Maximum : 100 marks

Time : 1 hour and 15 minutes

1. Kirchhoff's Voltage Law (KVL) is a restatement of :
   (A) Principle of conservation of charge
   (B) Principle of conservation of energy
   (C) Both (A) and (B)
   (D) None of the above

2. If the number of turns of a coil is doubled, its inductance :
   (A) Decreases two times
   (B) Decreases four times
   (C) Increases two times
   (D) Increases four times

3. Two batteries having emf's of 10 V and 7 V and internal resistances 2 Ω and 3 Ω respectively are connected in parallel across a load of resistance of 1 Ω. The current drawn by the load is :
   (A) 3 A
   (B) 1 A
   (C) 4 A
   (D) 2 A

4. A square coil of 10 cm side and with 100 turns is rotated at a uniform speed of 1000 revolutions per minute about an axis at right angles to a uniform magnetic field having a flux density of 0.5 wb/m^2. The instantaneous value of induced emf when the plane of the coil is parallel to the plane of the field is :
   (A) Zero
   (B) 25.3 V
   (C) 52.3 V
   (D) 40.5 V

5. In an RLC series circuit, $R = 2\Omega$, $X_L = 4\Omega$ and $X_C = 6\Omega$. The current is 5 A. The applied voltage in the circuit is :
   (A) 14.14 V
   (B) 10.44 V
   (C) 141.4 V
   (D) 1.414 V

6. A current of 10 A flows in a circuit with 30° angle of lag when the applied voltage is 100 V. The resistance, reactance and impedance are :
   (A) 8.666 Ω, 5 Ω, 10 Ω
   (B) 10 Ω, 5 Ω, 0.866 Ω
   (C) 10 Ω, 0.866 Ω, 5 Ω
   (D) 0.866 Ω, 10 Ω, 5 Ω

7. A wire is placed parallel to the lines of force in a magnetic field and a current flows in this wire. Then :
   (A) The wire experiences a force in the direction of the magnetic field
   (B) The wire does not experience any force
   (C) The wire experiences a force in a direction opposite to the magnetic field
   (D) The wire experiences a force in a direction perpendicular to the magnetic field

8. If a 10 Ω resistance is connected to an a.c. supply $v = 100\sin(314t + 37^\circ)\ V$, the power dissipated by the resistance is :

(A) 10,000 W (B) 1000 W
(C) 250 W (D) 500 W

9. A three phase, four wire $100\,V\,(L-L)$ system supplies a balanced star connected load having impedance of $10\underline{|-30^\circ}\ \Omega$ in each phase. How much current is flowing through the neutral?

(A) 10 A (B) 1 A
(C) 0 A (D) 5.77 A

10. If T_a is the torque and I_a, the armature current for a DC series motor, which of the following relation is valid, after core saturation?

(A) $T_a \alpha I_a^2$ (B) $T_a \alpha = \frac{1}{(I_a)^2}$

(C) $T_a \alpha \frac{1}{I_a}$ (D) $T_a \alpha I_a$

11. The permissible flux density of cold rolled grain oriented steel used for transformer core is around :

(A) 1.7 wb/m² (B) 2.7 wb/m²
(C) 3.5 wb/m² (D) 0.5 wb/m²

12. The nameplate of an energy meter reads '1 KWh = 15,000 revolutions'. If the meter completes 150 revolutions during 50 seconds, what is the power in the circuit?

(A) 100 W (B) 720 W
(C) 600 W (D) 1000 W

13. An ammeter with full scale deflection current of 100 μA (micro ampere) and internal resistance of 100 Ω is required to measure a maximum current of 10 mA. The shunt resistance value is :

(A) 1.10 Ω (B) 1.01 Ω
(C) 1.11 Ω (D) 1.00 Ω

14. If the moving coil of a voltmeter consists of 100 turns around on a square former which has a length of 30 mm and flux density in the air gap is 0.09 wb/m². The deflecting torque on the coil when carrying a current of 10 mA is :

(A) 27×10^{-6} Nm (B) 8.1×10^{-6} Nm
(C) 2.7×10^{-6} Nm (D) 81×10^{-6} Nm

15. A 5 A, 230 V meter on full load, unity power factor test makes 72 revolutions in 360 seconds. If the normal disc speed is 600 rev/KWh, what is the percentage error?

(A) 0.12% (B) 1.2%
(C) 0.434% (D) 4.17%

16. In a moving iron instrument, the deflection torque, T_d is :

(A) Directly proportional to square of current
(B) Inversely proportional to square of current
(C) Directly proportional to current
(D) Inversely proportional to current

17. Inductance affects the direct current (d.c.) flow :

(A) only at the time of turning off
(B) only at the time of turning on
(C) at the time of turning on and off
(D) at all the time of operation

18. For a sine wave with peak value E_{max}, the average value is :

(A) $0.636\ E_{max}$
(B) $0.707\ E_{max}$
(C) $0.434\ E_{max}$
(D) $1.414\ E_{max}$

19. The ratio of starting torque to full load torque is least in :

(A) DC series motor
(B) DC shunt motor
(C) DC compound motor
(D) None of the above

20. The iron core from an iron-cored coil is removed so that it becomes air-cored. The inductance of the coil :

(A) remains the same
(B) becomes zero
(C) decreases
(D) increases

21. The forbidden energy band gap for Germanium is :

(A) 0.12 eV
(B) 0.32 eV
(C) 0.72 eV
(D) 7.2 eV

22. When the reverse bias is applied to a junction diode :

(A) The minority carrier current is increased
(B) The majority carrier current is increased
(C) The potential barrier is lowered
(D) The potential barrier is increased

23. In a full-wave rectifier which uses two ideal diodes, the approximate relationship are :

(A) $V_{dc} = \frac{V_m}{\pi}, PIV = 2V_m$
(B) $V_{dc} = \frac{2V_m}{\pi}, PIV = 2V_m$
(C) $V_{dc} = \frac{2V_m}{\pi}, PIV = V_m$
(D) $V_{dc} = \frac{V_m}{\pi}, PIV = V_m$

24. A forward biased silicon diode when carrying a negligible current has a voltage drop of 0.65 V. When the current through the diode is increased to 1A, it dissipates 500 mW. The ON-resistance of the diode is :

(A) 0.325 Ω
(B) 0.5 Ω
(C) 0.65 Ω
(D) 0.77 Ω

25. Which of the following statement is correct for the basic transistor configurations?
(A) CB configuration has low input impedance and a low current gain
(B) CC configuration has low output impedance and a high voltage gain
(C) CE configuration has very poor voltage gain but very high input impedance
(D) The current gain of CB configuration is higher than the current gain of CC configuration

26. A Bipolar Junction transistor is said to be operating in saturation region if
(A) Emitter junction is forward biased and collector junction is reverse biased
(B) Emitter junction is reverse biased and collector junction is forward biased
(C) Both the junctions are forward biased
(D) Both the junctions are reverse biased

27. Pinch – off voltage of a JFET is :
(A) The gate-to-source voltage at which the drain current starts to saturate
(B) The drain-to-source voltage at which the drain current becomes zero
(C) The channel-to-gate voltage at which the drain current becomes zero
(D) The channel-to-gate reverse bias voltage at which the drain current starts to saturate

28. The best material for the gate region construction of a MOSFET is :
(A) High purity silicon
(B) High purity silica
(C) Epitaxial grown silicon
(D) Heavily doped polycrystalline silicon

29. The common-emitter short circuit current gain β of a BJT :
(A) Is a monotonically increasing function of I_c
(B) Is a monotonically decreasing function of I_c
(C) Increases with I_c for low values of I_c, reaches a maximum and then decreases with further increase in I_c
(D) Is not a function of I_c

30. For full-wave rectification, a four-diode bridge rectifier is claimed to have the following advantages over a two-diode circuit :
(1) Less expensive transformer
(2) Smaller size transformer and
(3) Suitability for higher voltage application
Of these
(A) Only (1) and (2) are true
(B) Only (1) and (3) are true
(C) Only (2) and (3) are true
(D) (1), (2) and (3) are true

31. A 1 MHz sinusoidal carrier wave is amplitude modulated by a sine wave of period 100 μs. Which of the following frequencies will not be present in the modulated output signal?
(A) 990 KHz
(B) 1000 KHz
(C) 1010 KHz
(D) 1020 KHz

32. Two non-inverting amplifiers, one having a unity gain and the other having a gain of 10, are made using identical operational amplifiers. As compared to the unity gain amplifier, the amplifier circuit with gain 10 has :
(A) Less negative feedback
(B) Greater input impedance
(C) More bandwidth
(D) None of these

33. The image frequency of the AM super heterodyne receiver when it is tuned to receive a radio station operating at 628 KHz is :
(A) 1538 KHz
(B) 1256 KHz
(C) 1083 KHz
(D) 855.5 KHz

34. A 741 type op-amp has a gain bandwidth product of 1 MHz. A non-inverting amplifier using this op-amp and having a voltage gain of 20 dB will exhibit a –3dB bandwidth of :
(A) 50 KHz
(B) 100 KHz
(C) $\frac{1000}{17}$ KHz
(D) $\frac{1000}{70.7}$ KHz

35. How many number of NOR gates are required to realise an AND function?
(A) 2
(B) 3
(C) 4
(D) 5

36. Simplified form of the logic expression :
$(X + Y + Z)(X + \overline{Y} + Z)(X + \overline{Y} + \overline{Z})$
(A) X
(B) $XY + \overline{Z}$
(C) $X + \overline{Y}Z$
(D) $\overline{X}Y + \overline{Z}$

37. The C – band is :
(A) 1 to 2 GHz
(B) 2 to 4 GHz
(C) 4 to 8 GHz
(D) 8 to 12 GHz

38. If D is the distance between two co-channel cells and R is the cell radius, then D/R is known as :
(A) Co-channel interference reduction factor
(B) Adjacent channel interference reduction factor
(C) Adjacent and co-channel interference reduction factor
(D) None of these

39. The cell using different carrier frequencies in a cluster is :
(A) Co-channel cell
(B) Adjacent cell
(C) Micro cell
(D) Macro cell

40. Which of the following is the correct statement in connection with satellite communication?
(A) A satellite is stationary in the outer - space
(B) Co-located earth stations are used for frequency diversity
(C) Satellites are allocated so that it is impossible for two earth stations not to face the same satellite
(D) A satellite earth station must have as many receiver chains as there are carriers transmitted to it

41. Two forces of equal magnitude 'P' act at an angle 'θ' to each other. Their resultant will be :

(A) $2P\sin\frac{\theta}{2}$ (B) $2P\cos\frac{\theta}{2}$

(C) $P\cos\frac{\theta}{2}$ (D) $P\sin\frac{\theta}{2}$

42. The unit of energy in SI system of units is :

(A) watt (B) dyne

(C) joule (D) kg-m

43. The moment of inertia of a thin disc of mass 'm' and radius 'r', about an axis passing through its centre of gravity and perpendicular to the plane of the disc is :

(A) $0.5\ mr^2$ (B) mr^2

(C) $0.25\ mr^2$ (D) $2\ mr^2$

44. The ratio of limiting friction to the normal reaction between the two bodies is defined as :

(A) Sliding friction (B) Angle of friction

(C) Friction of resistance (D) Coefficient of friction

45. The loss of kinetic energy during the impact of collision of two inelastic bodies (mass = m_1, m_2, velocities = u_1, u_2) is given by :

(A) $\frac{m_1 m_2}{(m_1+m_2)}(u_1-u_2)^2$ (B) $\frac{m_1 m_2}{2(m_1+m_2)}(u_1-u_2)^2$

(C) $\frac{m_1 m_2}{2(m_1+m_2)}(u_1-u_2)$ (D) $\frac{m_1 m_2}{2(m_1-m_2)}(u_1-u_2)^2$

46. The maximum deflection at the centre of a simply supported beam of length 'l' with a uniformly distributed load w/unit length is given by :

(A) $\frac{5wl^3}{192\,EI}$ (B) $\frac{5wl^3}{384\,EI}$

(C) $\frac{5wl^4}{384\ EI}$ (D) $\frac{5wl^4}{192\,EI}$

47. If the momentum of a given body is doubled, its kinetic energy will :

(A) Increase by four times (B) Increase by two times

(C) Increase by eight times (D) Gets halved

48. For a given velocity of projectile, the horizontal range will be maximum when angle of projection with the horizontal is :

(A) 45° (B) 30°

(C) 60° (D) 90°