Unit 3. Effects of Electric Current (20 marks)

1 mark → 2 Questions	5 mark → 1 Question 54
3 mark → 1 Question 36	10 mark→ 1 Question 64

UNIT – 3.Effects of Electricity – 1 mark questions

1. Joule's law of heating is -- [M-08]
   a) H = I^2t/R
   b) H = V^2Rt
   c) H = $IR^2 t$
   d) H = VIt

2. In the experiment to verify Joule's law when the current passed through the circuit is doubled keeping resistance (R) constant and time of passage of current (t) constant, the temperature of the liquid is -----
   a) increases twice
   b) increases four times
   c) increase sixteen times.
   d) decreases four times [S-12]

3. Nichrome is used as heating element, because ------
   a) low resistance
   b) low melting point
   c) high specific resistance
   d) high conductivity
   (J-06,08,M-12,S-12)

4. Peltier effect is the converse of ------ [M-07]
   a) Joule effect
   b) Raman effect
   c) Thomson effect
   d) Seebck effect

5. Peltier coefficient at a junction of a thermocouple depends on
   a) the current in the thermocouple
   b) the time for which current flows
   c) the temperature of the junction
   d) the charge that passes through the thermocouple [J-09,12,13]

6. Unit of peltier coefficient is ---- [S-09]
   a) ohm
   b) mho
   c) Volt
   d) ampere

7. For a given thermocouple the neural temperature --[J-10]
   a) depends upon the temperature of cold junction
   b) depends upon the temperature
   c) the temperature of the junction
   d) the charge that passes through the thermocouple .

8. AB is a rod of lead. The end A Is heated. A current I is allowed to flow along AB. Now, due to Thomson effect, in rod AB: [J-13]
   a) heat is absorbed
   b) heat is liberated
   c) heat is neither absorbed nor liberated
   d) heat is first absorbed and then liberated

9. In which of the following pairs of metals of a thermocouple the e.m.f is maximum? --- [J-07]
   a) Fe –Cu
   b) Cu – Zn
   c) Pt – Ag
   d) Sb - Bi

10. Fuse wire is an alloy of --- [M-08]
    a) Lead & Tin
    b) Tin and copper
    c) Lead and copper
    d) Lead and Iron

11. Fuse wire --- [S-11]
    a) is an alloy of lead and copper
    b) has low resistance
    c) high resistance
    d) has high melting point

12. Which of the following principles used in a thermopile -----
    a) Thomson effect
    b) Peltier effect
    c) Seebeck effect
    d) Joule's effect [S-07]

13. Thermopile is used to ------- [S-08]
    a) measure temperature
    b) measure current
    c) detect thrmal radiation
    d) measure pressure

14. The magnitude and direction of the magnetic Lorentz force is given by
    a) F = (v X B)
    b) F = q/(v X B)
    c) F = q(v X B)
    d) F = V (q X B)   [J-09]

15. When the number of turns (n) in a galvanometer is doubled, current sensitvity ---- [O-10]
    a) remains constant
    b) decreases twice
    c) increases twice
    d) increases four times

16. The unit of reduction factor of tangent galvanometer is ----
    a) no unit
    b) tesla
    c) ampere
    d) ampere/degree [M-06]

17. An ideal voltmeteter has ---- [S-07,J-10,J-11]
    a) infinite resistance
    b) finite resistance between zero & G
    c) resistance greater than G but less than infinity
    d) an infinite resistance

18. The galvanometer can be converted into voltmeter by connecting
    a) low resistance in series
    b) high resistance in parallel
    c) high resistance in series
    d) low resistance in parallel [M-06]

19. Phosphor bronze wire is used for suspension in moving coil galvanometer, because it has ----- [S-09]
    a) high conductivity
    b) high resistivity
    c) large couple per unit twist
    d) small couplr per unit twist

20. Which of the following equations represents Biot-Savart law --
    a) $\overrightarrow{dB} = \frac{\mu_0 Idl}{4\pi \ r^2}$
    b) $\overrightarrow{dB} = \frac{\mu_0 Idl \sin\theta}{4\pi \ r^2}$
    c) $\overrightarrow{dB} = \frac{\mu_0 \ Idl \times r}{4\pi \ \ r^2}$
    d) $\frac{\mu_0 \ Idl \times r}{4\pi \ \ r^3}$ [M-10]

21. Magnetic induction at a distance a from an infinitely long straight conductor carrying current i and placed in a medium of permeability   μ is ----- [J-11]
    a) $\frac{\mu_0 I}{4\pi a}$
    b) $\frac{\mu I}{2\pi a}$
    c) $\frac{\mu I}{4\pi a}$
    d) $\frac{\mu I}{5\pi a}$

22. The torque experienced by a rectangular current loop placed perpendicular to a uniform magnetic field is ---- [M-07]
    a) maximum
    b) zero
    c) finite minimum
    d) infinity

23. The direction of force on a current carrying conductor placed in a magnetic field is given by :   [M-13]
    a) Fleming's Left hand Rule
    b) Fleming's Right hand Rule
    c) End Rule
    d) Right Hand Palm Rule

24. The period of charged particle inside a cyclotron does not depend on ---- [M-11,13]
    a) the magnetic induction
    b) the charge of the particle
    c) the velocity of the particle
    d) the mass of the particle

UNIT – 3. Effects of Electricity – 1 mark problems

1. Which of the following produces large joule heating effect - [M-12]
   a) 1 A current through 2 Ω resistor for 3 second
   b) 1 A current through 3 Ω resistor for 2 second
   c) 2 A current through 1 Ω resistor for 2 second
   d) 3 A current through 1 Ω resistor for 1 second

2. The resistance of electric bulb rated 110 W, 220 V is [M-09]
   a) 440 Ω
   b) 220 Ω
   c) 484 Ω
   d) 848 Ω

3. In a thermocouple, the temperature of the cold junction is 20^0C, the temperature of inversion is 520^0C. The neutral temperature is ----
   a) 500^0C
   b) 54^0C
   c) 270^0
   d) 510^0C [DPM]

4. In a thermocouple, the temperature of the cold junction is 20^0C, and the neutral temperature is 270^0C. Then the temperature inversion is -----

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a) 520^0 C   b) 540^0C   c) 500^0C   d) 510^0C
[J-08,S-08,M-10]

5. In a thermocouple, the temperature of the cold junction is -30^0C, and the neutral temperature is 270^0C. Then the temperature inversion is –
   a) 520^0C   b) 540^0C   c) 500^0C   **d) 570^0C**   [S-11]

6. In a thermocouple, the temperature of the cold junction is 20^0C, the temperature of inversion is 600^0C, then the neutral temperature is
   a) 310^0C   b) 320^0C
   c) 300^0C   d) 315^0C   [S-06]

7. Of the following which has small resistance? [J-06,M-09,J-12]
   a) voltmeter   **b) ammeter of range 0 – 10 A**
   c) moving coil galvanometer   d) ammeter of range 0 – 1 A

8. In a TG, for a constant current the deflection is 30^0. The plane of the coil is rotated through 90^0. Now for the same current, the deflection will be ----- [DPM,J-07]
   a) 0^0   b) 30^0 c) 60^0 d) 90^0

9. In a TG a current 1 A, produces a deflection of 30^0. The current required to produce a deflection of 60^0 is --- [O-06]
   a) 3 A   b) 2 A   c) √3 A   d) 1/√3 A

10. An electron is moving with a velocity of 3×10^6 m/s perpendicular to a magnetic field of induction 0.5 T. The force experienced by the electron is ---- [M-11]
    a) 2.4×10^{-13} N   b) 13.6×10^{-27} N
    c) 13.6×10^{-11} N   d) zero

UNIT – 3. Effects of Electricity – 3 mark Questions

1. What are the characteristics of heating element used in electric heating device? [M-10]
2. Why nichrome is used as a heating element? [J-07]
3. Mention any two differences between Peltier effect and Joule's heating effect.   [M-06,J-12]
4. Define Peltier coefficient and write its unit.   [J-06,J-11,M-12]
5. Define Thomson coefficient.   [S-12]
6. What is neutral temperature of a thermocouple? S-08
7. State Ampere' circuital law.   [M-09]
8. State Fleming's left hand rule   [O-10]
9. State tangent law   [M-11]
10. Mention the limitations of cyclotron.   [O-06,J-10,M-13]
11. How a galvanometer can be converted into i) an ammeter ii) a voltmeter   [J-09]
12. How we increase the sensitivity of a galvanometer ?   (S-09)
13. In a galvanometer, increasing the current sensitivity does not necessarily increase the voltage sensitivity. Explain. [M-07,J-13]
14. Define ampere in terms of force (OR) Define ampere.
          [DPM,M-08. J-08,O-11]

UNIT – 3. Effects of Electricity – 3 mark Problems

1. Calculate the resistance of the filament of a 100 W,.20 V electric bulb   [S-07]
2. A long straight wire carrying a current produces a magnetic induction of 4×10^{-6} T at appoint 15 cm from the wire. Calculate the current through the wire.   [S-07]   [J-12/5m]

UNIT – 3. Effects of Electricity – 5 mark Questions

1. What are the special features of magnetic Lorentz force?
          [J-07,M-11]
2. State and explain Biot-savart law.   [J-09]
3. Explain in detail the principle, construction of a tangent galvanometer (diagram, theory not necessary)   [S-08]
4. Explain the conversion of galvanometer into an ammeter.
          [M-08,J-12]
5. Explain how will you convert a galvanometer into a voltmeter.
          [M-10,12,J-11]

UNIT – 3. Effects of Electricity – 5 mark Problems

1. A long straight wire carrying a current produces a magnetic induction of 4×10^{-6} T at appoint 15 cm from the wire. Calculate the current through the wire.   [S-07]
2. A circular coil of 50 turns and radius 25 cm carries a current of 6A. It is suspended in a uniform magnetic field of induction 10^{-3} T. The normal to the plane of the coil makes an angle of 60^0 with the field. Calculate the torque of the coil.   [DMP]
3. A circular coil of 20 cm has 100 turns of wire and it carries a current of 5A. Find the magnetic induction at a point along its axis at a distance of 20 cm from the Centre of the coil.
          [M-06,O-06,M-09]
4. A rectangular coil of 500 turns and of area 6×10^{-4} m^2 is suspended inside a radial magnetic field of induction 10^{-4} T by a suspension wire of torsional constant 5×10^{-10} Nm per degree. Calculate the current required to produce deflection of 10^0.
          [S-09,M-13]
5. A moving coil galvanometer of resistance 20 Ω produces full scale deflection for a current of 50 mA. How will you convert the galvanometer into i) an ammeter of range 20 A and ii) a voltmeter of range 120 volt?   [M-07,M-09, J-13]
6. A moving coil galvanometer of resistance 40 Ω produces full scale deflection for a current of 2 mA. How will you convert the galvanometer into voltmeter of range 20 V? [O-10]
7. The deflection galvanometer falls from 50 divisions to 10 divisions when 12 ohm resistance is connected across the galvanometer. Calculate the galvanometer resistance. [S-12]
8. Two parallel wires each of length 5 m are placed at a distance of 10 cm apart in air. They carry equal currents along the same direction and experience a mutually attractive force of 3.6×10^{-4} N. Find the current through the conductors.   [S-09,J-10,M-13]
9. Two straight infinitely long parallel wires carrying equal current placed at a distance of 20 cm apart experience a mutually attractive force of 4.9×10^{-5} N per unit length of the wire. Calculate the current.   [O-11]
10. In a hydrogen atom electron moves in an orbit of radius 0.5 A^0 making 10^{16} revolutions per second. Determine the magnetic moment associa ted with orbital motion of the electron. (Given : e = 1.6×10^{-19} C) [J-08]

UNIT – 3. Effects of Electricity – 10 mark Questions

1. State Joule's law. Explain Joule's calorimeter experiment to verify Joule's laws of heating.   [J-07,12]
2. Derive an expression for magnetic induction due to an infinitely long straight conductor carrying current.   [M-06,M-10]
3. Derive an expression for magnetic induction due to an infinitely long straight conductor carrying current. Write the expression for the magnetic induction when the conductor is placed in a medium of permeability μ.   [J-06,S-09]
4. Deuce the relation for the magnetic induction at a point along the axis of a circular coil carrying current.   [S-07M-08,M-12]
5. Explain in detail the principle, construction and theory of T.G.
6. Define Ampere's circuital law. Applying it, find the magnetic induction due to a long solenoid carrying current. [O-06, J-09]
7. Deduce an expression for the force acting on a current carrying conductor placed in a magnetic field. Find the magnitude of the force   [S-08,M-09,J-11,S-12]
8. Obtain expression for force between two long parallel current carrying conductors. Hence define 'ampere'.   [M-11]
9. Explain in detail the principle, construction, working and limitations of cyclotron with a diagram. [M-07,O-10,11,J-13]
10. Discuss the motion of the charge particle in uniform magnetic field.
          [DPM,M-11,13]

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