Khulna University of Engineering & Technology
B. Sc. Engineering 1st year 2nd Term (Regular) Examination, 2017
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 law of demand. Why the demand curve slopes downward? Explain. (10)

(b) How does technology and government policy affect the supply of any goods or services? (05)

(c) If there are 10,000 identical individuals in the market for commodity X, each with a demand function is given by $Q_{dx} = 12 - 2P_x$ and 1000 identical procedures of X, each with a supply function is given by $Q_{sx} = 20P_x$. (20)

    (i) Find the market demand equation and market supply equation.

    (ii) 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-

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

    (iv) Who actually pays the tax?

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

Q2. (a) Explain the idea of price-elasticity of demand, income elasticity of demand and cross price elasticity of demand. (15)

(b) The "Nabarun corporation" is a publisher of romance novels. The corporation hired an economist to determine the demand for its product. After months of hard work the economist informed that the demand for the firm's novel is given by the following equation: (20)

$Q_x = 12000 - 5000P_x + 5I + 500P_c$

where, Q_x is the demand for the firm's novel, P_x is the price charged for the novel, I is the income per capita, P_c is the price of books from competing publishers. Assume that the initial values of P_x, I and P_c are $5, $10,000 and $6, respectively. Using the above information, the company's manager wants to

    (i) determine the effect of price increase would have on total revenue.

    (ii) Evaluate how sale of the novel would change during a period of rising income.

    (iii) Assess the probable impact if competing publishers raise their prices.

Q3. (a) Define market. Write down the forms of market. (10)

(b) Define short-run. For a given price, explain how the perfect competitive firm chooses the level of output that maximizes profit. (15)

(c) Explain the short-down position in the short-run under perfect competition. (10)

Q4. (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 scale? (10)

Section B

Q5. (a) What is basic accounting equation? What are the elements of accounting equation? (05)

(b) Mr. Saiful established Sundarbon Travel Agency. The following transactions were completed during the month of January 2015: (30)

2015

January 1 Invested Tk 80,000 cash and Tk 20,000 equipment to start the agency.

January 2 Paid Tk 4000 cash for January office rent.

January 3 Purchased office equipment for Tk 5000 cash.

January 4 Incurred Tk 3000 of advertising costs in the Daily Ittefaq on account.

January 5 Paid Tk 6000 cash for office supplies.

January 6 Earned Tk 75000 for service rendered: Tk 10,000 cash is received from customers and the balance of Tk 65,000 is billed to customers on account.

January 7 Withdraw Tk 2000 cash for personal use.

January 8 Paid Daily Ittefaq amount due in transaction (January 4).

January 9 Paid employees' salaries Tk 22000 in cash.

January 10 Received Tk 50,000 in cash from customers who have previously been billed in transaction (January 6).

January 11 Service provided on account Tk 6000.

January 12 Utility bill received but not yet paid Tk 500.

Instructions: Prepare a tabular summary of the transactions, using the following column headings:

Cash, Accounts Receivable, Supplies, Office equipment, Accounts payable and Mr. Saiful's, Capital.

Q6. (a) What is accounting process/cycle? What are the steps of accounting cycle? (05)

(b) Bina is a licensed CPA. During the first month of operation of her business, the following events and transactions occurred: (30)

2015

January 1 Bina invested Tk 1, 60,000 cash.

January 3 Hired a secretary-receptionist at a salary of Tk 12,000 per month.

January 4 Purchased Tk 3000 of supplies on account from Excellent Supply Company on account.

January 8 Paid office rent of Tk 4,800 cash for the month.

January 12 Completed a tax assignment and billed client Tk 8000 for service rendered.

January 13 Received Tk 7000 advance on a management consulting engagement.

January 18 Received cash of Tk 5,400 for service completed.

January 30 Paid secretary-receptionist Tk 12000 salary for the month.

January 31 Paid cash to Excellent Supply Company transaction (January 4).

Required: Prepare necessary ledger accounts.

Q7. (a) What is trial balance? What are the limitations of trial balance? (05)

(b) What is adjustment entry? Discuss the importance of adjusting entries. (10)

(c) From the following ledger balances of Sumon Traders, prepare a Trial Balance as on 31st December, 2016: (20)

Cash ------------------ Tk 20,500   Service Revenue -------------------- Tk 70,000

Land ------------------ Tk 70,000   Salaries expense -------------------- Tk 19,000

Building --------------- Tk 82,000   Prepared Insurance ---------------- Tk 2000

Accumulated depreciation-building -- Tk14,000

Office expense ------- Tk 2000   Accounts payable -------------------- Tk 33,000

Interest expense ------Tk 500   Capital ------------------------------- Tk 80,000

Electricity expense ---Tk 1000

Q8.   The following trial balance related to Green Trading House is a 31st December,   (35)
2015:

Green Trading House
Trial Balance as on December 31, 2015

Account Titles	Debit (Taka)	Credit (Taka)
Sales		1,80,000
Sales returns	5000	
Purchase	95,000	
Transportation-in	4000	
Stock 1-1-2015	10,000	
Wages	20,000	
Administrative expenses	25,000	
Insurance	3000	
Selling and distribution expense	10,000	
Purchase return		2,500
Drawings	10,000	
Capital		1,50,000
Land	1,20,000	
Equipment	20,000	
Accounts Receivable	15,000	
Account payable		10,000
Cash	7000	
Allowance for baddebts		1500
	3,44,000	3,44,000

Adjustments:
   (i)   Ending stock is estimated to have cost Tk 8000.
   (ii)   Equipment is to be depreciated by Tk 4000.
   (iii)   Administrative expenses Tk 2000 is unpaid.
   (iv)   Raise the allowance for baddebts to Tk 3,500.
Required:
   (a) Prepare a statement of comprehensive income for the period ended December 31, 2015.
   (b) Prepare owner's equity statement; and
   (c) 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, 2017
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) Define ordinary differential equation with example. Find the differential (10) equation, whose solution is $y = Ae^{2x} + Be^x + C$, where A, B, C are arbitrary constants.

(b) Solve the following initial value problem: (12)
$(2x \cos y + 3x^2 y)dx + (x^3 - x^2 \sin y - y)dy = 0, \; y(0) = 2.$

(c) A RC circuit has an emf 5 volts, a resistance of 50 ohms, an inductance of (13) 1 Henry, and no initial current. Form a differential equation for this circuit and find the current in the circuit at any time t and its steady-state component.

Q2. (a) A RCL circuit connected in series with a resistance of 4 ohms, a capacitor of (15) $\frac{1}{26}$ farad, and an inductance of $\frac{1}{2}$ Henry and has an applied voltage $E(t) = 16 \cos 2t$. Assuming no initial current and no initial charge on the capacitor, find an expression for the current flowing through the circuit at any time t by forming the differential equation.

(b) Identify all the properties of the differential equation: (10)
$(3x^2 + 4xy)dx + (2x^2 + 2y)dy = 0$, and solve it.

(c) Determine the general solution of the differential equation: (10)
$(x^2 - 3y^2)dx + 2xydy = 0$

Q3. (a) Write down the first order liner equation in standard form. Identify and solve (10) the following differential equation:
$\frac{dr}{d\theta} + r \tan \theta = \cos^2 \theta, r\left(\frac{\pi}{4}\right) = 1.$

(b) Find the general solution of (10)
$y' + y = xy^3.$

(c) Identify all the properties and solve the following differential equation: (15)
$x^2 y'' + 4xy' + 2y = 4 \ln x, \; x > 0$

Q4.   Find the general solution of the following differential equation: (35)

(a) $\frac{d^2 y}{dx^2} - y = \frac{2}{1 + e^x}$

(b) $\frac{d^2 y}{dx^2} - 3\frac{dy}{dx} - 4y = 16x - 12e^{2x}$

(c) $\frac{d^2 y}{dx^2} - 2\frac{dy}{dx} + 3y = e^x \sin x$

Section B

Q5. Evaluate any three of the followings: (35)

(a) $\int \sqrt{\dfrac{2x+1}{3x+2}}\ dx$

(b) $\int \sin^{-1}\left(\sqrt{\dfrac{x}{3+x}}\right) dx$

(c) $\int \dfrac{dx}{x^{\frac{1}{3}}(1-x)^{\frac{8}{3}}}$

(d) $\int \dfrac{d\theta}{5-13\sin\theta}$

Q6. Determine any three of the followings: (35)

(a) $\displaystyle\int_{\alpha}^{\beta} \sqrt{(x-\alpha)(\beta-x)}\ dx$

(b) $\displaystyle\int_{0}^{1} \dfrac{dx}{(x+1)\sqrt{1+2x-x^2}}$

(c) $\displaystyle\int_{0}^{\pi} x\log\sin x\ dx$

(d) $\displaystyle\int_{0}^{\frac{\pi}{2}} \dfrac{\sin^2 x\ dx}{1+\sin x\ \cos x}$

Q7. (a) Evaluate (11)

$$\underset{n\to\infty}{\text{Lt}}\left[(1+\dfrac{1}{n^2})^{\frac{2}{n^2}}\ (1+\dfrac{2^2}{n^2})^{\frac{4}{n^2}}\cdots\cdots\cdots\cdots\cdots (1+\dfrac{n^2}{n^2})^{\frac{2n}{n^2}}\right]$$

(b) Define Beta and Gamma functions. Establish the relation between Beta and (14) Gamma functions.

(c) Obtain a reduction formula for $\int \tan^n x\ dx$ and hence find $\int \tan^6 x\ dx$ (10)

Q8. (a) Find the common area bounded by the curves $y^2 = 4ax$ and $x^2 = 4ay$. (12)

(b) Find the perimeter bounded by the curve $(\dfrac{x}{a})^{\frac{2}{3}} + (\dfrac{y}{a})^{\frac{2}{3}} = 1$ (12)

(c) Determine the volume of the solid generated by the revolution about the x-axis (11) of the loop of the curve $2ay^2 = x(x-a)^2$.

Khulna University of Engineering & Technology

B. Sc. Engineering 1ˢᵗ year 2ⁿᵈ Term (Regular) Examination, 2017

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) Figures in the right margin indicate full marks.
  (iii) Assume reasonable data if any missing.
  (iv) Steam table may be supplied on request.

Section A

Q1. (a) What is meant by sources of energy? Describe briefly about the conversion of solar energy to electrical energy. (10)

  (b) Briefly describe the electrical energy situation in Bangladesh. (07)

  (c) Define the terms: (i) Dryness fraction, (ii) Enthalpy of steam, and (iii) Entropy of steam. (06)

  (d) Draw and explain the temperature-total heat graph during steam formation. (12)

Q2. (a) What is meant by steam generator? Differentiate between steam generator mountings and accessories. (07)

  (b) Describe with neat diagram, the constructions and working principles of Babcock and Wilcox Boilers. (12)

  (c) A coal fired boiler plant consumes 500 kg of coal per hour. The boiler evaporates 4000 kg of water at 48° C into superheated steam at a pressure of 14 bar and 285° C. If the calorific value of fuel is 32600 kJ/kg of coal, determine: (i) Equivalent evaporation "from and at 100° C," and (ii) Thermal efficiency of the boiler. (16)

Q3. (a) What is meant by heat engine? How would you classify the heat engine? (12)

  (b) Briefly explain the actual indicator diagram for a four stroke cycle petrol engine with the necessary diagram. (06)

  (c) What is detonation in IC engines? Which factors causes detonation? (07)

  (d) Describe with neat diagram, the working principle of a 4-stroke cycle diesel engine. (10)

Q4. (a) What is the difference between Gas turbine and Steam turbine? (07)

  (b) Draw a combined cycle power plant, with brief description. (10)

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

  (d) Define internal energy? Using the 1ˢᵗ law of thermodynamics derive the expression for non-flow energy equation. (10)

Section B

Q5. (a) What is meant by refrigeration and air conditioning? (05)

  (b) Define the terms: (i) Refrigerator, (ii) Coefficient of performance, (iii) Tonne of refrigeration and (iv) Heat pump. (12)

  (c) Explain the working principle of a vapour compression refrigeration system with the schematic diagram. (12)

  (d) State the properties of a good refrigerant. (06)

Q6. (a) What is meant by human comfort? Write down the factor affecting the human comfort. (07)

(b) Briefly describe the working principle of winter air conditioning system with neat sketch. (14)

(c) What is meant by air standard cycle? Draw the following cycle on p-v and T-s planes indicating each process (14)
(i) Carnot cycle (ii) Brayton cycle (iii) Duel cycle and (iv) Ericsson cycle.

Q7. (a) Define 'stress', 'strain' and 'torsion'. (05)

(b) Compute the sharing stress in the pin at B for the member supports as shown in Fig. Q7 (b). The pin diameter is 20 mm. (13)
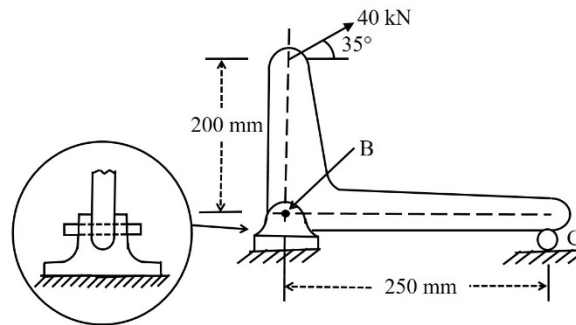

Fig. Q7 (a)

(c) The rigid bars AB and CD shown are supported by pins at A and C and the two rods. Determine the maximum force P that can be applied as shown in Fig. Q7 (c), it its vertical movement is limited by 5 mm. Neglect the weights of all members. (17)
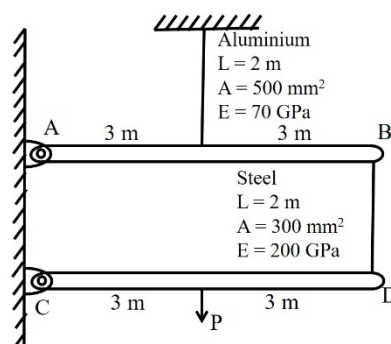

Fig. Q7 (b)

Q8. (a) A rigid bar with negligible mass is pinned at O and attached to two vertical rods as shown in Fig. Q8 (a). Assuming that the rods were initially stress-free, what maximum load P can be applied without exceeding stress of 160 MPa in the steel rod and 75 MPa in the bronze rod. (18)
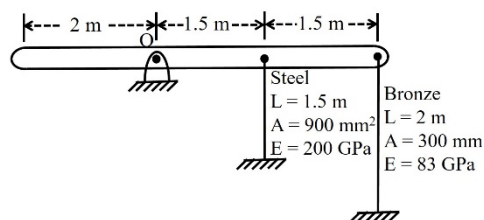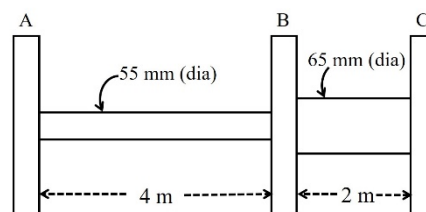

Fig. Q8 (a)   Fig. Q8 (b)

(b) The steel shaft shown in Fig. Q8 (b) above rotates at 4 Hz with 35 kW taken off at A. 20 kW removed at B and 55 kW applied at C. Using $G = 83$ GPa, find the maximum shearing stress and the angle of rotation of gear A relative to gear C. (17)

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B. Sc. Engineering 1st year 2nd Term (Regular) Examination, 2017
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.
    (ii) Assume reasonable data if any missing.

Section A

Q1. (a) What does it mean to say that two spacetime events are "space-like separated"? "time-like separated"? and "light-like separated"? (10)

(b) What are the postulates of special theory of relativity? Develop relations for relativistic momentum and energy. (15)

(c) A man has a mass of 100 kg on the earth. When he is in the space-craft, an observer from the earth registers his mass as 101 kg. Determine the speed of the space-craft. (10)

Q2. (a) How did Einstein's photoelectric equation explain the effect of intensity and potential on photoelectric current? How did this equation account for the effect of frequency of incident light on stopping potential. (10)

(b) What is Compton effect ? Explain and derive an expression for Compton shift on the basis of quantum theory. Discuss the results. (15)

(c) The photoelectric threshold wavelength of silver is 2768 $\overset{\circ}{A}$. Calculate (i) maximum kinetic energy of the ejected electrons, (ii) the maximum velocity of the electrons and (iii) the stopping potential in volts for the electrons, when the silver surface is illuminated with ultraviolet light of wavelengths 2000 $\overset{\circ}{A}$. (10)

Q3. (a) Why was a change in the Bohr Model of atom required? Due to which important development(s), concept of movement of an electron in an orbit was replaced by, the concept of probability of finding electron in an orbital? What is the name given to the changed model of atom? (10)

(b) Explain in a few sentences what is the difference between the phase velocity and group velocity? Using the concept of group velocity and phase velocity show that they are related by (15)

$$V_g = V_p - \frac{\lambda \, dV_p}{d\lambda}$$

(c) Compute the wavelength of the most energetic photons emitted by an X-ray tube operated at a steady potential of 80000 volts. At what glancing angle would these photons be reflected, in the first order from the 100 planes of sodium? (10)

Q4. (a) What is nuclear binding energy? Explain in terms of binding energy why very large nuclides undergo fission and very small nuclides undergo fusion. (10)

(b) Starting with the definition of radioactivity and law of radioactive disintegration, show that for a successive radioactive disintegration, the amount of daughter substance at instance t is given by (15)

$$N_2 = \frac{\lambda_1 N_1^{\,0}}{\lambda_2 - \lambda_1} \left[e^{-\lambda_1 t} - e^{-\lambda_2 t} \right]$$

(c) A carbon specimen found in a cave contained 1/8 as much as C^{14} as equal amount of carbon in living matter. Calculate the approximate age of the specimen Half-life of C^{14} is 5568 years. (10)

Section B

Q5. (a) Explain the concept of Miller indices. How the orientation of a plane is specified by Miller indices? State their important features. (15)

   (b) What do you mean by the closest distance of approach? Find these distances for bcc and fcc solids. (10)

   (c) In Bragg's Law setup, X-rays were diffracted by an fcc crystal (having lattice constant of 0.408 nm) at an angle $2\theta = 64.6972^o$ from the [220] planes. Find the wavelength of X-rays. (Assume first order diffraction) (10)

Q6. (a) Describe the propagation of elastic waves in one dimensional continuous, homogenous medium and hence, drive the dissipation relation. (10)

   (b) What are the assumptions of Einstein's theory of specific heat of solids? Drive the relation for lattice heat capacity following Einstein model. (15)

   (c) Compare the frequencies of sound waves of wavelength $\lambda = 10^{-7}$ cm for (i) homogeneous line (ii) acoustic waves on a linear lattice containing two identical atoms per primitive cell of inter-atomic spacing 2.6 Å and (iii) light waves of the same wavelength, given that $v_o = 10^5$ cm/sec. (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) Using the free electron model and denoting the electron concentration by n, show that the radius of the Fermi sphere K-space is given by $K_F = (3\pi^2 n)^{\frac{1}{3}}$ and hence, prove the density of states of the free electron is given by (13)

   $$D(E) = \frac{V}{2\pi^2}\left(\frac{2m}{\hbar^2}\right)^{3/2} E^{\frac{1}{2}}$$

   (c) The inner collision time in copper 2.45×10^{-14} s. Calculate its thermal conductivity at 310 K. (10)

Q8. (a) What is a LASER? Give the brief outlines of the form of input energy of a LASER. Mention the characteristics of LASER light. (15)

   (b) What is population inversion? How can it be achieved? Explain the working principle of a He-Ne LASER with necessary diagram. (10)

   (c) A LASER beam has a power of 125 mW. It has an aperture of 5.3×10^{-3} m and it emits light of wavelength 6865 Å. The beam is focused with a lens of focal length 0.12 m. Calculate the area and the intensity of the image. (10)