TDP (Honours) 3rd Semester Exam., 2015

PHYSICS

(Honours)

THIRD (A) PAPER

Full Marks : 48

Time : 2 hours

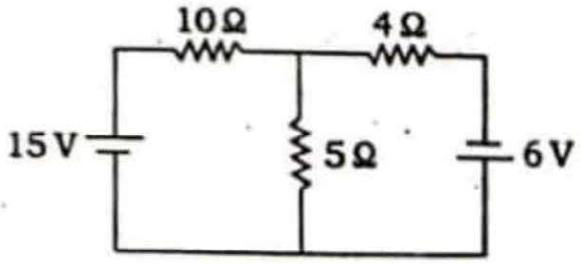
The figures in the margin indicate full marks for the questions

Answer **four** questions, taking **two** from each Unit

UNIT—I

1. *(a)* State and prove maximum power transfer theorem in an electric circuit.

   (b) Use superposition principle to find the current through the 5 Ω resistor shown below :



(c) What is meant by a resistance thermometer? Explain the use of platinum resistance thermometer for the measurement of high temperature of the order of 200 °C – 400 °C. (1+3)+3+(1+4)=12

2. (a) How does a ballistic galvanometer differ from a deadbeat-type galvanometer?

(b) What is meant by critical damping resistance?

(c) Two coils having self-inductances L_1 and L_2, and mutual inductance M between them are joined in parallel. Find the effective self-inductance.

(d) What is eddy current? Give its explanation. 3+2+4+3=12

3. A sinusoidal voltage is applied to a series L-C-R circuit.

(a) Find an expression for the instantaneous current in the circuit. Under what condition does the voltage lead the current?

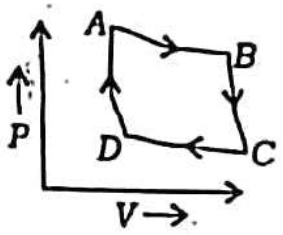
(b) Find the value of ω at which power consumed by the circuit becomes maximum.

(c) What is choke coil? Explain its working principle. (4+2)+3+3=12

UNIT—II

4. *(a)* Explain the necessity of second law of thermodynamics.

(b) A Carnot engine has a cycle as shown in the figure below :



P-309-10

(i) What thermodynamic processes are involved at the boundaries *AD* and *BC*; *AB* and *CD* ?

(ii) Where is the work put in the system and where is it extracted from the system?

(iii) This Carnot engine works in between temperatures 100 °C and 0 °C. If the work output in the cycle is 1200 kg-m, find the amount of the heat in calories absorbed from the source.

(c) Write down the conditions for a process to be reversible.

P-304

(d) Draw the *T-S* diagram of a Carnot cycle and hence calculate its efficiency.

2+(1+1+3)+2+(1+2)=12

P-348

5. *(a)* What are exact and inexact differentials? Is work an exact differential? Give reason to your answer.

   (b) Show that J-T expansion is an isenthalpic process.

   (c) Show that J-T coefficient

$$\mu = \frac{1}{C_P}\left[T\left(\frac{\partial V}{\partial T}\right)_P - V\right]$$

   (d) State and explain Wien's law with necessary graph related to blackbody radiation. 3+3+3+3=12

6. *(a)* Show that the energy density of radiation inside a uniformly heated enclosure is given by $u = 4\pi k / c$, where k is the specific intensity of radiation and c is the velocity of light.

   (b) What is meant by 'mean free path' of molecules in a gas? What is collision probability?

   (c) Give the rigorous proof of principle of equipartition of energy. 4+(1½+1½)+5=12

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TDP (Honours) 3rd Semester Exam., 2016

PHYSICS

(Honours)

THIRD (A) PAPER

Full Marks : 48

Time : 2 hours

The figures in the margin indicate full marks for the questions

Answer **four** questions, taking **two** from each Unit

The symbols used have their usual meaning

UNIT—I

1. *(a)* State and prove Thevenin's theorem as applied to network analysis.

   (b) Two cells, each of e.m.f. E and internal resistance r are connected in parallel across a variable load R. Find the value of the load for which the power delivered becomes maximum. Also find the maximum power.

UNIT—II

4. (a) State Carnot's theorem.

(b) Explain entropy and calculate the entropy of a perfect gas.

(c) Prove that

$$\left(\frac{\partial C_P}{\partial P}\right)_T = -T\left(\frac{\partial^2 V}{\partial T^2}\right)_P$$

(d) A reversible engine converts $\frac{1}{6}$th of the heat input into work. If the temperature of the sink is reduced by 335 K, the efficiency is doubled. Find the temperature of the source and the sink. 2+(2+2)+3+3=12

5. (a) Show that for one mole of a van der Waals' gas

$$C_p - C_v = \frac{R\left(p + \frac{a}{v^2}\right)}{p - \frac{a}{v^2} + \frac{2ab}{v^3}}$$

(b) Prove the following thermodynamical relations :

(i) $U = -T^2 \cdot \frac{\partial}{\partial T}\left(\frac{F}{T}\right)_V$

(ii) $H = -T^2 \frac{\partial}{\partial T}\left(\frac{G}{T}\right)_P$

(Continued)

(where U = internal energy, F = thermodynamic potential at constant volume, G = thermodynamic potential at constant pressure and H = enthalpy).

(c) State few important assumptions of kinetic theory of gas.

(d) Prove that dw is an inexact differential but $\frac{dw}{T}$ is an exact differential.

4+(2+2)+2+2=12

6. (a) From general theory of viscosity establish the coefficient of viscosity $\eta = \frac{1}{3} mnC_a\lambda$, where m = mass of each molecule, n = number of molecules per unit volume, C_a = average velocity of the molecules and λ = mean free path of the molecules.

(b) What is the probability that a molecule will traverse a distance r without suffering any collision?

(c) Using the thermodynamic functions, derive Maxwell's four thermodynamic relations. 5+3+4=12

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(c) Two cells of e.m.f. e_1 and e_2 and internal resistances r_1 and r_2 are connected in parallel to the ends of the wire of resistance R. Show that the current I in the wire is

$$\frac{e_1 r_2 + e_2 r_1}{R r_1 + R r_2 + r_1 r_2}$$

(d) What are the inadequacy of Wheatstone's bridge? (1+3)+3+3+2=12

2. (a) Define Thomson coefficient. What do you mean by positive and negative Thomson coefficient?

(b) Derive from thermodynamical considerations the following relations :

(i) $\pi = T\frac{dE}{dT}$

(ii) $\sigma = -T\frac{d^2E}{dT^2}$

(c) For a certain thermocouple, in which cold junction is kept at 0 °C and the hot junction at T °C, the variation of e.m.f. with temperature is given by $e = \alpha T + \frac{1}{2}\beta T^2$, where

$$\alpha = 16{\cdot}65 \times 10^{-6} \text{ V/°C and}$$
$$\beta = -2{\cdot}97 \times 10^{-8} \text{ V/°C}^2$$

Calculate the neutral temperature of the couple.

(d) With the consideration of time variation of weakly damped oscillator, find an expression for logarithmic decrement of a ballistic galvanometer. 2+(3+2)+2+3=12

3. (a) Show that the self-inductance of a solenoid of finite length is given as

$$L = \frac{\mu_0 N^2 A}{l^2}(\sqrt{a^2 + l^2} - a)$$

(b) In a d.c. circuit an inductance (L), a resistance (R) and a capacitance (C) are connected in series. Show graphically how current and charge changes with time.

(c) An alternating voltage of 200 volts at a frequency of 50 Hz is applied to a circuit containing a resistance of 1·5 Ω and inductance 0·01 henry and a capacitor of capacity 600 μF in series. Find (i) current flowing through the circuit, (ii) angle of lag and (iii) power factor.

(d) What are the different losses in transformers? 4+3+3+2=12

5. *(a)* Establish Clausius-Clapeyron equation from Maxwell's thermodynamics relation.

(b) What is solar constant? Calculate the temperature of the sun from the following data :

Stefan's constant = $1 \cdot 37 \times 10^{-12}$ cal/cm^2/s
Solar constant = 2·3 cal/cm^2/minute
Radius of the sun = 7×10^{10} cm^2
Distance between sun and earth
= $1 \cdot 5 \times 10^{13}$ cm

(c) What is radiation pressure?

(d) Show graphically the distribution of energy of a blackbody radiation spectrum at different temperatures.

3+(2+3)+2+2=12

6. *(a)* Find an expression for average velocity and RMS velocity from Maxwell's velocity relation.

(b) Define mean free path. Calculate the molecular diameter of the gas at 27 °C, if pressure is 10^5 N/m^2, mean free path is 2×10^{-5} cm and Boltzmann constant $k = 1 \cdot 38 \times 10^{-23}$ J/K.

(c) Discuss the principle of refrigeration.

(2+2)+(1+3)+4=12

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TDP (Honours) 3rd Semester Exam., 2017

PHYSICS

(Honours)

THIRD (A) PAPER

Full Marks : 48

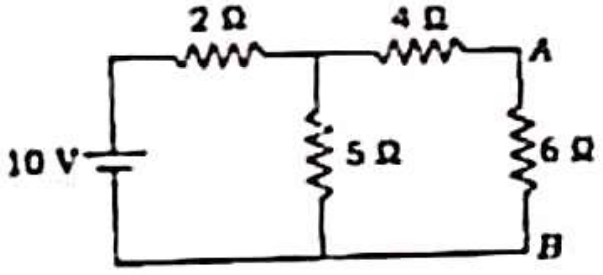
Time : 2 hours

The figures in the margin indicate full marks for the questions

Answer four questions, taking two from each Unit

UNIT—1

1. *(a)* State Norton's theorem. Using the theorem, find the current through the 6 Ω resistor :



(b) Discuss briefly on the sensitivity of a Wheatstone bridge.

(Turn Over)

(c) State the principle on which a potentiometer works. Also discuss the basic assumption related to this principle. With the help of circuit diagram, explain how we can compare the two resistances using potentiometer. (1+3)+3+(1+2+2)=12

2. (a) What is Thomson effect? Describe an experimental arrangement to realize that Thomson effect occurs actually.

(b) What is thermoelectric diagram?

(c) Discuss the theory of determination of high resistance by the method of leakage.

(d) Calculate the capacitance of a capacitor which is charged up to 5 volts and then discharged through a ballistic galvanometer. The time period of oscillation is 10 sec and current sensitivity is 2 micro-amp/mm. The 1st and 9th throws are 16 cm and 4 cm respectively. (1+3)+2+3+3=12

3. (a) Show that the magnetic energy stored in an inductor is $\frac{1}{2}LI^2$, where I is the current through it.

(b) Explain the term 'eddy current'. How would you reduce losses due to eddy currents?

(c) A coil of self-inductance 10 mH is connected in series with a 50 Ω resistor and supply voltage of 200 V at a frequency of 50 cycles/sec. Find the impedance, power factor and power dissipated in the circuit.

(d) What is quality factor Q of a series resonant circuit? How is bandwidth related to quality factor of series resonant circuit? 3•(1•1)•(1•1•2)•(1•2)=12

UNIT—2

4. (a) What is internal energy of a thermodynamic system? "Internal energy is a state function and not a path function." Explain.

(b) Show that all reversible engines working between the same two temperatures have the same efficiency.

(c) Find the efficiency of Carnot's engine working between 127 °C and 27 °C. What must be the change in temperature of the source to make the efficiency double? Also find the amount of heat it rejected to sink, if it absorbs 70 cal of heat.

(d) Calculate the change in entropy when 10 kg of water at 100 °C is converted into steam at the same temperature.

(1•2)•3•(1•2•1)•2=12

TDP (Honours) 3rd Semester Exam., 2018

PHYSICS

(Honours)

THIRD (A) PAPER

Full Marks : 48

Time : 2 hours

The figures in the margin indicate full marks for the questions

Answer **four** questions, taking **two** from each Unit

UNIT—I

1. *(a)* A battery of e.m.f. E and internal resistance r delivers power to a variable load resistance R. Plot the power absorbed by the resistance R as a function of R. Find the value of R at which this power is maximum. Explain how the efficiency varies with R.

(b) What is thermoelectric diagram? How can you calculate thermo-e.m.f. from a thermoelectric diagram?

(c) The current density at any instant of time t at a distance r from the origin O of a spherical co-ordinate system is

$\vec{J}(r) = ar^2 \exp(-bt)\hat{r}$, where a and b are two constants. Find *(i)* the current I through the surface of a sphere of radius R with centre at O and *(ii)* the charge density $\rho(r, t)$. 4+(2+3)+3=12

2. *(a)* Applying thermodynamics in a thermocouple, establish the relations

$$\sigma_a - \sigma_b = -T\frac{d^2E}{dT^2}$$

where symbols have their usual meanings.

(b) Derive an expression for the time-period of a moving-coil ballistic galvanometer and hence show that the charge passing through it is proportional to the ballistic throw.

(c) A Cu-rod of length L rotates with an angular velocity ω in a uniform magnetic field B. Evaluate the e.m.f. developed between two ends of the rod.

(d) What is meant by Critical Damping Resistance (CDR)? 4+4+2+2=12

3. *(a)* A sinusoidal voltage $v = V_0 \cos \omega t$ is applied to a series L-C-R circuit. Using the concept of rotating vectors, find an expression for the instantaneous current.

(b) Draw the variation of impedance (Z) and phase angle (φ) with frequency (ω) of the applied alternating voltage in a series L-C-R circuit.

(c) Set up the e.m.f. equation for a series L-C-R circuit driven by a battery of e.m.f. E from energy consideration and discuss the case when charge is oscillatory.

(d) In a series L-C-R circuit, $L = 10$ mH, $C = 1\ \mu$F. Calculate the value of R for which the capacitor discharge is critically damped. 3+2+(2+3)+2=12

UNIT—II

4. (a) If the internal energy of a thermodynamic system is independent of volume, show that the specific heat capacity at constant volume C_V is a function of T only.

(b) "Entropy is a measure of unavailable energy." Justify the statement.

(c) An ideal gas expands reversibly according to the equation $pV^n = A$ (constant). Show that the heat absorbed by the gas is $W(\gamma - n)/(\gamma - 1)$, where W is the work done by the gas during the process and γ is the ratio of two specific heat capacities.

(d) Using Maxwell's relations, show that

$$C_P - C_V = T\left(\frac{\partial P}{\partial T}\right)_V \left(\frac{\partial V}{\partial T}\right)_P = \left[P + \left(\frac{\partial U}{\partial V}\right)_T\right]\left(\frac{\partial V}{\partial T}\right)_P$$

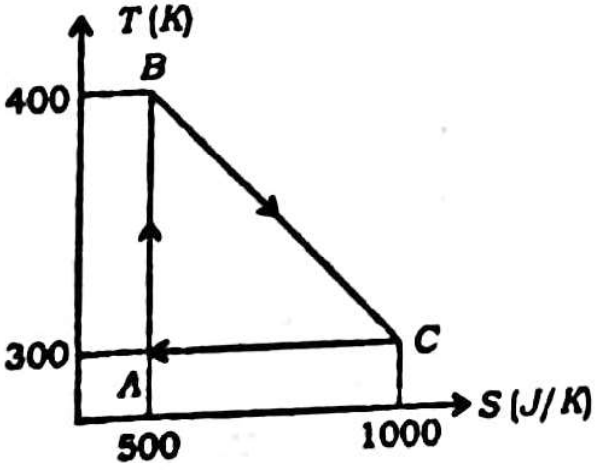
2+2+4+4=12

5. (a) What is the difference between free expansion of a gas and *J-T* expansion?

(b) What is inversion temperature? Explain why cooling occurs below inversion temperature and heating occurs above the inversion temperature in porus-plug experiment.

(c) Write Wien's radiation law and discuss its shortcomings.

(d) The *T-S* diagram of a reversible engine is illustrated in the adjoining diagram. Find its efficiency. 2+(1+3)+(2+2)+2=12



6. (a) Write Maxwell's velocity distribution formula. Using this, derive an expression for the most probable speed.

(Continued)

(b) Show that the probability of a gas molecule traversing a distance x, without collision is given by $\exp\left(-\frac{x}{\lambda}\right)$, where λ is the mean free path of the gas molecule.

(c) "Brownian motion may be considered as analogous to the heat motion of the molecules but on a much reduced scale." Explain the significance of the statement.

(d) What is the coefficient of performance of a refrigerator? (1+3)+4+2+2=12

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TDP (Honours) 3rd Semester Exam., 2019

PHYSICS

(Honours)

THIRD PAPER (Group—A)

Full Marks : 48

Time : 2 hours

The figures in the margin indicate full marks for the questions

Answer **four** questions, taking **two** from each Unit

UNIT—I

1. *(a)* State superposition theorem as applied to network analysis. Considering a simple resistive *T*-network and two DC sources, verify the validity of this theorem.

(b) Show that the self-inductance of solenoid of finite length is given as

$$L = \frac{\mu_0 N^2 A}{l^2}\left(\sqrt{a^2 + l^2} - a\right)$$

where symbols have their usual meanings. Also discuss the case when $l \gg a$.

(c) Establish the differential form of Faraday's law in electromagnetic induction.

(d) An L-C-R circuit is critically damped with $L = 0{\cdot}2$ H and $R = 100$ ohms. What is the value of C? (1+3)+(3+1)+2+2=12

2. (a) In a thermoelectric circuit, discuss the origin of Peltier e.m.f.

(b) What is thermoelectric power diagram? Explain its significance.

(c) Using thermoelectric diagram, find the expression for total e.m.f. generated by a thermocouple.

(d) The e.m.f. equation of thermocouple is $E = at + bt^2$ in μV, where t is the temperature of the hot junction, the cold junction being at 0 °C. Given $a = 20\ \mu V/°C$, $b = -0{\cdot}0025\ \mu V/°C^2$. Find the temperature at which the Peltier coefficient is maximum and hence obtain the difference of the Thomson coefficients for the pair of metals of the thermocouple. 2+(2+2)+3+3=12

3. *(a)* What is the power factor in an AC circuit? What is its value for purely resistive and inductive circuits? What is wattless current?

(b) An air cored solenoid has a diameter of 2·5 cm and 500 turns wound over a length of 30 cm. Calculate the self-inductance of the solenoid and the self-linked flux, when the current in the solenoid is 2 A.

(c) A parallel *L-C* combination is in series with a resistance *R*. If a voltage $V_i \sin \omega t$ is applied to this circuit, calculate the voltage across the *L-C* combination. Show that this voltage reaches a maximum, when $\omega = \frac{1}{\sqrt{LC}}$. (Here *L* = inductor and C = capacitor.)

(d) How do you measure current in a circuit using a potentiometer?

(1+1+1)+2+(3+1)+3=12

UNIT—II

4. *(a)* Is it possible to utilize the huge internal energy of ocean to convert into external work? Justify your answer.

(b) Why a Carnot engine must be reversible in nature?

(c) Why is it not possible to get a 100% efficient Carnot engine?

(d) What necessitates the existence of entropy function?

(e) Calculate the change in the melting point of ice when it is subjected to pressure of 100 atmospheres. Given, density of ice = 0·917 g/cc, latent heat of ice = 336 J/g. 2+2+2+3+3=12

5. (a) "Substances having positive volume expansion coefficient generate heat on isothermal compression." Establish it from Maxwell's thermodynamic equation. Also discuss the anomalous expansion of water at 0 °C at normal atmospheric pressure.

(b) Even at sufficiently low temperature, why H_2, He show heating effect on throttling due to J-T expansion unlike other gases?

(c) What is radiation pressure? Show that the energy density of radiation inside a uniformly heated enclosure is given by $u = 4\pi K/c$, K = specific intensity of radiation and c = velocity of light.
(3+2)+2+(2+3)=12

6. (a) Derive Maxwell's law of velocity distribution of molecules for an ideal gas.

(b) What do you mean by self-diffusion of gas? Define the coefficient of diffusion and write down its mathematical form.

(c) Calculate the mean-free path, collision rate and molecular diameter of hydrogen, given $\eta = 85 \times 10^{-6}$ dyne/sq-cm, per unit velocity gradient $\bar{c} = 16 \times 10^5$ cm/s and $\rho = 0{\cdot}000089$ g/cc. 5+(2+2)+3=12

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TDP (Honours) 3rd Semester Exam. 2020
(Held in 2021)

PHYSICS

(Honours)

THIRD (A) PAPER

Full Marks : 48

Time : 2 hours

The figures in the margin indicate full marks for the questions

Answer **four** questions, taking **two** from each Unit

UNIT—I

1. *(a)* State Thevenin's theorem as applied to network analysis. Considering a simple resistive T-network and two DC sources, verify the validity of this theorem.

   (b) Discuss the working principle of a platinum resistance thermometer.

   (c) What is the difference between dead beat and ballistic galvanometer?

(d) Examine whether the discharge of a charged capacitor of 0·1 μF through an inductive coil of inductance 100 mH and resistance 200 ohm is oscillatory or not. If it is oscillatory, then find the frequency of oscillation.

(2+3)+2+(1½+1½)+2=12

2. (a) Applying thermodynamics in a thermo-couple, establish the following relation :

$$\sigma_a - \sigma_b = -T\frac{d^2E}{dT^2}$$

where the symbols have their usual meanings.

(b) The thermoelectric power of silver and iron with respect to lead are given by $3\cdot34+0\cdot008t$ μV/°C and $16\cdot65-0\cdot030t$ μV/°C respectively. Calculate the e.m.f. of an Ag-Fe thermo-couple with the junctions at 20 °C and 80°C.

(c) An e.m.f. is suddenly applied to a circuit containing a resistance, an inductance and a capacitance in series.

(i) Write down the e.m.f. equation of the circuit.

(ii) Point out the conditions for non-oscillatory and oscillatory growths.

(iii) For the second case, obtain expression for the frequency of oscillation of capacitor charge.

(iv) Represent graphically all the possible cases of growth of charge in the given capacitor as a function of time. 4+3+(1+1+2+1)=12

3. (a) An alternating voltage $v(t) = V_0 \sin \omega t$ volts is applied to a purely resistive load R. Find the time taken for the current to rise from half of the peak value to the peak value.

(b) What is meant by 'choke coil'?

(c) Using the idea of rotating vectors, derive the expressions for the instantaneous current and power factor in a series L-C-R circuit when an alternating voltage $v = V_0 \cos \omega t$ is applied.

(d) Discuss with circuit diagram, how you can measure a small current with the help of one potentiometer. 2+2+4+4=12

UNIT—II

4. *(a)* Applying the first law to deduce the difference of molar specific heats

$$C_p - C_v = \left\{p + \left(\frac{\partial U}{\partial V}\right)_T\right\}\left(\frac{\partial V}{\partial T}\right)_p$$

(b) Using Maxwell's thermodynamic relations, show that the ratio of adiabatic to isobaric volume expansivity is $\frac{1}{1-\gamma}$, where the symbols have their usual meanings.

(c) Entropy is the measure of the so-called unavailable energy. Explain.

(d) The efficiency of a Carnot's engine is 40% when the temperature of the sink is 15 °C. It is desired to increase the efficiency to 60%. By how many degrees Celsius should the temperature of the source to be increased? 4+2+2+4=12

5. *(a)* What is the significance of Clausius inequality?

(b) Applying Clausius inequality, derive an expression for the work done in a cyclic process where the intake temperature is T_1 and exhaust temperature is T_2. Show that the maximum work is available if the cycle is a Carnot's cycle.

(c) Establish that J-T effect is the resultant of deviation from Joule's law and Boyle's law.

(d) Show that for an isochoric process

$$U = F - T\left(\frac{\partial F}{\partial T}\right)_V$$

2+4+4+2=12

6. (a) Using Maxwell velocity distribution, find the average values of $\langle v_x \rangle$ and $\langle v_x^2 \rangle$.

(b) With a simple diagram, explain the basic working principle of a refrigerator.

(c) Calculate the probability that the speed of an oxygen molecule will lie between 100 m/s and 101 m/s at 200 K. The mass of oxygen molecule is 32 u.

Take :

Boltzmann constant = $1 \cdot 38 \times$ $^{-23}$ J/K

Avogadro's number = 6×10^{26} $kmol^{-1}$

5+3+4=12

★★★

TDP (Honours) 3rd Semester Exam., 2021
(Held in 2022)

PHYSICS

(Honours)

THIRD (A) PAPER

Full Marks : 48

Time : 2 hours

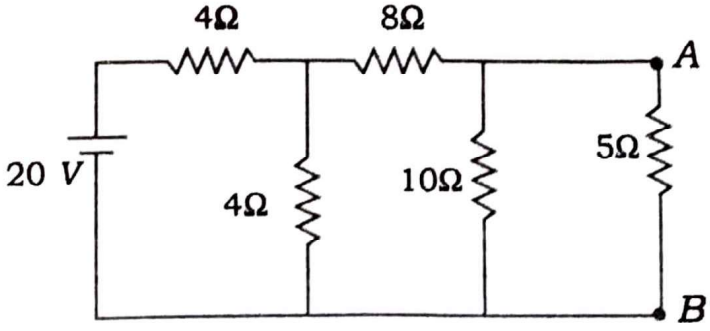
The figures in the margin indicate full marks for the questions

Answer **four** questions, taking **two** from each Unit

UNIT—I

1. *(a)* How can you measure temperature of inversion from thermoelectric diagram?

(b) Using Norton's theorem, calculate the current flowing through 5Ω resistance of the network shown in the figure below :



(c) Two cells of e.m.f. E_1 and E_2 $(E_1 > E_2)$ are joined in *(i)* series and *(ii)* opposition. The combination in each case is connected across the same potentiometer setup. The balancing length in two cases are l_1 and l_2 respectively. Find E_1 / E_2.

(d) What are the compensating leads used in a platinum resistance thermometer? What are the functions of these leads?

3+4+3+(1+1)=12

2. (a) In what ways, the principle and construction of a ballistic galvanometer is different from that of a dead-beat moving-coil galvanometer?

(b) Show that a current sensitive galvanometer must have high resistance whereas reverse is the case with a voltage sensitive galvanometer.

(c) In an inductive circuit, current cannot grow to a steady value all at once, why?

(d) Given a coil of self-inductance 5 mH and resistance $0 \cdot 5\ \Omega$. Calculate the value of the capacity of the capacitor required to generate oscillations of frequency 1 kHz.

3+4+2+3=12

3. *(a)* A voltage $v = V_0 \cos \omega t$ is applied to a series *L*-*C*-*R* circuit. Find the value of ω at which power consumed by the circuit becomes maximum. Find the two half-power frequencies and hence the *Q*-value of the circuit.

(b) What is the function of a bypass capacitor?

(c) Find the capacity of the condenser which is to be introduced in series with 100 volt, 50 watt lamp to light it from 200 volt, 50 Hz mains. Find the phase of the current with respect to the applied voltage. (3+3)+2+4=12

UNIT—II

4. *(a)* State Carnot's theorem.

(b) A Carnot engine whose low temperature reservoir is at 7°C has an efficiency of 40%. It is desired to increase the efficiency to 50%. By how many degrees should the temperature of the source be increased?

(c) 10 g of water at 60 °C is mixed with 30 g of water at 20 °C. Will the entropy of the system increase or decrease? Calculate the change.

(d) Prove that

$$C_p - C_v = TV\alpha^2 / K_T$$

where α is the volume coefficient of expansion and K_T is the isothermal compressibility.

(e) Write down the first, second and third TdS equations. 1+2+3+3+3=12

5. (a) Define the term 'perfectly black-body'.

(b) Show that the pressure due to diffused black-body radiation is one-third of the energy density of radiation.

(c) State Planck's formula of energy distribution in black radiation at an absolute temperature T.

(d) Show that Wien's formula and Rayleigh-Jeans formula are particular cases of Planck's formula. 2+4+2+(2+2)=12

6. *(a)* Suppose λ is the mean free path of the molecules in a gas. What is the probability that a molecule traverses a distance x without suffering any collision?

(b) Derive Maxwell's velocity distribution law.

(c) Calculate the radius of an oxygen molecule if its coefficient of thermal conductivity

$$K = 24 \times 10^{-3} \text{ J/m-s-K at } 0\ ^\circ\text{C}$$

$$C_v = 20 \cdot 9 \times 10^{3} \text{ J/kilomole-K}$$

Boltzmann constant $k = 1 \cdot 38 \times 10^{-23}$ J/K and mass of an oxygen molecule $m = 5 \cdot 31 \times 10^{-26}$ kg. 3+6+3=12

★★★