L-1/T-1/ME

Date : 06/12/2014

BANGLADESH UNIVERSITY OF ENGINEERING AND TECHNOLOGY, DHAKA

L-1/T-1 B. Sc. Engineering Examinations 2013-2014

Sub : **MATH 161** (Differential Calculus, Three Dimensional Coordinate Geometry and Vectors)

Full Marks : 280 Time : 3 Hours

The figures in the margin indicate full marks.

Symbols used have their usual meaning.

USE SEPARATE SCRIPTS FOR EACH SECTION

SECTION – A

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

1. (a) Discuss the continuity and differentiability of the function **(19⅔)**

$$f(x)=\begin{cases}5x-4, & 0<x\le 1\\ 4x^2-3x, & 1<x<2\\ 3x+4, & x\ge 2\end{cases}$$ at the points $x = 1$ and $x = 2$.

Also, sketch the graph of the function.

(b) Evaluate $\lim_{x\to 0}(x \ln \sin x)$. **(12)**

(c) Find the n-th derivative of $y = \sin^5 x \cos^4 x$. **(15)**

2. (a) State Leibnitz's theorem. If $y = x \cos(\ln x)$, then show that **(16⅔)**

$$x^2 y_{n+2} + (2n-1)x y_{n+1} + (n^2 - 2n + 2)y_n = 0.$$

(b) Expand the polynomial $2x^3 + 7x^2 + x - 1$ in power of $(x - 2)$. **(15)**

(c) Verify Cauchy's mean value theorem for the functions $f(x) = x^2 - 2x + 3$ and $g(x) = x^3 - 7x^2 + 26x - 5$ in the interval $[-1, 1]$. **(15)**

3. (a) Discuss the concavity and hence find the point of infection of $f(x) = x^3 - 3x^2 + x - 2$. **(16⅔)**

(b) A battery having fixed voltage V and fixed internal resistance r is connected to a circuit that has variable resistance R. If the power output P is given by $P = I^2R$, show that the maximum power occurs if $R = r$. **(15)**

(c) If $u = f(y - z, z - x, x - y)$, show that $\frac{\partial u}{\partial x}+\frac{\partial u}{\partial y}+\frac{\partial u}{\partial z}=0$. **(15)**

4. (a) Find the pedal equation of the parabola $y^2 = 4ax$ with respect to its focus. **(15)**

(b) Show that the radius of curvature at any point (x, y) of the curve $x^{2/3} + y^{2/3} = a^{2/3}$ is three times the perpendicular from the origin to the tangent at (x, y). **(16⅔)**

(c) Find all the asymptotes of the curve $x^3 + x^2y - xy^2 - y^3 - 3x - y - 1 = 0$. **(15)**

Contd P/2

MATH 161/ME

SECTION – B

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

5. (a) If l_1, m_1, n_1 and l_2, m_2, n_2 are the direction cosines of two mutually perpendicular straight lines, show that the direction cosines of the line perpendicular to both of them are $m_1n_2 - m_2n_1, n_1l_2 - n_2l_1, l_1m_2 - l_2m_1$. **(15)**

(b) A line makes angles $\alpha, \beta, \gamma, \delta$ with the diagonals of a cube. Prove that **(15)**

$$\cos^2\alpha + \cos^2\beta + \cos^2\gamma + \cos^2\delta = \frac{4}{3}.$$

(c) The axes are rectangular and a point P moves on the fixed plane $\frac{x}{a} + \frac{y}{b} + \frac{z}{c} = 1$. The plane through P perpendicular to OP meets the axes in A, B, C, where O is the origin. The plane through A, B, C parallel to the coordinate planes intersect in Q. Show that the locus of Q is $\frac{1}{x^2} + \frac{1}{y^2} + \frac{1}{z^2} = \frac{1}{ax} + \frac{1}{by} + \frac{1}{cz}$. **(16⅔)**

6. (a) Through the point P(–1, 1, 2) a line is drawn parallel to the line of intersection of the planes $x - 2y + z = 3$ and $x + 6y - 5z = 0$. This line cuts the plane $x - 3y + 2z = 2$ in Q. Find the equation of the line PQ and their coordinates. **(15)**

(b) Find the length and the equation of the shortest distance between the two lines **(16⅔)**

$$\frac{x-3}{2} = \frac{y+15}{-7} = \frac{z-9}{5} \text{ and } \frac{x+1}{2} = \frac{y-1}{1} = \frac{z-9}{-3}$$

(c) Find the equation of the straight line that intersects the lines $4x+y-10=0=y+2z+6$, $3x - 4y + 5z + 5 = 0 = x + 2y - 4z + 7$ and passes through the point (–1, 2, 2). **(15)**

7. (a) If $\mathbf{a} \times \mathbf{r} = \mathbf{b} + \lambda\mathbf{a}$ and $\mathbf{a} \cdot \mathbf{r} = 3$ where $\mathbf{a} = 2\mathbf{i} + \mathbf{j} - \mathbf{k}$ and $\mathbf{b} = -\mathbf{i} - 2\mathbf{j} + \mathbf{k}$, find $\mathbf{r}$ and λ. **(15)**

(b) A rigid body is rotating with an angular velocity $\frac{\pi}{4}$ radians per second about an axis which passes through a point (–1, 3, 2) having direction cosines proportional to (3, 2, 7). Find the linear velocity at the point (9, 11, –7) of the body. **(16⅔)**

(c) Show that the vectors $\mathbf{a} = 2\mathbf{i} + \mathbf{j} - 3\mathbf{k}$, $\mathbf{b} = \mathbf{i} - 4\mathbf{k}$, $\mathbf{c} = 4\mathbf{i} + 3\mathbf{j} - \mathbf{k}$ are linearly dependent. Determine a relation among them. **(15)**

8. (a) Show that $(\mathbf{a} \times \mathbf{b}) \times (\mathbf{c} \times \mathbf{d}) = [\mathbf{a}\ \mathbf{b}\ \mathbf{d}]\ \mathbf{c} - [\mathbf{a}\ \mathbf{b}\ \mathbf{c}]\ \mathbf{d}$. **(14)**

(b) Solve for $\mathbf{x}$ the vector equation $\mathbf{x} + \mathbf{x} \times \mathbf{a} = \mathbf{b}$. **(18⅔)**

(c) If the system of vectors $\mathbf{a}', \mathbf{b}', \mathbf{c}'$ are reciprocal to the system of vectors $\mathbf{a}, \mathbf{b}, \mathbf{c}$ respectively, then prove that $[\mathbf{a}'\ \mathbf{b}'\ \mathbf{c}'] = \frac{1}{[\mathbf{a}\ \mathbf{b}\ \mathbf{c}]}$. **(14)**

L-1/T-1/ME Date : 11/12/2014

BANGLADESH UNIVERSITY OF ENGINEERING AND TECHNOLOGY, DHAKA

L-1/T-1 B. Sc. Engineering Examinations 2013-2014

Sub : **PHY 105** (Structure of Matter, Electricity and Magnetism and Modern Physics)

Full Marks : 210 Time : 3 Hours

The figures in the margin indicate full marks.

USE SEPARATE SCRIPTS FOR EACH SECTION

SECTION – A

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

1. (a) Define Coulomb force, gravitational force and the Nuclear force. Calculate the Coulomb force and gravitation force between two protons in a nucleus assuming that the two protons are separated from each other by a distance of 4.0×10^{-15} m. **(10)**

(b) Fig. 1(b) shows an electron of mass m and charge e projected with speed V_0 at right angles to a uniform electric field E. Derive an equation to describe the electron trajectory. **(15)**

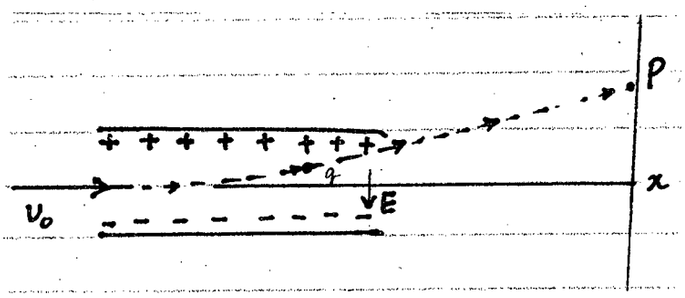

Fig. 1(b)

(c) The electric field between the plates of a cathode-ray oscilloscope (Fig. 1(b)) is 1.2×10^4 nt/coul. What deflection will an electron experience if it enters at right angles to the field with a kinetic energy of 2000 eV. The deflecting assembly is 1.5 cm long. [$\epsilon = 8.85 \times 10^{-12}$ fm^{-1}] **(10)**

2. (a) Discuss Gauss's law in electrostatics. Apply Gauss's law to obtain an electric field E created by a line of +ve charges with linear charge density λ at a distance y from the line of charge. Write down an identical equation for the magnetic field B developed at the same point due to a current *i* flowing through a conductor having similar geometry. **(10)**

(b) Define electric potential V. Fig. 2(b) below shows a charged disk of radius 'a' and of surface charge density 'σ'. **(15)**

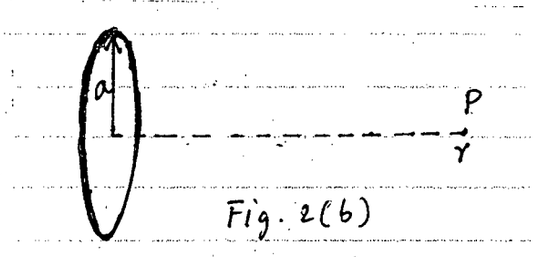

Fig. 2(b)

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PHY 105 (ME)

Contd .... No. 2(b)

Find the electric potential V for points on the axis of the disk and at a distance r from the center of the disk. Show that the disk behaves like a point charge for r >> a.

(c) The charged disk in Fig. 2(b) has a radius a = 3.50 cm and the potential at the center of the disk V_0 = 550 V. **(10)**

(i) What is the total charge q on the disk?

(ii) What is the potential at point P which is at a distance r = 5a?

3. (a) Define capacitance. Discuss how capacitance of a capacitor can be compared to a container of gas having volume V and pressure P, temperature T, which gas law does the capacitance corresponds to? **(10)**

(b) A cylindrical capacitor (Fig. 3(b)) consists of two coaxial cylinders of radius 'a' and 'b' and length *l*. Obtain an expression for the capacitance C of this capacitor (assume *l* >>b). Show that the capacitance of such a capacitor depends only on the geometry of this device. **(15)**

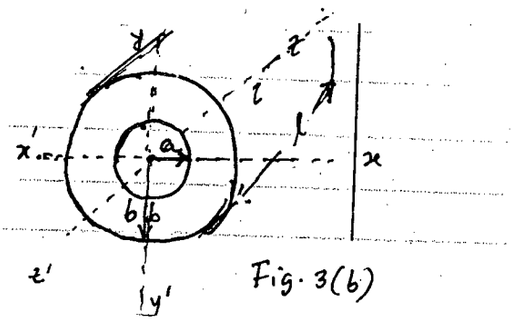

Fig. 3(b)

(c) A beam of 16 MeV deuterons from a cyclotron falls on a copper block. The beam is equivalent to a current of 15×10^{-6} A. **(10)**

(i) At what rate do deuterons strike the copper block?

(ii) At what rate is heat produced in the block? [1 MeV = 10^6 eV]

4. (a) Describe NaCl structure. How does it differ from a standard face centered cubic structure? **(9)**

(b) Write down the relation between Miller indices and interplanar spacing for a cubic crystal. Prove that the ratio $d_{100} : d_{110} : d_{111}$ of simple cubic, body centered cubic and face centered cubic crystal structures are not the same. **(18)**

(c) In an orthorhombic crystal, consider a plane which is parallel to z-axis and cuts the intercepts 5a and 7b along the x and y axes respectively. Find out the Miller indices of the plane and also draw the plane. **(8)**

Contd P/3

PHY 105 (ME)

SECTION – B

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

5. (a) Derive Bragg's law of X-ray diffraction. **(15)**

   (b) Monochromatic X-ray beams are incident on a plane of a crystal and second order reflection is observed for the angle 24° 32′. Find out the interplanar spacing between the planes in this case. $\lambda = 2.82\ A^{\circ}$ **(5)**

   (c) Distinguish between metal, semiconductor and insulator in the light of band theory of solids. **(15)**

6. (a) Define cohesive energy. Calculate the cohesive energy per atom of a NaBr crystal in which the equilibrium separation between Na^{+} and Br^{-} is 2.50 Å. (Ionization energy of Na is 5.14 eV, electron affinity of Br is 3.36 eV, Madelung constant is 1.75 and n = 8). **(15)**

   (b) Discuss briefly point defects and plane defects in crystals. **(20)**

7. (a) What do you mean by Doppler Effect in light? Find the expression of observed frequency of light in the case of longitudinal Doppler Effect. **(20)**

   (b) The relativistic equation for the kinetic energy is $k = mc^2 - m_0c^2$, where the terms have their usual meanings. Find the kinetic energy of the body when it is moving with a very low speed i.e., $v/c << 1$. **(7)**

   (c) Two electrons emit from a radioactive sample in the same direction, having speeds of 0.5 c and 0.7 c with respect to the sample. What is the speed of the slow electron relative to the fast electron? Explain the result. **(8)**

8. (a) Show that the expression for wavelength shift of a photon undergoing Compton scattering is, $\lambda' - \lambda = \frac{h}{m_0 c}(1 - \cos\phi)$, where the terms have their usual meanings. What is Compton wavelength? Calculate its value. **(20)**

   (b) What are the failures of classical wave theory about photoelectric effect? **(7)**

   (c) Estimate the age of earth from the relative abundance of two isotopes of uranium, U^{235} and U^{238}. Given that half life of U^{235} is 7.07×10^8 years and half life of U^{238} is 4.5×10^9 years. **(8)**

Ratio : 99.3 % U^{238}

0.7 % U^{235}

~~ME~~ CE 307
2+3

L-1/T-1/ME Date : 03/01/2015

BANGLADESH UNIVERSITY OF ENGINEERING AND TECHNOLOGY, DHAKA

L-1/T-1 B. Sc. Engineering Examinations 2013-2014

Sub : **ME 161** (Introduction to Mechanical Engineering)

Full Marks : 210 Time : 3 Hours

The figures in the margin indicate full marks.

USE SEPARATE SCRIPTS FOR EACH SECTION

SECTION – A

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

Psychrometric chart (SI unit) for normal temperature for Q. No. 4(b) is attached.

1. (a) What are the native sources of energy? For what main purpose, these energy sources are used in Bangladesh? How fossil fuels are formed and how they are related to the sun's energy? **(10)**

   (b) How nuclear energy is available from radioactive materials? Give an example of a fission reaction. With a schematic diagram, show the main components of a nuclear power plant. **(10)**

   (c) What is wind energy? Express available wind power 'P' with its unit, in terms of 'ρ', 'A' and 'V' where, ρ = density of air, A = Area through which air is blowing and V = wind velocity (assign suitable units for each parameter). **(7)**

   (d) Draw the following: (i) schematic diagram of PV cell connected to variable resistance, with ammeter and voltmeter. (ii) I-V characteristics of a typical silicon PV cell showing I_{SC}, V_{OC} and P_{max}. **(4×2=8)**

2. (a) Draw the actual value timing diagram for a 4 stroke cycle petrol engine with minimum and maximum limits of crank angles for valve operation. In this diagram show the valve overlap and mention its maximum and minimum values. **(15)**

   (b) Draw and label with circuit diagram for a coil ignition system for a 4-stroke 4-cylinder SI engine. **(10)**

   (c) What is the difference between the magneto ignition system and the coil ignition system? Draw and label only the portion which is different from the coil ignition system. **(10)**

3. (a) With a neat sketch, show how valves of an IC Engine operates. Mention the component parts involved in sequence from 'crank' to 'valve'. **(15)**

   (b) In a 2-stroke cycle petrol engine, the exhaust port remains uncovered for sometime when air-fuel mixture is forced inside the cylinder through the other part, then how the fresh air-fuel mixture is prevented from escaping out? **(10)**

   (c) A 150 cc internal combustion engine has its stroke equal to its bore. Calculate the crank radius of the engine. If the clearance volume is 25 cc, determine its compression ratio. From the result of this compression ratio, determine whether it is a petrol or a diesel engine. **(10)**

Contd P/2

ME 161

4. (a) What are the 4 basic components of a vapour compression refrigeration cycle? Show the cycle in a schematic diagram. Corresponding to this schematic diagram, show the 4 processes of ideal vapour compression cycle in T-s and P-h diagrams. **(10)**

   (b) Using the psychrometric chart, determine the 5 properties of air with their corresponding units, inside a conditioned room. For the same room condition, the wet bulb temperature and density of air were found respectively as 19.5 °C and 1.111 kg/m^3. **(15)**

   (c) What are the main items of cooling load calculation for a space to be air conditioned? With a neat sketch show various types of heat gains in a space from internal and external sources, dividing them in two groups (sensible and latent). **(10)**

SECTION – B

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

5. (a) What do you understand by 'compounding' of a steam turbine? Explain the 'pressure compounding' of an impulse turbine and show with the help of a neat sketch, the arrangement of nozzle and blades and the variation of pressure and velocity across the different stages for an impulse turbine having four stages of constant turbine cross-section. **(15)**

   (b) What are the different components of forces by which a reaction turbine is moved? Briefly explain the functions of rotor, gland and diaphragm of a steam turbine. **(10)**

   (c) With a neat sketch, briefly explain the nozzle controlled governing of a steam turbine. **(10)**

6. (a) What do you understand by the capacity and efficiency of a boiler? **(5)**

   (b) Write down the merits and demerits of water tube boilers over the tube boilers. **(8)**

   (c) What are the advantages of the dome shape of the furnace and hemispherical shape of the top of the shell in a Cochran boiler? **(5)**

   (d) Show the construction of a Babcock and Wilcox boiler with a simple sketch and describe the flow of flue gas and the circulation of water in this boiler. **(17)**

7. (a) Compare rotodynamic pumps with positive displacement pumps. **(5)**

   (b) What do you understand by priming of a centrifugal pump? What can be done to ensure that a centrifugal pump remains primed? **(10)**

   (c) With the help of a neat sketch, explain the principle of operation of a centrifugal pump. **(12)**

   (d) What is cavitation? How does it occur in a centrifugal pump? **(8)**

8. (a) Write down the advantages and disadvantages of gas turbines over stream turbines. **(8)**

   (b) Show air standard Otto and Diesel cycles on separate p-v and T-s diagrams. Write down the names of all four processes involved in both these cycles. **(15)**

   (c) Sketch the flow diagram and T-s diagram of a gas turbine plant having two-stage compression with intercooling and two-stage expansion with reheating and regeneration. **(12)**

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(3)

Carrier

PSYCHROMETRIC CHART

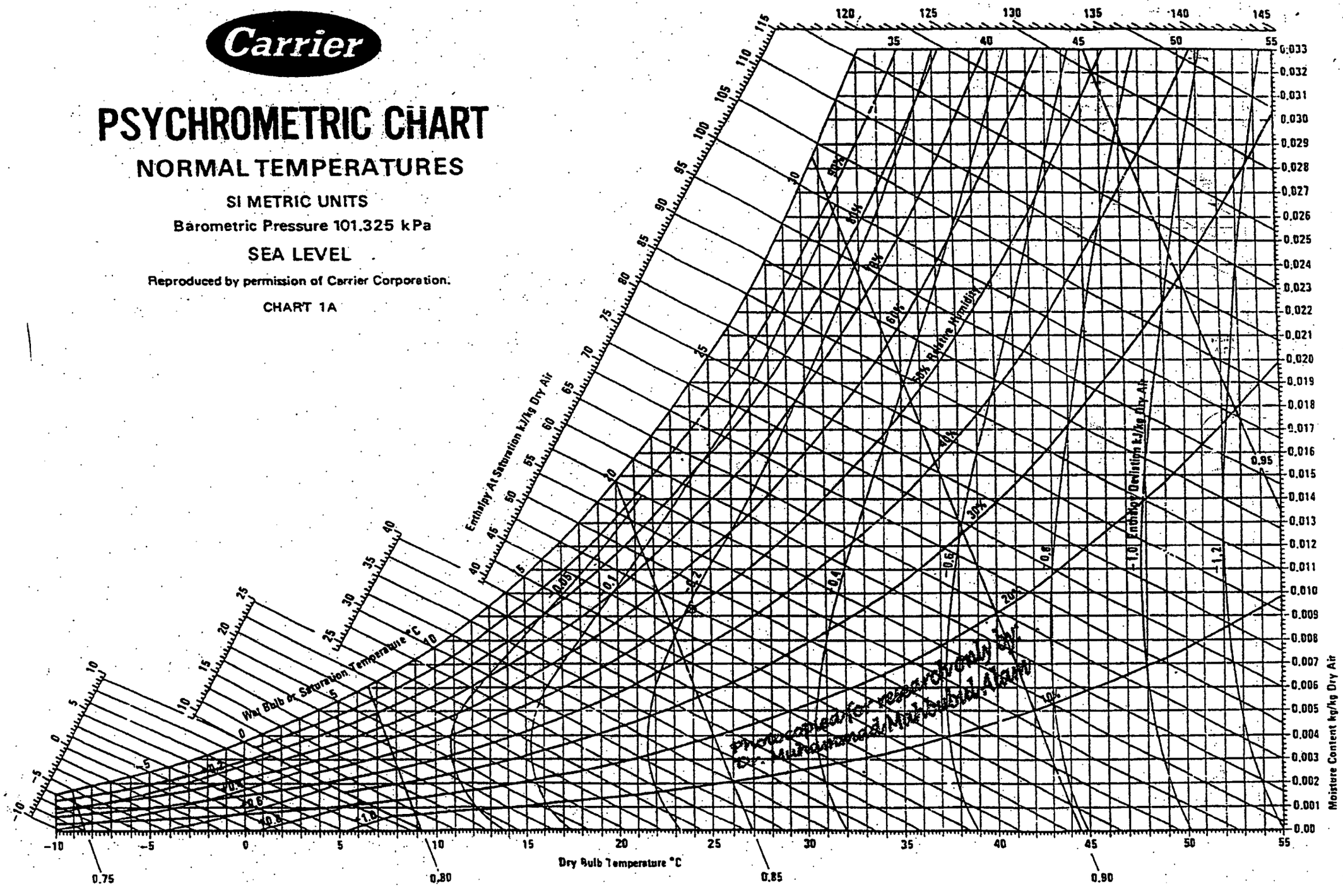
NORMAL TEMPERATURES

SI METRIC UNITS

Barometric Pressure 101.325 kPa

SEA LEVEL

CHART 1A



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L-1/T-1/ME Date : 08/01/2015

BANGLADESH UNIVERSITY OF ENGINEERING AND TECHNOLOGY, DHAKA

L-1/T-1 B. Sc. Engineering Examinations 2013-2014

Sub : **CHEM 109** (Chemistry I)

Full Marks : 210 Time : 3 Hours

The figures in the margin indicate full marks.

USE SEPARATE SCRIPTS FOR EACH SECTION

SECTION – A

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

1. (a) Derive the kinetic equation for a consecutive reaction. Draw the concentration vs time profile reaction if any. **(12)**

   (b) Prove that a second order reaction $2A \rightarrow P$ has half life which is inversely proportional to the initial concentration. Derive the kinetic equation. **(13)**

   (c) How can you determine the order of a reaction by integral and isolation method? **(5+5)**

2. (a) The relationship between equilibrium constant and temperature is exponential – Prove through derivation of a mathematical equation. **(12)**

   (b) What are the significance of the relationship $\Delta G^{o} = -RT \ln K$? **(6)**

   (c) How does change of pressure and presence of a catalyst effect "K" of a reaction? **(8)**

   (d) 35%, PCl_5 is dissociated at 373 K. If the total pressure is 1.5 atm, find out the values of K_P and K_C. **(9)**

3. (a) Define heat of neutralization and heat of solution. Give the classification of heat of solution. **(6+2)**

   (b) Derive the mathematical model showing the relationship between heat of reaction and temperature at constant volume and pressure. **(10)**

   (c) What is Gibb's phase rule? Define the terms involved there in with suitable examples and derive phase rule. **(10)**

   (d) State and explain distribution law. Show by calculating that the multiple stage extraction is more efficient than single stage extraction. **(7)**

4. (a) What are Colligative Properties? Why are they so called? Discuss with suitable examples. **(5)**

   (b) Define freezing point with respect to vapour pressure. Derive a mathematical relation which expresses the relation between depression of freezing point of a solution and the molecular weight of the solute. What is meant by Cryoscopic constant? **(12)**

   (c) The freezing point of benzene is 5.4 °C and that of a solution containing 2.0 g of solute per 100 g of benzene is 4.40 °C. Calculate the molecular weight of solute. The molal depression constant is 5. **(10)**

   (d) Define osmotic pressure. State and explain laws of osmotic pressure. **(8)**

Contd P/2

CHEM 109 (ME)

SECTION – B

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

5. (a) What are the postulates of Bohr atomic model? Based on the postulates, deduce the equation for the calculation of total energy of an electron in its orbit. Discuss how the spectral lines can be justified with the help of Bohr atomic theory. **(15)**

   (b) Deduce de-Broglie's equation. What does it describe? Discuss with suitable examples, the applicability of the equation in case of bigger particle and smaller particle like electron. **(12)**

   (c) Write a note on blackbody radiation. **(8)**

6. (a) Nitrogen molecule has three bonds due to the sharing of three pairs of electron between the two nitrogen atoms. Explain why one of the bonds is more stronger than the other two. **(10)**

   (b) With the help of potential energy diagram discuss how a combination occurs between two atoms and the molecule becomes stable. **(10)**

   (c) What are donor and acceptor atoms? Explain bond formation in OCl^-, O_2Cl^-, O_3Cl^- and OCl_4^- ions. Name the ions. **(8)**

   (d) Discuss the chemical properties of noble gas elements. **(7)**

7. (a) According to molecular orbital theory explain the formation of O_2^+, F_2, H_2^+ and He_2^+ and comment on their magnetic properties. **(12)**

   (b) Define acids and bases according to Arrhenius, Protonic and Lewis theory. Cite suitable examples in each case. Discuss the advantages and disadvantages of one theory over another. **(10)**

   (c) Discuss how relative strength of acids/bases is determined. **(7)**

   (d) Discuss the principle of LASER production. **(6)**

8. (a) With respect to equilibrium point of view define (i) saturated solution, (ii) unsaturated solution and (iii) super-saturated solution. Explain your definition of super-saturated solution. **(10)**

   (b) Define solubility and solubility product constant. Discuss the effect of temperature on the solubility of different types of solid solutes in water with proper explanation. **(13)**

   (c) Discuss the effect of temperature and nature of salts on the partial miscibility of partially miscible liquid-liquid solution. What is meant by CST? **(12)**

ME 510

2+3=5

L-1/T-1/ME Date : 13/01/2015

BANGLADESH UNIVERSITY OF ENGINEERING AND TECHNOLOGY, DHAKA

L-1/T-1 B. Sc. Engineering Examinations 2013-2014

Sub : **EEE 159** (Fundamentals of Electrical Engineering)

Full Marks : 210 Time : 3 Hours

The figures in the margin indicate full marks.

USE SEPARATE SCRIPTS FOR EACH SECTION

SECTION – A

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

1. (a) The readings of the voltmeter and the ammeter in the circuit in Fig. for Q. No. 1(a) are 10 V and 0.6 A respectively. Find the values of R_2 and R_3. **(15)**

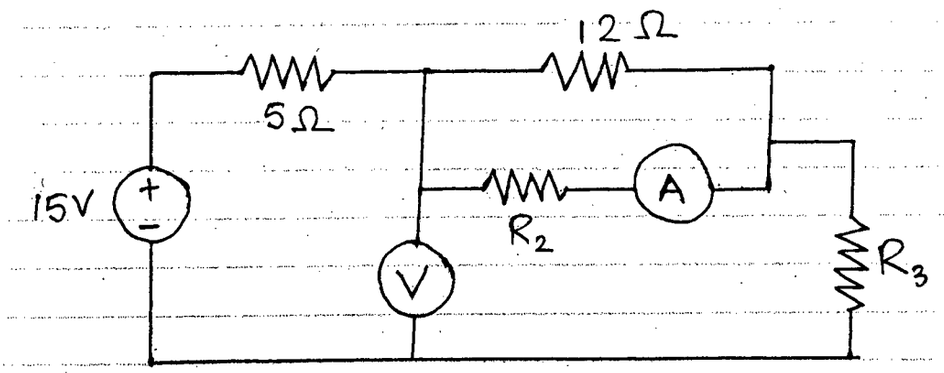

Fig. for Q. 1(a)

(b) Find the equivalent resistance between terminals A and B in the circuit in Fig. for Q. No. 1(b). All the values are indicated in Ohms (Ω). **(20)**

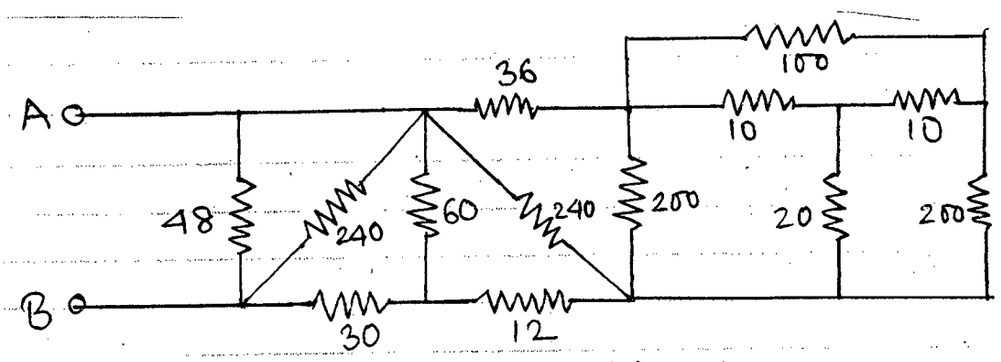

Fig. for Q. 1(b)

2. (a) Find the value of the voltage V_x in the circuit in Fig. for Q. No. 2(a). Use the concept of supernode in performing nodal analysis. **(20)**

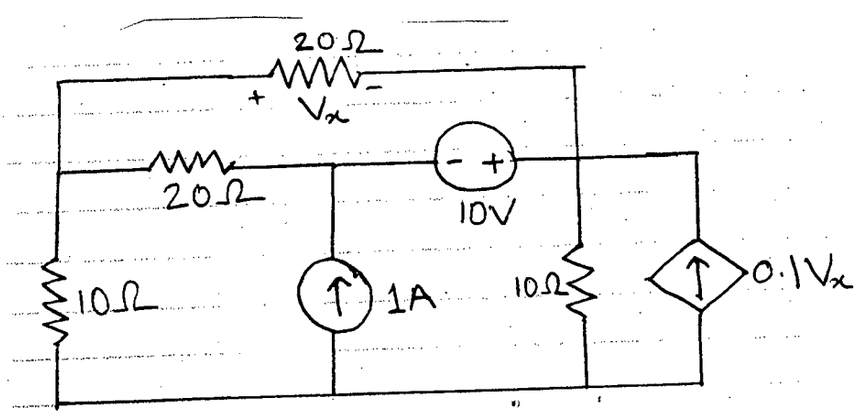

Fig. for Q. 2(a)

Contd P/2

EEE 159 (ME)

Contd ... Q. No. 2

(b) Find the value of the unspecified resistances, voltage and current sources for the circuit in Fig. for Q. No. 2(b). The loop current equations are given as – **(15)**

$$35\ I_1 - 15\ I_2 = 75$$

$$-15\ I_1 + 65\ I_2 - 15\ I_3 = -50$$

$$I_3 = -1$$

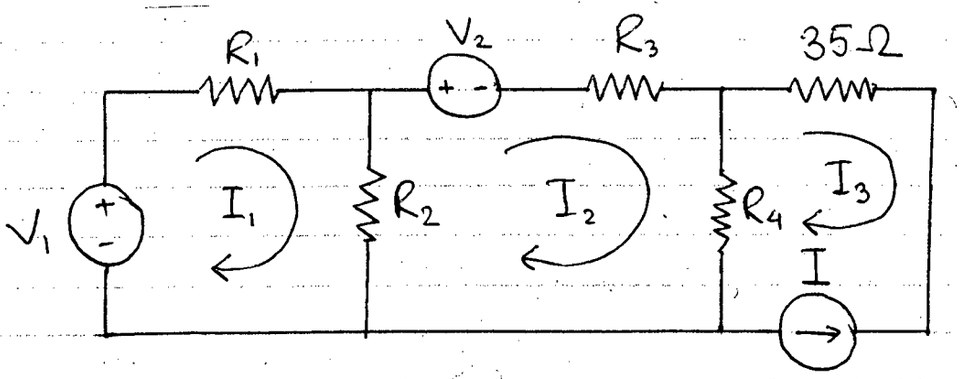

Fig. for Q. No. 2(b)

3. (a) The four terminal network ABCD in the circuit in Fig. for Q. No. 3(a) is a resistive network. How the open circuit voltage and short circuit current varies upon applying a variable DC voltage source between the terminals A and B is showed in the graphs with the figure. Find the value of R_{Th} as seen from the C-D terminals with an arbitrary voltage source between terminals A and B. **(15)**

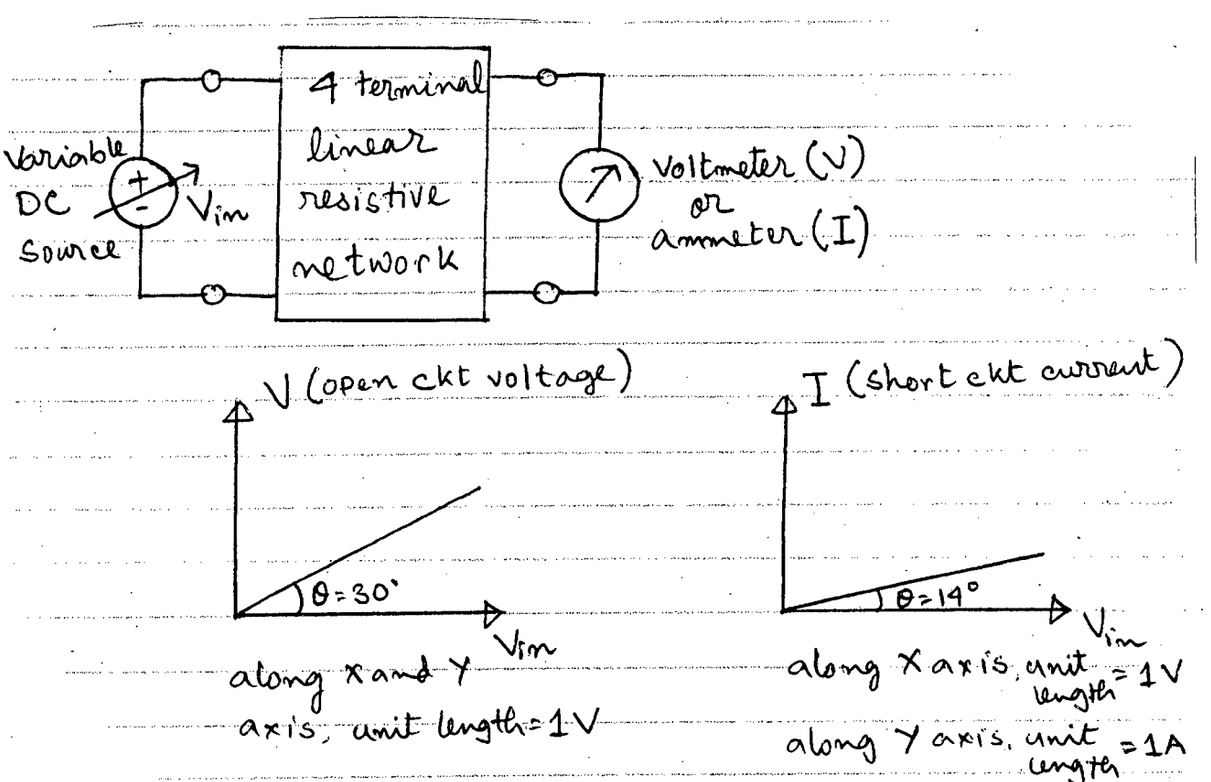

Fig. for Q. No. 3(a)

EEE 159 (ME)

Contd ... Q. No. 3

(b) Find the Thevenin equivalent circuit as seen from the terminals A-B for the circuit in Fig. for Q. No. 3(b). **(20)**

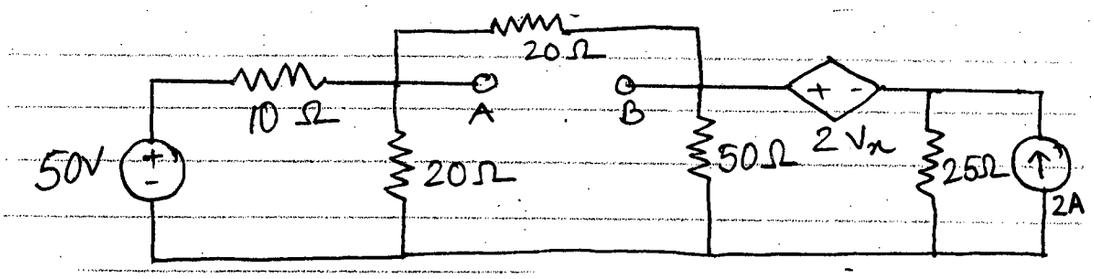

Fig. for Q. No. 3(b)

4. (a) Use superposition principle to determine the current I_x in the circuit in Fig. for Q. No. 4(a). You may use some other technique to simplify the circuit. **(20)**

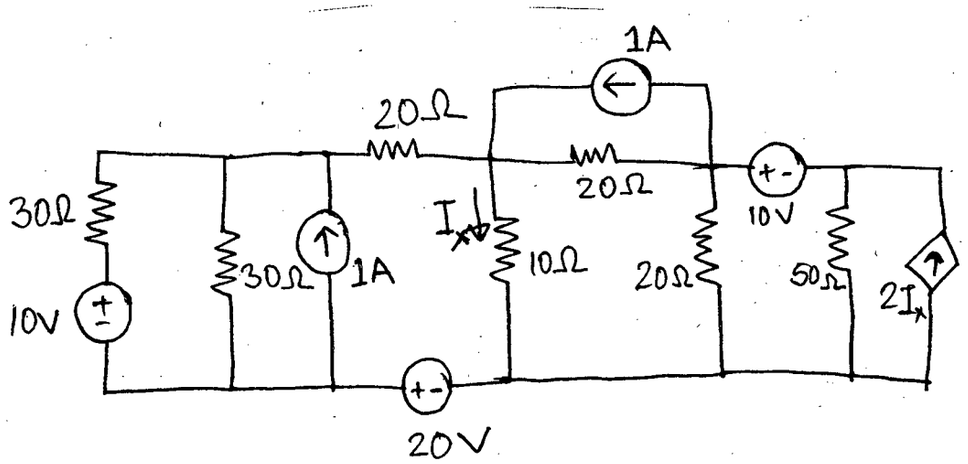

Fig. for Q. No. 4(a)

(b) If the two networks in Fig. for Q. No. 4(b) are equivalent for any V and I, obtain the expressions of relation between the quantities in these two networks. **(15)**

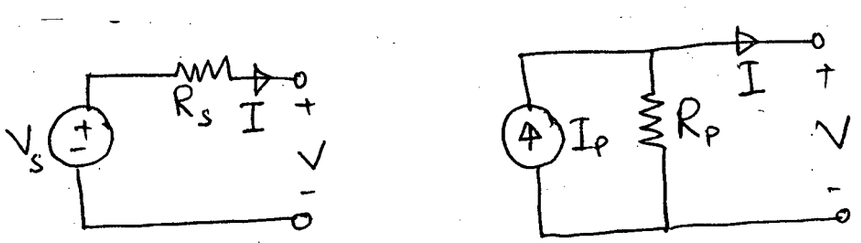

Fig. for Q. No. 4(b)

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SECTION – B

There are **FOUR** questions in this section. Answer any **THREE**.
Attach the B-H curve with the answer script if you answer to Q. No. 8(b).

5. (a) For the circuit shown in Fig. 5(a), obtain Thevenin's equivalent circuit at terminal a-b. Also find the value of Z_L that will absorb maximum power and the value of maximum power. **(18)**

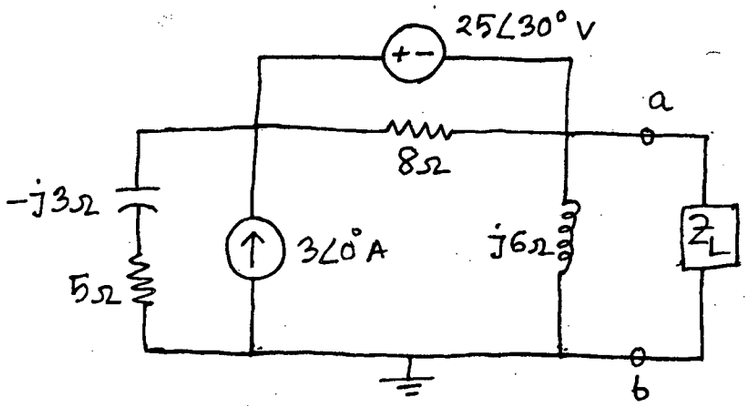

Fig. for Q. 5(a)

(b) Using superposition principle, find i in the circuit of Fig. 5(b). **(17)**

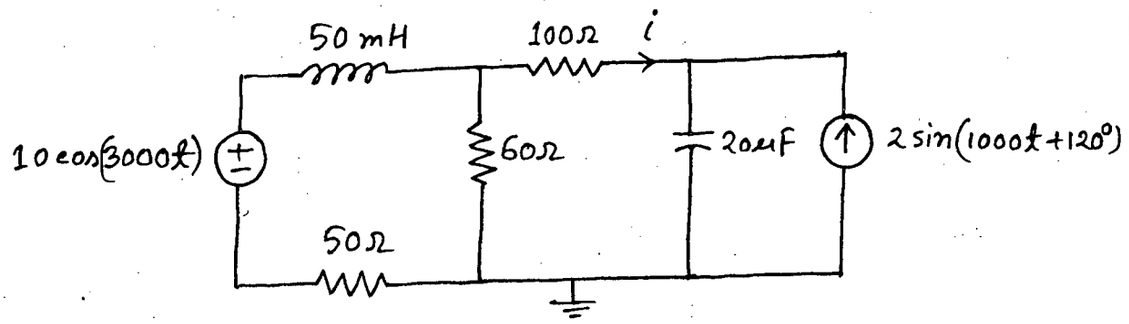

Fig. for Q. 5(b)

6. (a) Determine the (i) RMS value (ii) Average value (iii) Form factor (iv) Peak factor of the voltage waveform in Fig. 6(a). If this voltage is applied across a 2 Ω resistor, find the average power absorbed by the resistor. **(18)**

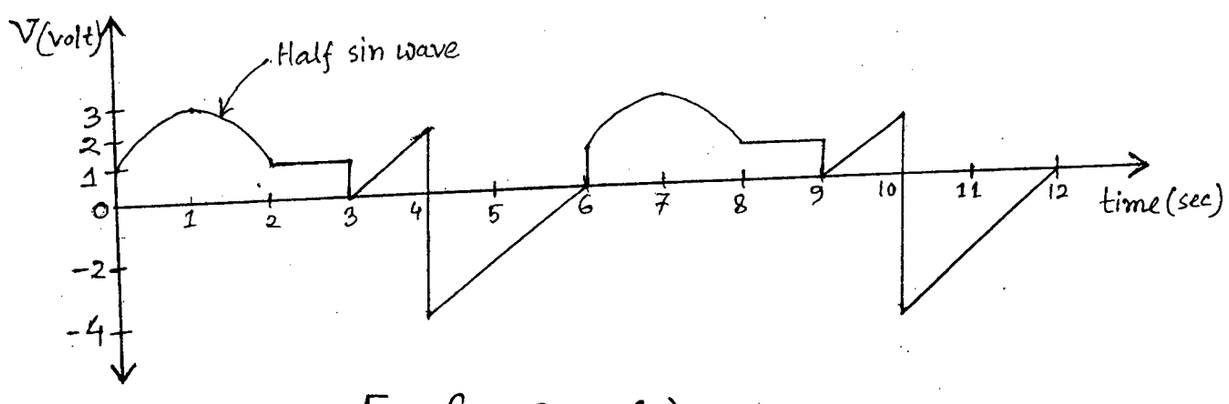

Fig. for Q. 6(a)

Contd P/5

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Contd ... Q. No. 6

(b) For the power system shown in Fig. 6(b), determine (i) the total complex power (ii) the value of parallel capacitance required to adjust the system power factor to 0.9 leading. **(17)**

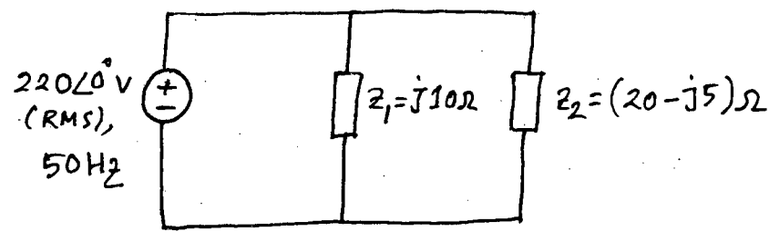

Fig. for Q. 6(b)

7. (a) For the circuit in Fig. 7(a), calculate the line currents, power loss in supply lines and the total power dissipated by the load itself. **(17)**

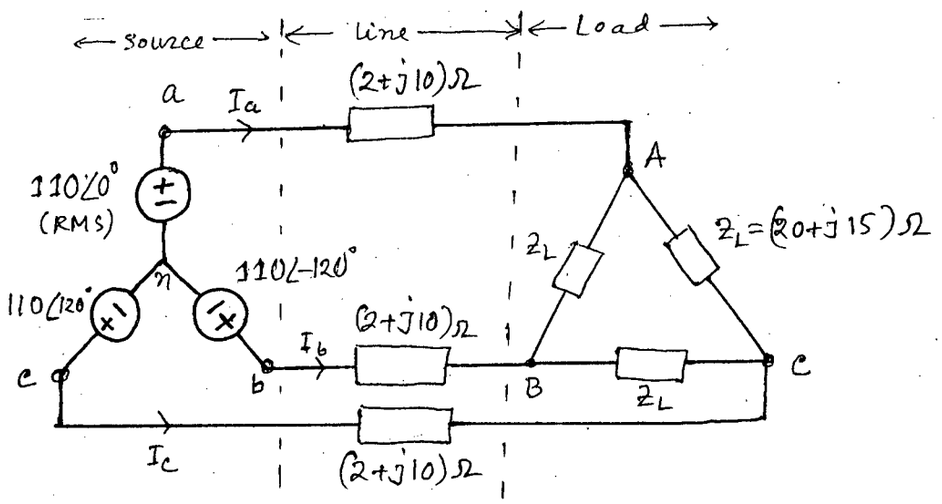

Fig. for Q. 7(a)

(b) A three phase, 5 hp, 220 volt balanced Y-connected induction motor as 80% efficiency and operates at a 0.85 p.f. lagging. It is paralleled with a balanced delta load having resistance of 30 Ω in each phase. Find (i) the total KVA, (ii) line current, (iii) power factor demanded by the combination. Line voltage is 220 V. **(18)**

8. (a) For the circuit in Fig. 8(a), draw the corresponding phasor diagram with exact magnitude and angle. Take V_L reference. **(15)**

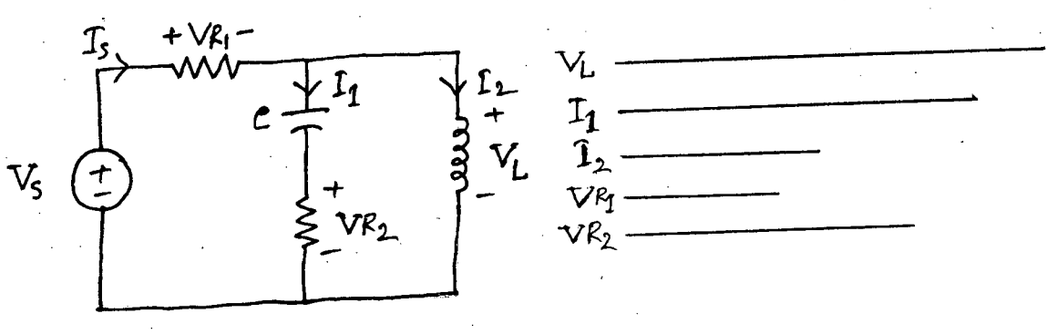

Fig. for Q. 8(a)

Contd P/6

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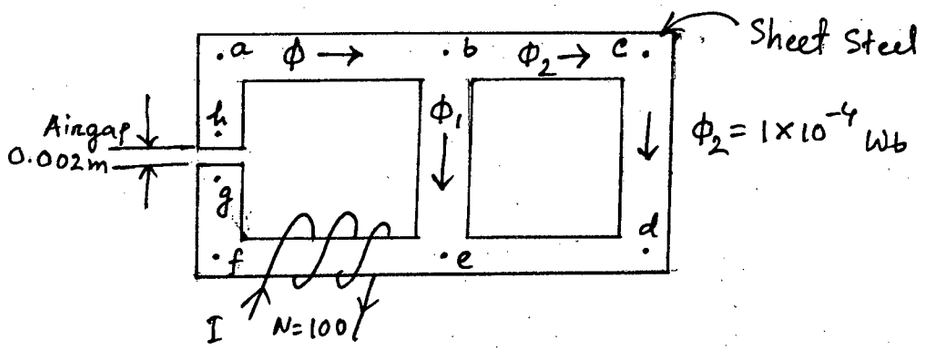
Contd ... Q. No. 8

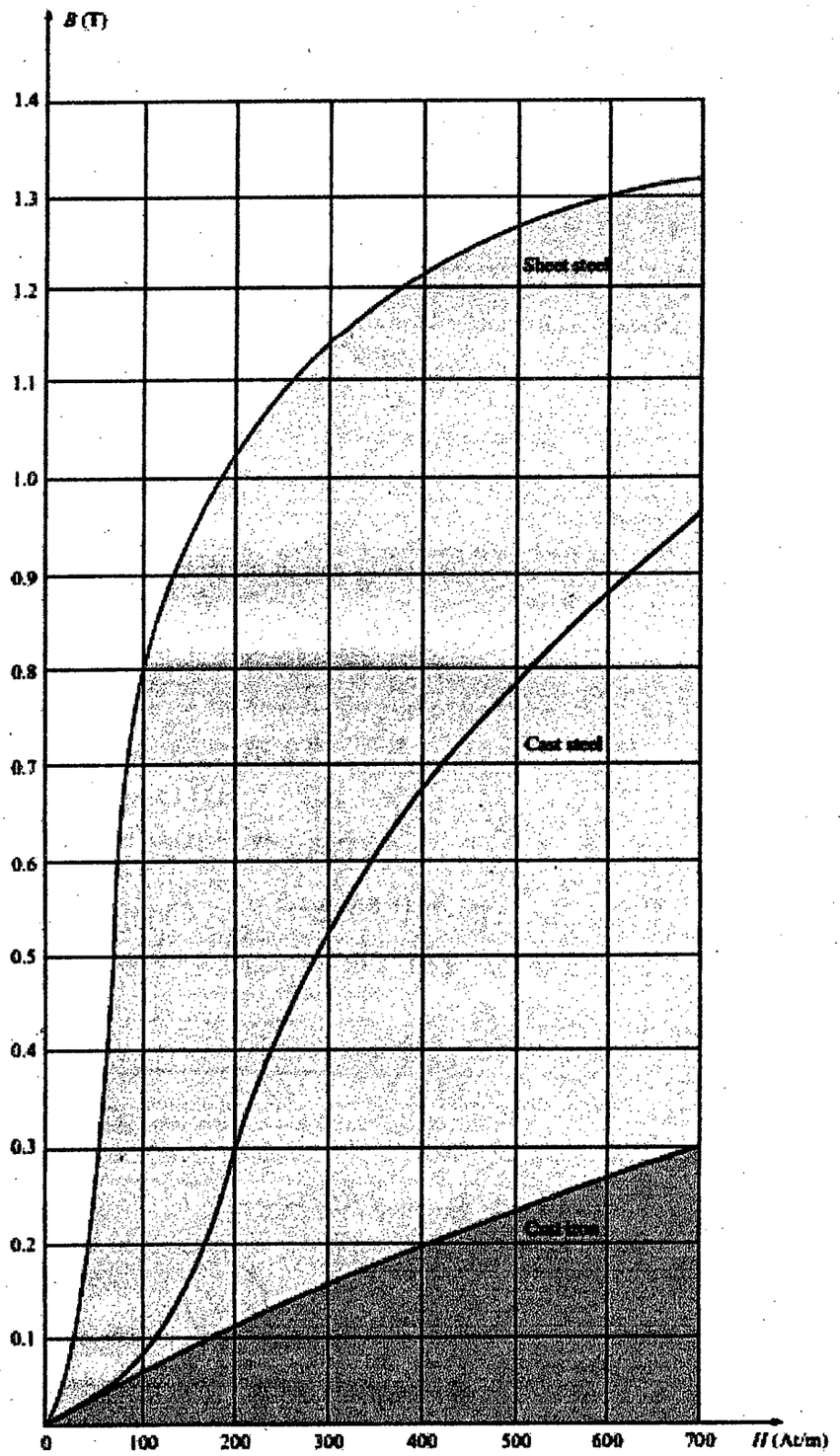
(b) Determine the current I required to establish a flux of 1×10^{-4} wb in the section of the core indicated in Fig. 8(b). **(20)**



$l_{be} = l_{ab} = l_{bc} = l_{cd} = l_{de} = l_{ef} = l_{af} = 0.02m$

Area, A (throughout) $= 4 \times 10^{-4}\ m^2$

Fig. for Q. 8(b)



B-H curve for Q. 8(b)