (a) What is allotropy? What are the different allotropes of Iron and Carbon? Mention their crystalline structures. (15)
- (b) For a NaCl crystal: (20)
- (i) Sketch the atom in a (100) plane.
- (ii) The effective radius of Na is 1.0 \AA and that of Cl is 1.8 \AA . Determine the lattice constant.
- (iii) Calculate the volume density of Na and Cl atoms.
- (iv) Calculate the mass density of NaCl.
6. (a) The density of gold is 19300 kg/m^3 and its atomic mass is 196.67 g/mol . Assuming each Au atom donates one conduction electron, calculate the drift mobility of the electrons in gold at 22°C . The resistivity of pure Au at 273 K is $22.8 \text{ n}\Omega \text{ m}$. The TCR for Au is $\frac{1}{251} \text{ K}^{-1}$. What is the mean free path of the conduction electrons if their mean speed is $1.4 \times 10^6 \text{ m/s}$? (20)
- (b) For a pure metal derive the Hall coefficient for electron conduction. (15)
7. (a) The work function of a clean cesium surface is 1.9 eV . Answer the followings:
- (i) What is the longest wavelength of radiation which can result in photoemission?
- (ii) If blue radiation of wavelength 450 nm is incident onto the Cs photocathode, what will be the kinetic energy of the photoemitted electrons in eV? What should be voltage required on the opposite electrode to extinguish the external photocurrent? (15)
- (b) Consider a step potential function, having a "height" V_0 . A particle with energy $E > V_0$ is incident from the $+x$ direction travelling in the $-x$ direction. Answer the followings: (20)
- (i) Write the wave solutions for each region.
- (ii) Derive expressions for the transmission and reflection coefficients.
8. (a) The Fermi energy level for a particular material at $T = 300 \text{ K}$ is 6.25 eV . The electrons in this material follow the Fermi-Dirac distribution function. Answer the followings: (10)
- (i) Find the probability of an energy level at 6.5 eV being occupied by an electron.
- (ii) Calculate the temperature at which there is a 1 percent probability that a state 0.3 eV below the Fermi level will be empty of an electron.
- (b) Show that for a free electron, the first derivative of energy with respect to wave number is proportional to the velocity of the electron. Also show that the second derivative of energy with respect to wave number is inversely proportional to the mass of the electron. (10)
- (c) Given that the width of an energy band is typically $\sim 10 \text{ eV}$, calculate the followings in per cm^3 and per eV units. (15)
- (i) The density of states at the center of the band.
- (ii) The number of states per unit volume within a small energy range kT about the center.
- (iii) The density of states at kT above the bottom of the band.
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BANGLADESH UNIVERSITY OF ENGINEERING AND TECHNOLOGY, DHAKA

L-3/T-1 B. Sc. Engineering Examinations 2014-2015

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

Full Marks : 210

Time : 3 Hours

The figures in the margin indicate full marks.

USE SEPARATE SCRIPTS FOR EACH SECTION

SECTION – AThere are **FOUR** questions in this section. Answer any **THREE**.

1. (a) According to revenue recognition principle when should the revenue record? (5)
- (b) What is the basic behind economic entity assumption? (3)
- (c) Mr. Khan started his manufacturing business on June 1, 2014. The following transactions took place during the month of operation: (27)
- June 1: Invested Tk. 800,000 cash in the business.
- June 6: Purchased office equipment in cash Tk. 120,000
- June 10: Hired a managing director to manage the business efficiency. He will be paid Tk. 30,000 per month
- June 12: Incurred advertising expenses on account Tk. 10,000
- June 16: Incurred office rent in advance Tk. 15,000
- June 17: Earned Tk. 80,000 for selling the product; Tk. 45,000 is received in cash and remaining on account.
- June 19: Withdrawn by Mr. Khan for his personal use Tk. 10,000 in cash from the business
- June 20: Paid the amount due related to advertising expense
- June 23: Received cash from previous customer related to transaction June 17
- June 26: Employees salaries expense was due for Tk. 8,000

Required:

- (i) Prepare a tabular summary from the above transactions.
- (ii) Prepare an owner's equity statement.

2. (a) Discuss the necessity of keeping journal. (5)
- (b) Mr. "Y" started his business on May 1, 2013. The following transactions took place during the month of operation: (18)
- May 1: Invested Tk. 90,000 cash in the business
- May 4: Purchased office supplies on account Tk. 10,000
- May 5: Insurance premium paid for the period Tk. 5,000 in cash
- May 7: Paid Tk. 5000 on account payable resulting from the transactions of May 4

Required:

- (i) Give journal entry from the above transactions.
- (ii) Prepare necessary ledger accounts.

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Contd ... Q. No. 2

(c) Related financial information of "Marcel Refrigerator" is given below:

(12)

"Marcel Refrigerator"
Balance Sheet
December 31, 2014

	2014	2013
Cash	Tk. 5,200	Tk. 3,700
Accounts 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	111,200	120,100
Accounts payable	13,070	31,100
Stockholder's equity:		
Common stock equity	75,000	69,000
Retained earnings	23,130	20,000
Total	111,200	120,100

Marcel 2014 income statement including net sales of Tk. 100,000, cost of goods sold Tk. 60,000 and net income Tk. 15,000.

Required: Calculate the following ratios for 2014 –

- (i) Current ratio
- (ii) Quick ratio
- (iii) Receivable turnover
- (iv) Inventory turnover
- (v) Profit margin
- (vi) Return on stock holder's equity

3. (a) Why do accrual basis financial statements provides more useful information than cash basis statements?

(5)

(b) The following information is available for "Advance Construction" Company for the month of December –

(30)

"Advance Construction"
Balance Sheet
December 31, 2014

Accounts Name	Debit (Tk.)	Credit (Tk.)
Cash	5,700	
Accounts receivable	6,000	
Supplies	1,900	
Prepaid insurance	3,600	
Office furniture	10,200	
Accounts payable		4,500
Unearned service revenue		2,000



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Contd ... Q. No. 3(b)

Accounts Name	Debit (Tk.)	Credit (Tk.)
Capital		17,700
Service revenue		7,500
Salary expense	3,400	
Rent expense	900	
Total	31,700	31,700

Additional information:

- Tk. 900 of supplies has been used during the period.
- Tk. 500 balances in the unearned revenue remained unearned at the end of the period.
- Insurance policy is for two years.
- Travel expense incurred but not paid on December 31, 2014 Tk. 1,200.
- Utility bill was not paid for the month Tk. 3,000.
- Annual depreciation on office furniture was 10%.
- Invoices showed that Tk. 2,000 of service performed during the month have not been recorded as of December 31, 2014.

Required:

- Prepare necessary adjusting entries.
- Prepare an adjusted trial balance as at December 31, 2014.

4. (a) Write down the classification of asset with example. (5)

(b) Following balances are extracted from the ledger balances of "M Company" (30)

"M Company"
 Trial Balance
 31st December, 2014

Accounts Name	Debit (Tk.)	Credit (Tk.)
Sales		320,000
Accounts payable		25,000
Wage payable		30,000
Note payable (for 5 years)		50,000
Unearned revenue		5,000
Accounts receivable	7,000	
Cash	50,000	
Prepaid insurance	42,000	
Long term investment	10,000	
Ending inventory (31.12.2014)	23,000	
Rent expense	5,000	
Supplies	8,000	
Capital		300,000
Machinery	100,000	
Store equipment	200,000	
Cost of goods sold	50,000	
Utility expense	15,000	
Maintenance expense (office)	20,000	
Copyright	200,000	
Total	730,000	730,000

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Contd ... Q. No. 4(b)

Adjustments data:

- 40% of utility expense is related to office and 60% related to sales.
- Charge @10% depreciation on store equipment.
- Accrued sales salary is Tk. 2,000.

Required:

- Prepare a multiple step (classified) income statement for the year ended December, 2014.
- Prepare an owner's equity statement and a classified balance sheet at 31st December, 2014.

SECTION – B

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

- Define variable and fixed cost. Do you think fixed cost is always fixed? (4)
 - What is prime cost and conversion cost? (4)
 - What is manufacturing overhead cost? (4)
 - Brentline Hospital is interested in predicting future monthly maintenance costs for budgeting Purposes. The senior management team believes that maintenance cost is a mixed cost and that the variable portion of this cost is driven by the number of patient-days. Each day a patient is in the hospital counts as one patient-day. The hospital's chief financial officer gathered the following data for the most recent seven-month period (23)

Month	Activity Level (Patient)	Maintenance cost Incurred (Tk)
January	5600	7900
February	7100	8500
March	5000	7400
April	6500	8200
May	7300	9100
June	8000	9800
July	6200	7800

Requirements:

- Prepare a scatter graph using the data given above and comment whether there is linear or non-linear relationship exist between number of patient and maintenance cost.
- Using High-Low method find out variable and fixed maintenance cost for the hospital.
- Express the fixed and variable components of admitting costs as a cost formula in the form $Y = a + bX$.
- Suppose in August the hospital is expecting that 5500 patient will come. Now find out the budgeted variable cost, fixed cost and total cost for the month of August.

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6. (a) The following data from the just completed year are taken from the accounting records of Eccles Company. (20)

Sales	\$750,000
Direct labor cost	\$90,000
Sells Commission	\$10,000
Raw material purchases	\$132,000
Selling expenses	\$100,000
Advertising expense	\$5,000
Administrative expense	\$43,000
Depreciation expense	\$11,000
Insurance expense	\$8,000
Actual manufacturing overhead costs	\$220,000
Manufacturing overhead budgeted	\$221,000
Sales Commissions	\$5,000

Inventories	Beginning of Year	End of Year
Raw materials	\$8,000	\$10,000
Work in process	\$5,000	\$20,000
Finished goods	\$70,000	\$25,000

Required:

- (i) Prepare a schedule of cost of goods manufactured. Assume all raw materials used in production were direct materials.
 - (ii) Prepare a schedule of cost of goods sold.
 - (iii) Prepare an income statement.
- (b) Siemens Company manufactures and sells a specialized cordless telephone for high the most electromagnetic radiation environments. The company's contribution format income statement for recent year is given below (15)

	Total (Tk)	Per Unit (Tk)	Percentage
Sales (20000 Unit)	1000000	50	100
Variable Expense	<u>(800000)</u>	<u>40</u>	<u>?</u>
Contribution Margin	200000	<u>10</u>	<u>?</u>
Fixed Cost	<u>(150000)</u>		
Net Operating Income	<u>50000</u>		

Management is anxious to increase the company's profit and has asked for an analysis of a number of items.

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Required:

- (i) Compute the company's CM ratio and variable expense ratio.
- (ii) Compute the company's break-even point in both units and Tk.
- (iii) Assume that sales increase by Tk. 400,000 next year. If cost behavior patterns remain unchanged, by how much will the company's net operating income increase? Use the CM ratio to compute your answer.
- (iv) Refer to the original data. Assume that next year management wants the company to earn a profit of at least Tk. 90,000. How many units will have to be sold to meet this target profit?
- (v) Refer to the original data. Compute the company's margin of safety and comment.

7. (a) Dexter Corporation produces and sells a single product, a single color marker pen. Selected cost and operating data relating to the product for two years are given below: (25)

Selling price per unit	\$60
Manufacturing costs:	
Variable per unit produced:	
Direct materials	\$11
Direct labor	\$6
Variable manufacturing overhead	\$3
Fixed manufacturing overhead per year	\$120,000
Selling and administrative expenses:	
Variable per unit sold	\$4
Fixed per year	\$70,000

	Year 1	Year 2
Units in beginning inventory	0	2000
Units produced during the year	10000	6000
Units sold during the year	8000	8000
Units in ending inventory	2000	0

Required:

Assume the company uses absorption costing

- I. Compute the unit product cost in each year.
- II. Prepare an income statement for each year.

Assume the company uses variable costing

- I. Compute the unit product cost in each year.
- II. Prepare an income statement for each year.

(b) Y Ltd. has three production department (P, Q and R) and two service department (X and Y). The overhead for the departments before reallocation are given below (10)

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Department	Overheads
P	\$30,000
Q	\$60,000
R	\$19,000
X	\$22,000
Y	\$38,000

The reallocation percentages of the service departments' costs are given below:

Department	P	Q	R	X	Y
X	40%	25%	25%	---	10%
Y	25%	30%	30%	15%	---

Requirement:

I. Use the direct allocation method to reallocate the overheads of service departments to production departments.

8. (a) What are the differences between discounted and non-discounted techniques of capital budgeting? (5)

(b) Consider the projects below with respective cash flows: (18)

Project	Years					
	0	1	2	3	4	5
A	(200,000)	35,000	80,000	90,000	75,000	20,000
B	(200,000)	28,000	40,000	50,000	90,000	10,000

Required: Calculate:

- (i) Pay Back Period for both projects.
- (ii) Internal rate of return (IRR). (For only project B)
- (iii) Net Present value (NPV) for both projects at 10% cost of capital.

(c) Foley Company uses job order costing system. The following data relate to the month of October, 2014 – (12)

- (i) Raw material purchased on account Tk. 210,000.
- (ii) Raw material issued to production Tk. 190,000 (80% direct and 20% indirect).
- (iii) Direct labor cost incurred Tk. 49,000 and indirect labor cost incurred Tk. 21,000.
- (iv) The company applies manufacturing cost to production on the basis of Tk. 4 per machine hour. There were 75,000 machine hours recorded for October.
- (v) Production ordered costing Tk. 500,000 according to their job cost sheet were completed during October and transferred to finished goods.
- (vi) Production ordered that had cost Tk. 450,000 to complete according to their job cost sheet were shipped to customers during the month. These goods were sold at 50% above cost. The goods were sold in account.

Required: Prepare journal entries to record the information given above.
