Khulna University of Engineering & Technology
B. Sc. Engineering 1st year 2nd Term (Regular) Examination, 2016
Department of Electrical and Electronic Engineering
EE 1203
Electrical Circuit and Filter Design

Time: 3 hours Full Marks: 210

N.B.: (i) Answer **ANY THREE** questions from each section in separate scripts.
(ii) Figures in the right margin indicate full marks.

Section A

Q1. (a) What is meant by planer graph and tree? Explain with example. (05)

(b) Find the expression for current when a series RC circuit is suddenly energized by a voltage $e = E_m \sin \omega t$. Also draw the current wave shape with respect to time. (15)

(c) The switch S_1 of Fig. 1(c) has been closed for a long time. At time $t = 0$ switch S_2 is closed. i) Find the mathematical expression for the current i_2 and voltage v_2 after closing the switch S_2. ii) Draw the wave form of i_2 and v_2 with respect to time. (15)

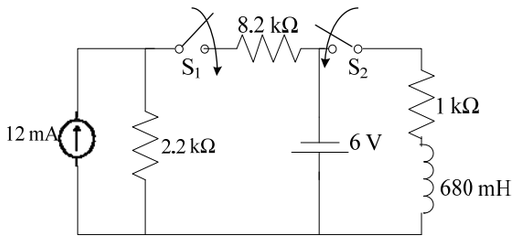


Fig. for Q. 1(c)

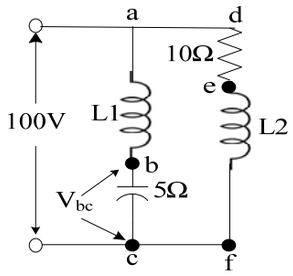


Fig. for Q. 2(b)

Q2. (a) Write down the significance of co-efficient of coupling. Discuss the dot rule of magnetically coupled circuit. (08)

(b) Calculate the phase and magnitude of the voltage drop V_{bc} with respect to the total drop from a to c in Fig. 2(b). Here $X_{L1} = 5\Omega$, $X_{L2} = 5\Omega$, $X_M = 4\Omega$. (12)

(c) Find v_x in the network shown in Fig. 2(c). (15)

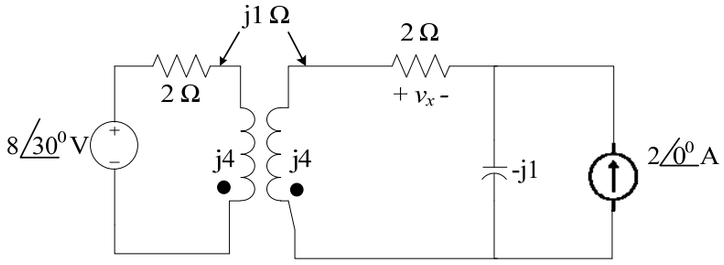


Fig. for Q. 2(c)

Q3. (a) Establish a relation between phase voltage and line voltage of a n phase star connected load. (05)

(b) Draw the vector diagram that represents two wattmeter method for power measurement in a balanced three phase wye system with p.f. lagging and explain the procedure. Draw and explain the wattratio curve. (15)

(c) Two balanced loads are connected to a 400V line in parallel. Load 1 draws 8KW at a p.f. 0.6 lagging while load 2 draws 6KVR at a p.f. 0.8 lagging. Determine (i) the total real and reactive power and power factor of the combined load, (ii) the line current and (iii) the KVAR rating of 3-φ capacitor that will raise the p.f. 0.9 lagging. (15)

Q4. (a) The total power of a three phase three wire unbalanced system can be measured by two wattmeters – justify the statement. (08)

(b) Determine the vector power factor of unbalanced load. (07)

(c) Find out the readings of the wattmeters after the switch is thrown at position 1 to position 2 of the Fig. 4(c). (20)

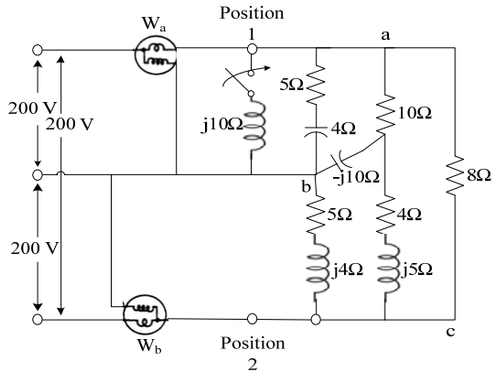


Fig. for Q. 4(c)

Section B

Q5. (a) Define i) iterative impedance, ii) image impedance, iii) propagation constant and iv) insertion loss. (12)

(b) The curve of reactance vs. frequency is shown in Fig. 5(b). Develop the circuit by Foster II method. (12)

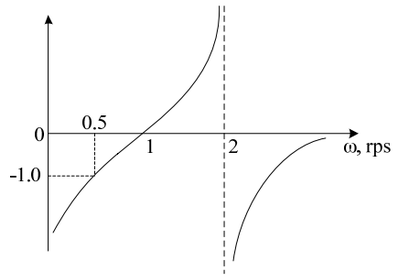


Fig. for Q. 5(b)

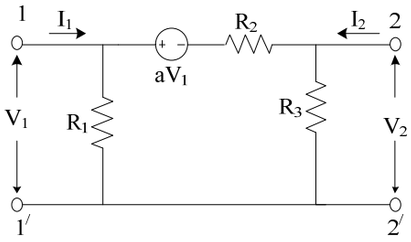


Fig. for Q. 5(c)

(c) Given V_1 and I_2 for the network shown in Fig. 5(c). Develop the following pair of simultaneous equations: (11)

$I_1 = ...$

$V_2 = ...$

Q6. (a) Define TPNs. (03)

(b) Draw the equivalent circuit of two port network with respect to hybrid parameters. Also write down the equations. (12)

(c) What are the disadvantages of prototype section? How this can be eliminated? (08)

(d) The z parameters of a two port network are $z_{11} = 10\Omega$, $z_{22} = 15\Omega$, $z_{12} = z_{21} = 5\Omega$. Find the equivalent T network and ABCD parameters. (12)

Q7 (a) Define filter. State and prove the theorem connecting attenuation (α) and characteristic impedance (Z_o) for filter. (13)

(b) Design a normalized low pass filter. From the normalized low pass filter, design a high pass filter with cutoff frequency of 1000 rps and design impedance of 200 Ω. (11)

(c) Design a bandstop filter having a design impedance of 500Ω and cutoff frequencies of 2kHz and 5kHz. (11)

Q8 (a) Derive the expression for current insertion ratio, CIR = $\frac{F_1 e^{+\theta}}{F_2 F_3 F_4}$ (10)

(b) Calculate the incident and reflected component of power, p_i and p_r, respectively, for the following network. (12)

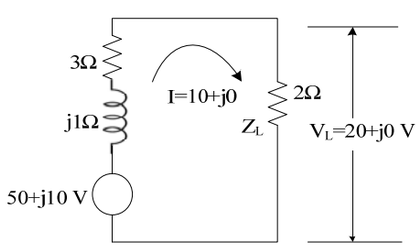


Fig. for Q. 8(b)

(c) Design a lowpass Butterworth filter with the attenuation -60dB per decade outside the passband. Also denormalize the filter for cutoff frequency of 1kHz and design impedance 600Ω. (13)

Khulna University of Engineering & Technology

B. Sc. Engineering 1st Year 2nd Term (Regular) Examination, 2016

Department of Electrical and Electronic Engineering

Hum 1203

Economics and Accounting

Time: 3 hours Full Marks: 210

N.B.: (i) Answer **ANY THREE** questions from each section in separate scripts.

(ii) Figures in the right margin indicate full marks.

Section A

Q1. (a) Define Robbins definition of Economics. Explain the basic problems of an economic organization. (07)

(b) Explain the factors behind the downward sloping demand curve. (08)

(c) Solve the following problems: (20)

There are 10000 identical individuals in the market for commodity X, each with a demand function is given by $Q_{dx} = 12 - 2P_x$ and 1000 identical producers of commodity X, each with a supply function is given by $Q_{sx} = 20P_x$

(i) Obtain equilibrium price and quantity.

Now, if the government decides to collect a sales tax of $2 per unit sold from each of the 1000 sellers of commodity X,

(ii) What effect does this have on the equilibrium price and quantity?

(iii) Who actually pays the tax?

(iv) What is the amount of taxes collected by the government?

Q2. (a) Define price-elasticity of demand. Explain various types of price-elasticities of demand with examples. (15)

(b) What are the main determinants of price-elasticity of demand? (15)

(c) Define Income-elasticity of demand with examples. (05)

Q3. (a) What do you mean by fixed cost and variable cost? What are the differences between fixed cost and variable cost? (12)

(b) What are the elements of Total cost of a firm in the short run? What average cost curve generally U shaped in the short-run? (13)

(c) What are the internal and external economics of sale? (10)

Q4. (a) Define National Income and Personal Income. Explain “Income Method” of National Income Accounting. (20)

(b) What is GDP deflator? Why do the economists prefer real GDP as a measure of Economic well-being? Explain. (15)

Section B

Q5. (a) What is transaction? Discuss the characteristics of financial transactions. (10)

(b) What is accounting cycle? Describe the steps of accounting cycle. (10)

(c) Mr. Rafin started a business on 1st July, 2016. During the first month of operation he completed these transactions. (15)

2016, July- 1	The owner invested TK 150000 of cash in the business.
2016, July- 2	Purchased TK 50000 of office equipment paying cash of TK 20000 and the balance on account.
2016, July- 3	Purchased supplies of TK 7500 for cash.
2016, July- 4	Performed services: for cash TK 26000 and on account TK 37000.
2016, July- 5	Paid TK 15000 to accounts payable.
2016, July- 6	The owner withdrew TK 20000 cash for personal use.
2016, July- 7	The company paid TK 6500 cash for rent.
2016, July- 8	Collected cash of TK 4500 from customers on account.
2016, July- 9	Paid employee salaries of TK 39000.
2016, July- 10	Incurred utilities expense of TK 5000 on account.

Required: Prepare a tabular analysis of the transactions, using the following column headings: Cash, Equipment supplies, Accounts Receivable, Accounts Payable, and Mr. Rafin's Capital.

Q6. (a) Define Accounting. Discuss the functions of Accounting. (10)

(b) Describe the steps in the Accounting process. (10)

(c) Discuss briefly the various users of Accounting data. (15)

Q7. (a) What is trial balance? Write down the limitation of trial balance. (08)

(b) From the following ledger balances, prepare a trial balance as on June 30, 2016. (17)

	TK			TK
Cash	7150		Capital	21750
Accounts receivable	10000		Salaries payable	1500
Prepaid insurance	2750		Service revenue	14400
Supplies	500		Rent expense	5500
Office equipment	15000		Depreciation expense	1000
Accumulated depreciation-office equipment	250		Insurance expense	250
Accounts payable	4500		Utilities expense	250
Utilities payable	150		Supplies expense	1500
Unearned Service revenue	1500		Advertisement expense	150

(c) The Accountant of M/S Arnab Enterprise completed Trial Balance for the year ended 31st December 2015. The following information were subsequently revealed: (10)

(i) Electric charge outstanding TK 2000.
(ii) Outstanding wages for December TK 25000.
(iii) A bill of TK 3500 for purchase of supplies on 20 December not yet paid.
(iv) Advertisement expense for the next year amounted to TK 2000.
(v) Goods purchased from Rahman on December 25 for TK 15000 but it did not yet record.

Required: Prepare the adjusting entries at December 31, 2015.

Q8. The following trial balance was taken from the ledger of Amin Traders at the end of the accounting period. (35)

Amin Traders
Trial Balance as on December 31, 2015

Account Titles	Debit (TK)	Credit (TK)
Capital		160000
Sales		310000
Sales returns	10000	
Purchase	120000	
Purchase discount		10000
Transportation- in	10000	
Salaries expense	60000	
Rent expense	60000	
Advertisement expense	30000	
Cash	30000	
Accounts Receivable	60000	
Inventory (1-1-15)	50000	
Store Equipment	90000	
Accumulated depreciation- Store Equipment		20000
Account payable		20000
Total	520000	520000

Additional Information:

(a) Ending inventory at December 31, 2015 TK 60000.
(b) Estimated depreciation of store equipment.
(c) Salaries unpaid TK 4000 for the period.
(d) Rent prepaid TK 12000.

Required: (i) You are required to prepare a statement of comprehensive income (ii) prepare an owner's equity statement and (iii) prepare a statement of financial position as on 31st December 2015.

Khulna University of Engineering & Technology
B. Sc. Engineering 1st year 2nd Term (Regular) Examination, 2016
Department of Electrical and Electronic Engineering
Math 1203
Mathematics-II

Time: 3 hours Full Marks: 210

N.B.: (i) Answer ***ANY THREE*** questions from each section in separate scripts.
(ii) Figures in the right margin indicate full marks.

Section A

Q1. (a) What is meant by a differential equation? Classify the differential equation with definitions. Form a differential from the relation $V = \frac{A}{r} + B$, where A and B are arbitrary constants. (12)

(b) Find the general solution of the following differential equation: (10)

$$\left(x \tan\frac{y}{x} + y\right) dx - xdy = 0.$$

(c) A RC circuit has an emf of $10 \sin t$ volts, a resistance of 100 ohms, a capacitance of 0.005 farad, and no initial charge on the capacitor. Draw a circuit and form a differential equation for it and hence find the charge on the capacitor at time t. Also find the steady-state current. (13)

Q2. (a) Determine the value of constant A such that the differential equation $(x^2 + 3xy)dx + (Ax^2 + 4y)dy = 0$ is exact and solve the resulting exact equation. (11)

(b) Define the integrating factor. Identify and solve the differential equation (11)

$$(4x + 3y^2)dx + 2xydy = 0.$$

(c) A RCL circuit connected in a series has a resistance of 5 ohms, an inductance of 0.05 henry, a capacitor of 4×10^{-4} farad, and an applied alternating emf of $200 \cos 100t$ volts. Draw a circuit and form a differential equation and hence find an expression for the current flowing through this circuit if the initial current and the initial charge on the capacitor are both zero. (13)

Q3. (a) Identify and solve the following differential equation: (08)

$$x\frac{dy}{dx} - 2y = 2x^4; y(2) = 8.$$

(b) Find the general solution of the differential equation $y'' - 2y' + y = e^x \sin x$. (12)

(c) Solve $\frac{d^2y}{dx^2} - 4\frac{dy}{dx} - 5y = xe^{-x}; y(0) = 0, y'(0) = 0.$ (15)

Q4. (a) Identify and solve the following equation: (12)

$$x^3y''' + 2x^2y'' + 2y = 10\left(x + \frac{1}{x}\right)$$

(b) Solve $(D^2 - 6D + 13)y = 8e^{3x}\sin 5x.$ (10)

(c) Solve $\frac{d^2y}{dx^2} + y = \sec x \tan x$ by the method of variation of parameters. (13)

Section B

Q5. (a) Evaluate any three of the following integrals: (35)

a) $\int \frac{\sin^{-1}x}{(1-x^2)^{3/2}}dx$ b) $\int\left(\sqrt{\tan x} + \sqrt{\cot x}\right)dx$

c) $\int e^x\left(\frac{1-x}{1+x^2}\right)^2 dx$ d) $\int \frac{dx}{x\sqrt{1+x^3}}$

Q6. (a) Determine any three of the following definite integrals: (35)

a) $\int_0^{\pi} \frac{x\tan x}{\sec x+\tan x}dx$ b) $\int_0^1 \frac{\ln x}{\sqrt{1-x^2}}dx$

c) $\int_0^{\pi} \frac{x\sin x}{1+\cos^2 x}dx$ d) $\int_0^1 x^3(1-x^2)^{\frac{5}{2}}dx$

Q7. (a) Prove that $\boxed{m}\boxed{m+\frac{1}{2}} = \frac{\sqrt{\pi}\boxed{2m}}{2^{2m-1}}$ (11)

(b) Obtain a reduction formula for $\int \frac{dx}{\sin^m x\cos^n x}$ $(n \neq 1)$. (12)

(c) Find the area enclosed by the parabola $y^2 = 4x$ and the straight line $y = 2x$. (12)

Q8. (a) Determine the length of the arc of the parabola $y^2 = 4ax$ which is intercepted between the points of intersection of the parabola and the straight line $3y = 8x$. (12)

(b) Find the volume of the solid generated by the revolution about the x-axis of the loop of the curve $9y^2 = x(3-x)^2$. (10)

(c) Prove that $\int_0^{\infty} \frac{log(1+a^2x^2)}{1+b^2x^2}dx = \frac{\pi}{b}log\left(\frac{a+b}{b}\right)$. (13)

Khulna University of Engineering & Technology

B. Sc. Engineering 1st Year 2nd Term (Regular) Examination, 2016

Department of Electrical and Electronic Engineering

ME 1203

Basic Mechanical Engineering

Time: 3 hours Full Marks: 210

N.B.: (i) Answer **ANY THREE** questions from each section in separate scripts.

(ii) Steam Table will be supplied on request.

(ii) Figures in the right margin indicate full marks.

Section A

Q1. (a) Why knowledge of mechanical engineering is necessary of an electrical engineer? (06)

(b) Define (i) Dryness fraction, (ii) Sensible heat of water, (iii) Enthalpy, and (iv) Latent heat of vaporisation. (08)

(c) Describe La Mont boiler with a neat sketch. (12)

(d) Write down the comparison between a water tube and a fire tube boiler. (09)

Q2. (a) Explain the terms: (i) Equivalent evaporation, (ii) Boiler Efficiency. (08)

(b) What is the difference between boiler mountings and accessories? (08)

(c) The following observations were made in a boiler trial: (15)

Coal used 250kg of calorific value 29800 kJ/kg, water evaporated 2000kg, steam pressure 11.5 bar, dryness fraction of steam 0.95 and feed water temperature 34^0C. Calculate the following terms:

(i) Equivalent evaporation "from & at 100^0C" per kg of coal

(ii) Efficiency of the boiler.

(d) What is the function of a 'blow off cock' and a 'Superheater'? (04)

Q3. (a) Define Heat Engine. What do you mean by External Combustion Engine and Internal Combustion Engine? Give example of them. (08)

(b) Draw and explain the actual indicator diagram for a four stroke cycle diesel engine. (07)

(c) What are the differences between Petrol and Diesel Engine? (10)

(d) Discuss the cooling requirement of an IC engine. Explain the method of water cooling system with neat sketch. (10)

Q4. (a) Define Thermodynamics. State the laws of thermodynamics. (10)

(b) What is a thermodynamic system? Describe different types of thermodynamic systems. (08)

(c) What are the assumptions in thermodynamic cycles? List out the important types of cycle and draw the p–v and T–S diagrams of Ericsson cycle and Dual combustion cycle. (12)

(d) Explain reversible and irreversible processes. (05)

Section B

Q5. (a) Explain the difference between a heat engine, refrigerator and heat pump. (08)

(b) Describe vapour absorption refrigeration system with schematic diagram. (13)

(c) Draw the p–h and T–S diagrams for theoretical vapour compression cycle with superheated vapour after compression and briefly explain it. (08)

(d) What are the types of vapour compression cycle? (06)

Q6. (a) Define comfort. What are the factors which affect comfort air conditioning? Briefly explain. (08)

(b) Compare conventional and non conventional sources of energy. (10)

(c) What are the liabilities and limitations for alternatives to conventional fossil fuels? (07)

(d) Describe the working principle of a summer air conditioning system with neat sketch. (10)

Q7. (a) Define the terms: (i) Tension (ii) compression (iii) shear force (iv) Torque (v) Bending Moment. (10)

(b) An Aluminium rod is rigidly attached between a steel rod and a bronze rod as shown in Fig. 7(b). Axial loads are applied at the positions indicated. Find the maximum value of P that will not exceed a stress in steel of 140MPa in Aluminium of 90MPa or in bronze of 100MPa. (15)

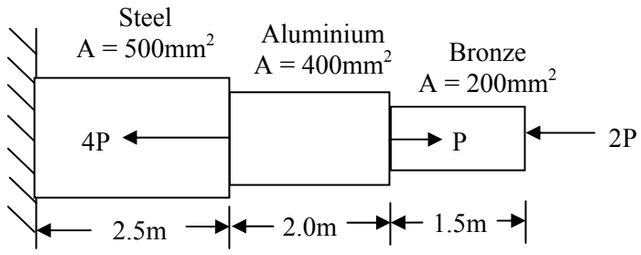


Fig. for Q7 (b)

(c) Show that the longitudinal stress is one-half the value of the tangential stress for a thin walled pressure vessel. (10)

Q8. (a) Draw the stress strain diagram and discuss all the remarkable points. (10)

(b) State Hookes law. Show that, $\delta = \frac{PL}{AE}$ where all the symbols have their usual meanings. (10)

(c) The composite rod in Fig. 8(c) 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 $P_1 = 150kN$ and $P_2 = 90kN$. (15)

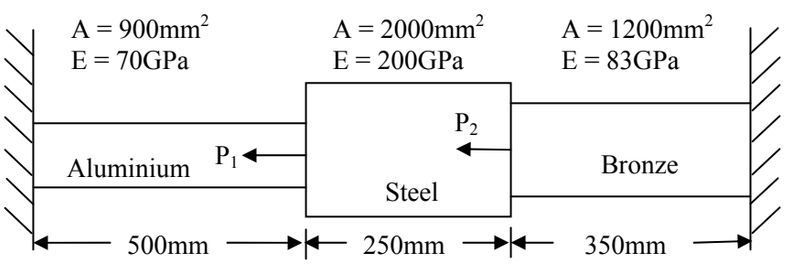


Fig. for Q8(c)

Khulna University of Engineering & Technology
B. Sc. Engineering 1st year 2nd Term (Regular) Examination, 2016
Department of Electrical and Electronic Engineering
Ph 1203
Physics-II

Time: 3 hours Full Marks: 210

N.B.: (i) Answer **ANY THREE** questions from each section in separate scripts.
(ii) Figures in the right margin indicate full marks.

Section A

Q1. (a) Briefly explain with necessary diagram that 'future' and the 'past' are absolute concept for a time like interval between two events. (10)

(b) Staring from Lorentz transformation equation for space and time co-ordinates derive equations for relativistic addition of velocities. Hence prove that no material particle can move with a velocity greater than that of light. (15)

(c) Assuming that the rest radius of earth is 6,400 km and its orbital speed about the sun is 30 km/hr, how much does earth's diameter appear to be shortened to an observer on the sun, due to earth's orbital motion. (10)

Q2. (a) Consider a photoelectric effect experiment, if violet light falls on the target electrons leave the target, causing a small current on the circuit. (5+8)

(i) When wavelength of the light is increased, the light become red and no electrons leave the target. Explain why violet light, but not red light causes electron emission.

(ii) While violet light shines at the sodium, a student studies the effect of varying the intensity of the light. Describe and explain how this will affect the rate of electron emission the maximum kinetic energy of the emitted electrons and the current in the circuit.

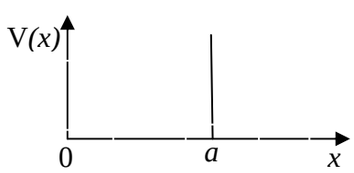
(b) What are de Broglie matter waves? Mention the factors on which the wavelength of the particle depends. (12)

(c) Monochromatic X-ray of wavelength $0.124A^0$ are scattered by a carbon block. Find the wavelength of X-rays scattered through 180^0. (10)

Q3. (a) Show that in a privileged orbit, the magnetic moment of the electron must be $-\left(\frac{e}{2m}\right)\bar{L}$, where $\bar{L}$ is an angular momentum. (10)

(b) Consider a particle of mass "*m*" is contained in a 1-D box of with "*a*". The potential energy is given by (12+3)

$$V(x) = \begin{cases} 0 & 0 \le x \le a \\ \infty & \text{Otherwise} \end{cases}$$



(i) Solve the Schrodinger equation for this particle and hence show that the normalized solution have the form

$\Psi_n(x) = \sqrt{\frac{2}{a}} \sin\left(\frac{n\pi x}{a}\right)$, where "*n*" is an integer.

(ii) Sketch the wave function for the case n=1, 2 and 3.

(c) Find the first excited state of a harmonic oscillator. (10)

Q4. (a) What do you understand by "mass defect" and "binding energy"? Using the (12)

curve for the binding energy per nucleon as a function of mass number A, state clearly how the release in energy in the process of nuclear fission and nuclear fusion can be explained.

(b) What is radioactive transformation? Discuss the law of radioactive successive disintegration. (13)

(c) A counter rate meter is used to measure the activity of a radioactive sample. At a certain instant, the count rate was measured as 4750 count per minute. Five minutes later, the count rate recorded was 2700 count per minute. Compute (10)

(i) The decay constant

(ii) The half life of the sample.

Section B

Q5. (a) What are Miller indices? Discuss in brief the procedure for finding Miller indices. (12)

(b) State the properties of a reciprocal lattice. Show that the volume of the unit cell is (13)

$$V = abc[1 - \cos^2\alpha - \cos^2\beta - \cos^2\gamma + 2\cos\alpha\cos\beta\cos\gamma]^{1/2}.$$

(c) In a tetragonal lattice $a = b = 2.2A^0$, $c = 1.8A^o$. Find (i) the lattice separation between [100] planes, and (ii) the density of lattice points in [110] planes. (10)

Q6. (a) Discuss the inelastic scattering of photons by phonons and obtain an expression for the frequency of phonon emitted in the process. (10)

(b) What are the assumptions of Debye model for lattice specific heat? Calculate the lattice specific heat capacity according to the Debye theory. (15)

(c) Calculate the maximum phonon frequency generated by scattering of visible light of wavelength $\lambda = 4850A^0$. Given that velocity of sound in medium is 4.88×10^5 cm/sec and refractive index is 1.52. (10)

Q7. (a) What are static and transport properties in the case of free electron model? Obtain an expression for the electrical conductivity of a metal on the basis of free electron theory. (12)

(b) Show that the density of states of free electrons is given by $D(E) = \frac{V}{2\pi^2}\left(\frac{2m}{\hbar^2}\right)^{3/2} E^{1/2}$. Use this expression to discuss number of filled state between electronic energy levels. (13)

(c) Copper has a mass density $\rho_m = 8.88$ gm/cm^3 and an electrical resistivity $\rho = 1.67 \times 10^{-8}$ ohm–m at room temperature. Calculate (i) The Fermi energy (E_f), (ii) The concentration of The conduction electrons, (iii) The mean free time τ, (iv) The Fermi velocity v_f and (v) The mean free path λ_f at Fermi level. (10)

Q8. (a) Discuss in details the concept of directionality, monochromacity, intensity and coherence of LASER. (12)

(b) Give the brief outlines of the form of input energy of a LASER. Explain the terms (i) induced absorption (ii) spontaneous emission and (iii) stimulated emission. (13)

(c) A LASER beam has a power of 120 mW. It has an aperture of 5.3×10^{-3} m and it emits light of wavelength $6855A^o$. The beam is focused with a lens of focal length 0.12 m. Calculate the area and the intensity of the image. (10)