Khulna University of Engineering & Technology
B. Sc. Engineering 1st Year 2nd Term (Regular) Examination, 2018
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.
(iii) Semilog paper may be supplied on request.

Section A

Q1. (a) Transient always represent undesirable circuit conditions. Do you agree with this statement? Justify your opinion. (05)

(b) Find the expression for current in a RLC series circuit is suddenly energizing by a constant voltage source. Discuss the different conditions. (15)

(c) For the circuit shown in Fig Q1(c), (i) Find the mathematical expression for the transient behaviour of the voltage v_l and current i_l when switch is closed. (ii) Sketch the waveforms of v_l and i_l . (15)

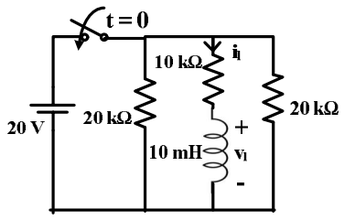


Figure for Q1(c)

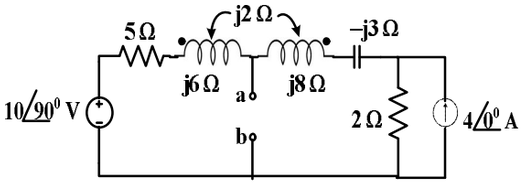


Figure for Q2(b)

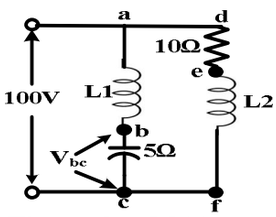


Figure for Q2(c)

Q2. (a) Explain with examples, Tree, Co-tree, Planer graph and Sub-graph. (08)

(b) Obtain the Thevenin equivalent circuit for the circuit in Fig Q2(b) at terminal $a - b$. (16)

(c) Calculate the phase and magnitude of the voltage drop V_{bc} with respect to the total drop from a to c in Fig 2(c). Here $X_{L1} = 5\Omega$, $X_{L2} = 5\Omega$, $X_M = 4\Omega$. (11)

Q3. (a) Why is three phase circuit preferred compared to single-phase to transmit power under fixed distance with a fixed line loss? Prove your answer. (08)

(b) Describe the two wattmeter method for measuring the total var of a three phase load. Draw the proper vector diagram. (12)

(c) A balanced induction motor takes 5.4 kW at 0.6 p.f. from a line voltage of 200 volts. It is in parallel with a pure resistive balanced wye load taking 5 kW. Determine the condenser size to get the overall p.f. 0.95 lagging. Also determine the line current of the combination. (15)

Q4. (a) Define power factor. Write short notes on vector power factor. (05)

(b) What are the methods of checking voltage phase sequences? With the help of neat sketch and vector diagram, describe the method of phase sequence determination. (15)

(c) Determine the reading of the wattmeters for the following circuit shown in Fig Q4(c). (15)

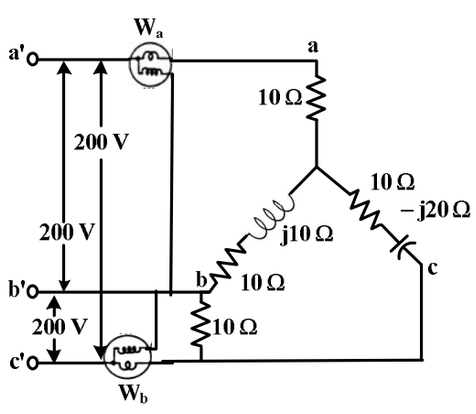


Figure for Q4(c)

Section B

Q5. (a) Define a dissipationless network. How can we synthesize dissipationless network? (05)

(b) For the dissipationless network shown in Fig Q5(b), (20)

(i) draw the reactance and susceptance curves;

(ii) what is the least number of circuit elements which may be used to represent the reactance behaviour of the network? Defend your answer;

(iii) what circuit arrangement of this least number of elements will do the job? Discuss the possibility of there being more than one answer.

(c) Draw a symmetrical and an asymmetrical two port network, and explain why they are called so. (10)

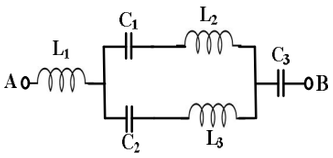


Figure for Q5(b)

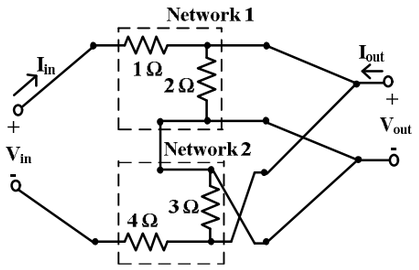


Figure for Q6(a)

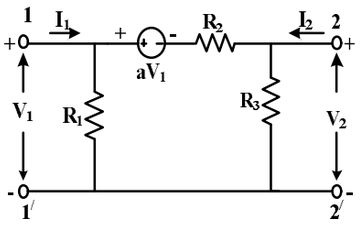
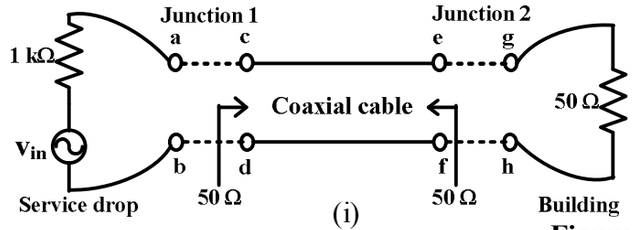


Figure for Q6(b)

Q6. (a) Two two-port networks are connected as shown in Fig Q6(a). Test the validity of this series-parallel connection. (10)

(b) V_1 and I_2 are known for the network shown in Fig Q6(b). Develop the simultaneous equations for I_1 and V_2. (10)

(c) In a telephone line, a coaxial cable brings the signal to the customer's building through a service drop, as shown in Fig Q6(c). The input impedance of the coaxial cable may be 50, 75, or 93 ohms. Now, a coaxial cable with 75 ohms input impedance is given to you for reconnecting the buildings line without changing the service drop. Do this job by matching image impedance at each junction. Design the matching networks and draw the complete connection. Design the matching networks and draw the complete connection. Also check your design by any appropriate method. (15)



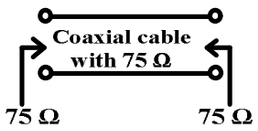


Figure for Q6(c)

Q7 (a) Why do we need filters in electrical and electronic applications? Illustrate the frequency responses of different types of filter. (10)

(b) Discuss the importance of an m-derived filter section over a prototype filter section. (08)

(c) Design a composite filter that comprised of the cascade connections of (i) high pass filter with cut-off frequency of 12000 rps and design impedance of 1000 Ω (ii) m-derived section with ω_∞ = 8000 rps and (iii) two terminating half section with m = 0.6. (17)

Q8 (a) Define (i) iterative impedance, (ii) image impedance, (iii) propagation constant and (iv) insertion loss. (08)

(b) The usable frequency band of voice signal is 300-3400 Hz. Design a filter which will pass the voice signal and attenuate all other signal frequencies. Assume that the load impedance is 600 Ω. (11)

(c) Design a normalized low-pass Chebysher model to meet the following specifications: (16)

(i) R_L = 1 Ω;

(ii) ω_c = 1 rps;

(iii) The ripple specification is $20 \log_{10} \frac{peak\ magnitude}{vally\ magnitude} = 1\ dB$

(iv) Slope of the dB gain curve is to be – 40 dB per decade at frequencies much higher than cutoff;

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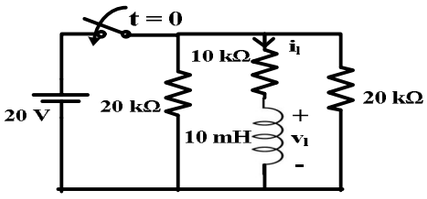
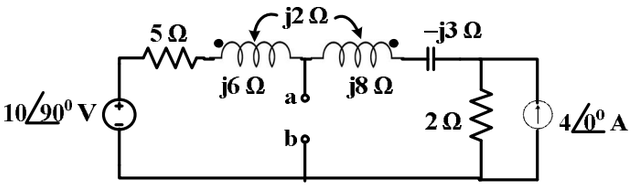


Figure for Q1(c)



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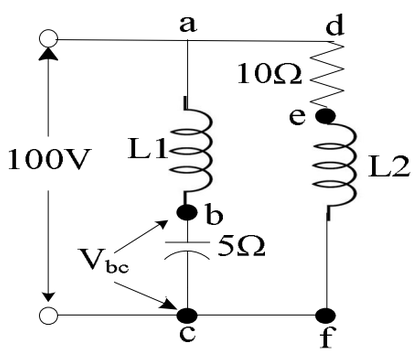

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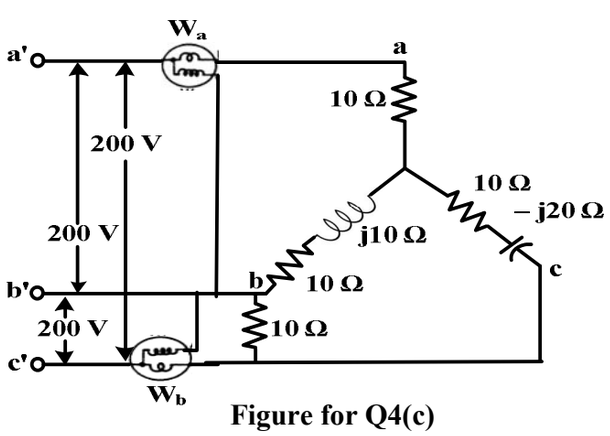

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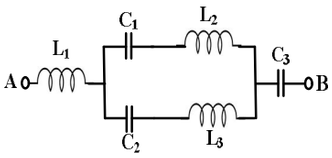
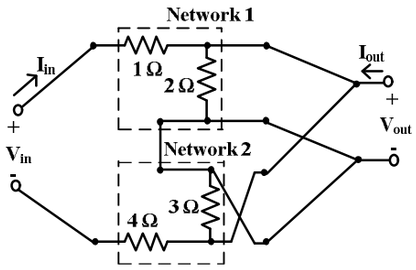


Figure for Q5(b)



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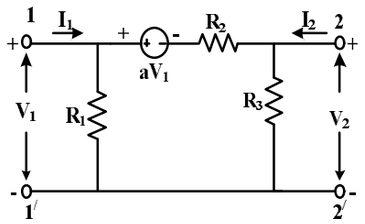

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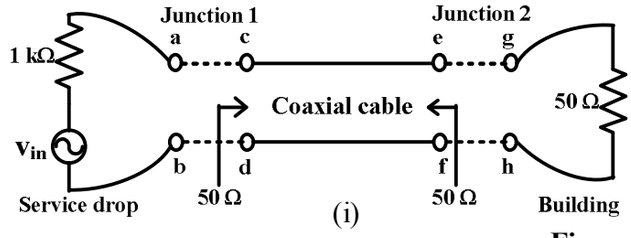
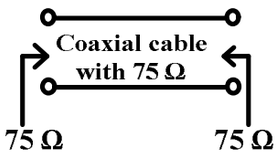


(i)



(ii)

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B. Sc. Engineering 1st Year 2nd Term (Regular) Examination 2018
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 Economics. Distinguish between Microeconomics and Macroeconomics. (10)
(b) Explain contraction in demand and extension in demand. (05)
(c) A demand function of X commodity given by $Q_d = 12 - 2P$ and supply function given by $Q_s = 20P$. Find the market equilibrium price and quantity of commodity X by diagram. (20)

Q2. (a) Discuss the characteristics of indifference curve. (05)
(b) Prove that price effect = substitution effect + income effect. (10)
(c) Explain how consumer's equilibrium is determined with help of budget line and indifference curve. (20)

Q3. (a) What are the differences between fixed and variable cost. (05)
(b) The following table gives an individual's marginal utility schedule for commodity X and Y. The price of X and the price of Y are \$1, and the individual's income is \$8 per time period and is all spent. (15)
(i) Indicate how this individual should spend her income in order to maximize her total utility.
(ii) What is the total amount of utility received by the individual when equilibrium?

Q	1	2	3	4	5	6	7	8	Total
MU_X	11	10	9	8	7	6	5	4	60
MU_Y	19	17	15	13	12	10	8	6	100

(c) Explain equilibrium of a competitive firm in short run under normal profit, abnormal profit and loss. (15)

Q4. (a) Define national income What are the measures of accounting national income? Discuss. (15)
(b) Prove that APC + APS = 1. (10)
(c) What is inflation? What are the main causes of inflation in a country like Bangladesh? (10)

Section B

Q5. (a) Define Accounting. State the importance of accounting. (10)
(b) Discuss the steps of Accounting cycle. (15)
(c) Describe the double entry system. (10)

Q6. (a) Presented below is information related to Peter Real Estate Agency: (20)

January 1	Peter begins business as a real estate agent with a cash investment of Tk. 15,000.
January 2	Hires an administrative assistant.
January 3	Borrowed Tk. 5000/- from bank by signing a note.
January 4	Purchased office furniture for Tk. 1900 on account.
January 6	Salls a house for Mr. Kidman, bills kidman Tk. 3200 for reality service provided.
January 25	Paid Tk. 700 on the balance relatedto the transaction of January 4
January 27	Purchased used car for Tk 4000 cash for use in business.
January 30	Paid the administrative assistant Tk. 2500 in salary for January.

Requirement: Journalize the transactions with explanations.

Q6. (b) What is transaction? Write down the characteristics of a transaction. (10)
(c) "All transactions are events, all the events are not transactions." Explain. (05)

Q7. (a) What is cost? Classify cost in relation to the volume of production. (10)
(b) Discuss the methods of depreciation. What is ledger? Why ledger is called the king of all books? (15)
(c) Following information is related to the purchase of a small delivery truck given by ABC company on January 1, 2005. (10)

Cost	1300
Expected salvage value	1000
Estimated useful life in Years	5
Estimated useful life in miles	1,00,000

Using above information calculate depreciation for the first 1 year under following methods: (i) Straight – line (ii) Units of activity (iii) declining – balance.

Q8. The unadjusted trial balance of Monir Traders on December 31, 2002 follows: (35)

Monir Traders Unadjusted Trial Balance December 31, 2002		
Name of accounts	Debit (Tk.)	Credit (Tk.)
Cash	11,000	
Supplies	4,500	
Equipment	1,50,000	
Accumulated depreciation, equipment		15,000
Unearned membership fees		24,000
Notes payable		50,000
Monir's capital		58,250
Monir's withdrawals	30,000	
Fees received		90,000
Salaries expense	38,000	
Interest expense	3,750	
Total	2,37,250	2,37,250

Additional data: (a) On December 31, employees have earned Tk. 800 but unpaid. (b) The cost of supplies on hand on December 31 is Tk. 1,800. (c) The amount of unrecorded accrued interest on December 31 is Tk. 1,250. (d) An analysis of the unearned membership fees shows that Tk. 16,000 remains unearned at December 31. (e) In addition to the membership fees included in the revenue account balance, the company has earned another Tk. 12,000 in fees that will be collected on January 21. (f) Depreciation expense for the year is Tk. 15,000.

Required:

(i) Prepare statement of comprehensive income and statement of owner's equity for this year ended December 31.
(ii) Prepare statement of financial position as on that date.

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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) Calculate $\int \frac{dx}{(x^2+1)\sqrt{2x^2-1}}$ (13)

(b) Calculate $\int e^x \left\{\frac{x^2+5x+7}{(x+3)^2}\right\} dx$ (11)

(c) Evaluate $\int \frac{dx}{3\sin x+4\cos x}$ (11)

Q2. (a) Obtain a reduction formula for $\int x^m(1-x)^n dx$; where $m, n > 0$ and integer. (12)
Find the value of $\int_0^1 x^4(1-x)^3 dx$.

(b) If $u_n = \int_0^1 x^n \tan^{-1} x\, dx$, then prove that $(n+1)u_n + (n-1)u_{n-2} = \frac{\pi}{2} - \frac{1}{n}$. (11)

(c) Evaluate $\int_0^{\pi} \frac{x\tan x}{\sec x+\tan x} dx$ (12)

Q3. (a) Evaluate $\int_0^{\frac{\pi}{2}} \log\cos x\, dx$ (12)

(b) Evaluate $\int_0^1 \cot^{-1}(1-x+x^2) dx$ (12)

(c) Evaluate (11)

$$\lim_{n\to\infty}\left[\left(1+\frac{1}{n^2}\right)\left(1+\frac{2^2}{n^2}\right)\left(1+\frac{3^2}{n^2}\right)\ldots\ldots\ldots\left(1+\frac{n^2}{n^2}\right)\right]^{1/n}$$

Q4. (a) State Walli's formula. (04)

(b) Define Beta function and Gamma function. Establish $\left[\frac{1}{2} = \sqrt{\pi}\right.$. (14)

(c) Determine the area bounded by the curve $x^{\frac{2}{3}} + y^{\frac{2}{3}} = 2^{\frac{2}{3}}$. Also find the entire length of this curve. (17)

Section B

Q5. (a) Formulate the differential equation from its solution given by $y(t) = c_1 e^{2t}\cos 3t + c_2 e^{2t}\sin 3t$ by eliminating arbitrary constants c_1 and c_2. (10)

(b) Solve $\left(y+\sqrt{x^2+y^2}\right)dx - xdy = 0$. (10)

(c) Find the solution of $9y'y + 4x = 0$ and hence sketch some solution curves with identification. (10)

(d) Is the differential equation $(y-4x-1)^2 dx - dy = 0$ a Bernoulli's equation? Justify your answer. (05)

Q6. (a) Solve $y(cos^3 x + ysinx)dx + cosx(sinxcosx + 2y)dy = 0$. (11)

(b) Solve $\frac{dy}{dx} + \frac{sin2y}{x} = x^3 cos^2 y$. (12)

(c) Solve $(2x-y)dx + (4x+y-3)dy = 0$. (12)

Q7 (a) Find the general solution of the differential equation: $(D^2 + 4D + 13)y = e^{-2x} \sin 3x + x$. (12)

(b) Solve by using the method of variation of parameters: $3y'' - 6y' + 6y = e^x \sec x$. (12)

(c) Solve $x^2 \frac{d^2y}{dx^2} - 3x \frac{dy}{dx} + 4y = x + x^2 \log x$. (11)

Q8 (a) The switch in the RL circuit in the following figure Q8(a) is closed at time $t = 0$. (15)

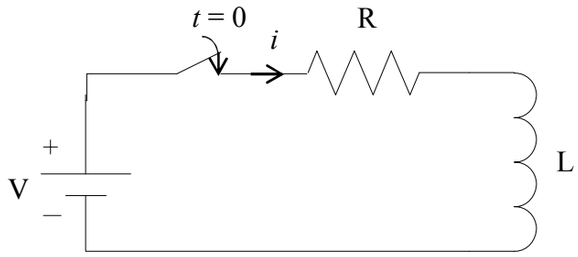

Figure for Q8(a)

(i) How will the current flow as a function of time.

(ii) Find the value of i that corresponds to $t = 3\frac{L}{R}$ and show that it is about 95% of the steady state value of $i(t)$ obtained in question (i).

(b) Suppose $L = 10$ henrys, $R = 10$ ohms, $C = \frac{1}{500}$ farads, $E = 100$ volts, $q(0) = 10$ coulombs, and $q'(0) = i(0) = 0$. Formulate and then solve the initial value problem that models the given RLC circuit. Interpret your results. (15)

(c) $y(x) = c_1 + c_2 x + c_3 \cos x$ is general solution of a linear homogeneous differential equation. Is the above statement true? If not true, give the reason. (05)

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ME 1203
Basic Mechanical Engineering

Time: 3 hours Full Marks: 210

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Section A

Q1. (a) What is meant by energy? Distinguish between renewable and non-renewable sources of energy. (06)
(b) Briefly describe the electrical energy situation in Bangladesh. (10)
(c) Distinguish between wet steam and dry steam. Mention the advantages of superheated steam. (06)
(d) Describe with neat sketch, the construction and working principle of Cochran Boiler. (13)

Q2. (a) Define the terms: (i) Dryness fraction, (ii) Enthalpy of steam, and (iii) Entropy of steam. (09)
(b) Describe the function of (i) Pressure gauge, (ii) Safety Value, (iii) Fusible plug and (iv) Economiser. (08)
(c) The following observation were made on a boiler plant during one hour test: Steam pressure = 20 bar, superheated steam temperature = 360^0C, steam generated = 5000 kg, temperature of water entering the economiser = 25^0C, temperature of water leaving the economiser = 92^0C, fuel used = 4000 kg, higher calorific value of fuel = 30000 kJ/kg. Calculate – (i) Equivalent evaporation per kg of fuel, (ii) The thermal efficiency of the plant, (iii) The percentage of heat absorbed of the fuel energy utilized by economiser and boiler, (iv) Boiler power. (18)

Q3. (a) Define and classify IC engine. Mention the important components of an IC engine. (10)
(b) Describe briefly with appropriate sketches the actual sequence of events in the cylinder of a petrol engine working on the four stroke cycle. (15)
(c) Define octane and cetane number. Compare between air cooling and water cooling system. (10)

Q4. (a) Define thermodynamic process and system. What is the zeroth law of thermodynamics? (06)
(b) State the first law for a closed system undergoing a cycle. (05)
(c) Define the terms: (i) Refrigeration, (ii) Coefficient of Performance, (iii) Tonne of refrigeration, and (iv) Heat pump. (08)
(d) Describe with neat diagram, the vapour absorption refrigeration system. (16)

Section B

Q5. (a) What is meant by air conditioning? Write down its classification. (07)
(b) State the properties of a good refrigerant. (05)
(c) What is meant by human comfort? Write down the factors affecting the human comfort. (08)
(d) Briefly describe the working principle of winter air conditioning system with neat sketch. (15)

Q6. (a) Define (i) Axial force (ii) Shear force (iii) Torque (iv) Bending moment (v) show them in a 3-D object. (10)

(b) Show that, for a thin walled pressure vessel failure will occur along the longitudinal section of cylinder. (12)

(c) A cylindrical pressure vessel is fabricated from steel plating that has a thickness of 20 mm. The diameter of the pressure vessel is 450 mm and its length is 2 m. Determine the maximum internal pressure that can be applied if the longitudinal stress is limited to 140 MPa and the circumferential stress is limited to 60 MPa. (13)

Q7 (a) Draw the stress strain diagram of structural steel and explain the important points. (12)

(b) Define the following terms: (i) Hooke's law (ii) Modulus of elasticity (iii) Modulus of rigidity. (10)

(c) As shown in Fig Q7(c), a rigid bar with negligible mass is pinned at O and attached to two vertical rods. Assuming that the rods were initially stress free, what maximum load P can be applied without exceeding stress of 150 MPa in the steel rod and 70 MPa in the bronze rod. (13)

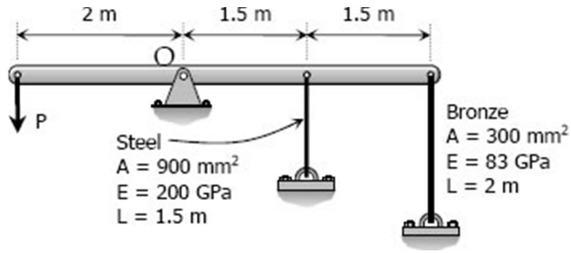

Figure for Q7(c)

Q8 (a) Derive the torsion formula and show that for solid shaft $\tau_{max} = \frac{16T}{\pi d^3}$ and for Hollow shaft $\tau_{max} = \frac{16TD}{\pi(D^4 - d^4)}$ where the symbols have their usual meaning. (14)

(b) Define: (i) Stress (ii) Strain (iii) Torque. (09)

(c) An aluminium shaft with a constant diameter of 50 mm is loaded by torques applied to gears attached to it as shown in Fig Q8(c). Using G = 28 GPa, determine the relative angle of twist of gear D relative to A. [N.B.: All gears are same diameter.] (12)

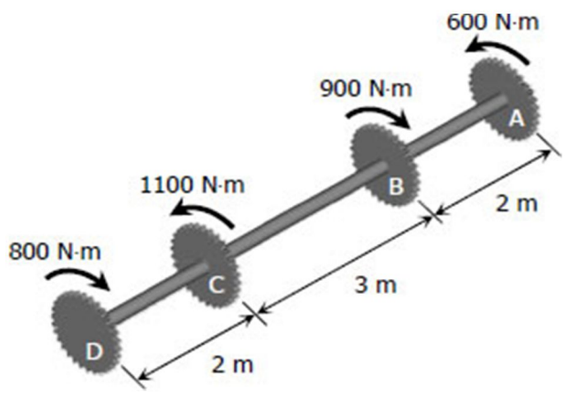

Figure for Q8(c)

Khulna University of Engineering & Technology
B. Sc. Engineering 1st Year 2nd Term (Regular) Examination, 2018
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) Discuss the procedure for finding Miller indices. (04)

(b) For FCC structure find (i) atomic radius, (ii) number of atom per unit cell, (iii) volume of the atom in unit cell, (iv) volume of unit cell, and (v) packing fraction. (12)

(c) Show that for a cubic lattice the interplaner distance between a set of (hkl) plane is given by $d_{hkl} = \frac{a}{\sqrt{h^2+k^2+l^2}}$. (09)

(d) Calculate the packing efficiency and density of sodium chloride from the following data: Radius of sodium ion $= 0.98A^0$; Radius of chloride ion $= 1.81A^0$; Atomic mass of sodium = 22.99 amu; and Atomic mass of chlorine = 35.45 amu. (10)

Q2. (a) What is lattice vibration? Derive the dispersion relation for the vibration of one dimensional monoatomic linear lattice and discuss phase velocity, group velocity at low, high and maximum efficiency. (25)

(b) The ratio of axial units of a certain orthorhombic crystal is $a:b:c = 0.424:1:0.367$. Find the Miller indices of the crystal faces whose intercepts are (i) 0.212:1:0.183, (ii) 0.848:1:0.732 and (iii) 0.424:∞:0.123. (10)

Q3. (a) Write down the basic postulates of classical free electron theory. Also discuss the drawbacks of this theory. (10)

(b) Starting with the explanation of Hall effect, show that the Hall coefficient, $R_H = -\frac{1}{ne}$. Also discuss the importance of Hall effect. (12)

(c) Starting from the vibrational energy derive the expressions for Debye specific heat of a solid at low and high temperatures. (13)

Q4. (a) Discuss spontaneous emission and stimulated emission. (10)

(b) Show that two levels LASER system is not suitable for optical pumping. (13)

(c) With the suitable diagram explain how the laser action can occur in Ruby LASER. (12)

Section B

Q5. (a) Discuss inertial and non-inertial reference frame. (06)

(b) Discuss Galilean transformation and show that the first postulate of relativity could not satisfy on the basis of this transformation. (07)

(c) Show that the relativistic formula of $k.E.$ is $E_k = mc^2 - m_oc^2$, where $mc^2 = E$ is total energy of the particle and m_oc^2 its rest energy. Hence find the Einstein's mass energy relation. (12)

(d) The total energy of a particle is exactly twice its rest energy. Calculate its speed. (10)

Q6. (a) What is de-Broglie wave? Explain in brief. (05)

(b) For a fixed frequency and intensity of incident light, Generally represent the variation of the photoelectric current with respect to the applied potential. Hence define the saturation current and the stopping or cut-off potential. (10)

(c) State and derive the Bragg's law for X-ray diffraction in crystals. (10)

(d) Calculate the de-Broglie wavelength of the following : (10)

(i) A smoke particle of mass 10^{-9} gm moving at 1 cm/s.

(ii) An electron with a kinetic energy of 1 eV.

Q7 (a) Define the term "magnetic total angular momentum quantum number". If $l = 2, j = \frac{5}{2}$ Hence draw the permitted orientations of j vector with the field direction B. (06)

(b) Draw the energy level diagram of hydrogen atom and show when the spectral series of hydrogen atom are found (in that diagram). (06)

(c) Show that the radius of the n^{th} permissible orbit for hydrogen is proportion to the square of the principle quantum number. (13)

(d) Calculate for H_2 atom (i) velocity of electron in the ground state, (ii) radius of Bohr's orbit in the ground state, (iii) time taken by the electron to traverse the Bohr'first orbit and Rydberg's constant. (10)

Q8 (a) Define the following terms: (06)

(i) Binding energy of the nucleus

(ii) Chain reaction.

(b) Discuss secular equilibrium and transient equilibrium. (08)

(c) Discuss the properties of α, β and γ rays. (12)

(d) A certain radioactive substance has a disintegration constant of 1.44×10^{-3} per hour. In what time will 75% of the initial number of atoms disintegrate? (09)