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Question Booklet Series

Question Booklet **D**

Paper—V

ELECTRICAL ENGINEERING

Time Allowed : 1 Hour **(Objective)** **Maximum Marks : 100**

Read the following instructions carefully before you begin to answer the questions.

IMPORTANT INSTRUCTIONS

1. This Question Booklet contains **50** questions in all.
2. **All** questions carry equal marks.
3. Attempt **all** questions.
4. **Immediately after commencement of the examination, you should check up your Question Booklet and ensure that the Question Booklet Series is printed on the top right-hand corner of the Booklet. The Booklet contains 11 printed pages and no page or question is missing or unprinted or torn or repeated. If you find any defect in this Booklet, get it replaced immediately by a complete Booklet of the same series.**
5. You must write your Roll Number in the space provided on the top of this page. Do not write anything else on the Question Booklet.
6. An Answer Sheet will be supplied to you separately by the Invigilator to mark the answers. **You must write your Name, Roll No. and other particulars on the first page of the Answer Sheet provided, failing which your Answer Sheet will not be evaluated.**
7. You will encode your **Roll Number** and the **Question Booklet Series A, B, C or D** as it is printed on the top right-hand corner of this Question Booklet with Black/Blue ballpoint pen in the space provided on **Page-2** of your Answer Sheet. **If you do not encode or fail to encode the correct series of your Question Booklet, your Answer Sheet will not be evaluated correctly.**
8. Questions and their responses are printed in English only in this Booklet. Each question comprises **four** responses—(A), (B), (C) and (D). You are to select ONLY ONE correct response and mark in your Answer Sheet. In case you feel that there are more than one correct response, mark the response which you consider the best. In any case, choose ONLY ONE response for each question. Your total marks will depend on the number of correct responses marked by you in the Answer Sheet.
9. In the Answer Sheet, there are **four** brackets—(A), (B), (C) and (D) against each question. To answer the questions you are to **mark with Black/Blue ballpoint pen** ONLY ONE bracket of your choice for each question. Select one response for each question in the Question Booklet and mark in the Answer Sheet. If you mark more than one answer for one question, the answer will be treated as wrong. **Any erasure or change is not allowed.**
10. You should not remove or tear off any sheet from the Question Booklet. You are not allowed to take this Question Booklet and the Answer Sheet out of the Examination Hall during the examination. **After the examination has concluded, you must hand over your Answer Sheet to the Invigilator.** Thereafter, you are permitted to take away the Question Booklet with you.
11. Failure to comply with any of the above instructions will render you liable to such action or penalty as the Commission may decide at their discretion.

SEAL

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1. The electric field intensity due to surface charge distribution is given by

(A) $\int \frac{\rho_l dl}{4\pi\varepsilon_0 |r|^2} \hat{a}_r$

(B) $\int \frac{\rho_s ds}{4\pi\varepsilon_0 |r|^2} \hat{a}_r$

(C) $\iint \frac{\rho_s ds}{4\pi\varepsilon_0 |r|^2} \hat{a}_r$

(D) $\iiint \frac{\rho_v dv}{4\pi\varepsilon_0 |r|^2} \hat{a}_r$

2. The principle of Hall effect is used in the construction of which one of the following?

(A) Ammeter

(B) Voltmeter

(C) Galvanometer

(D) Gaussmeter

3. Hysteresis loss and eddy current loss are proportional to

(A) f and f^2 respectively

(B) f and f^3 respectively

(C) f^2 and f respectively

(D) f^2 and f^3 respectively

4. Two resistances R_1 and R_2 are connected in series. R_1 and R_2 have the following ratings :

$R_1 = 1000\,\Omega \pm 5\%$; $R_2 = 200\,\Omega \pm 5\%$

Calculate the percentage of limiting error.

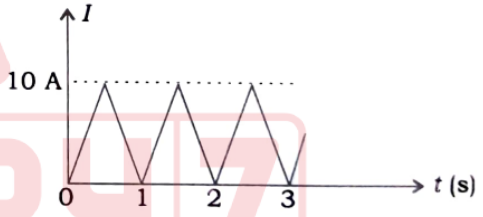
(A) $\pm 10\%$

(B) $+5\%$

(C) $\pm 25\%$

(D) $\pm 5\%$

5. The current having the waveform shown in the figure below is flowing in a resistance of 10 Ω :



The average power is

(A) 1000 W

(B) $\frac{1000}{2}$ W

(C) $\frac{1000}{3}$ W

(D) $\frac{1000}{4}$ W

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6. [illegible] iezoelectric type [illegible] has [illegible] m/s. The transducer [illegible] subjected to [illegible] constant acceleration [illegible] g. The [illegible] state output [illegible] the transducer will be

(A) zero

(B) [illegible]

(C) [illegible]

(D) [illegible]

7. The polarization in a solid dielectric is related to the electric field $\vec{E}$ and the electric flux D according to which one of the following equations?

(A) $\vec{E} = \varepsilon_0 \vec{D} + P$

(B) $D = \varepsilon_0 (E + P)$

(C) $D = \varepsilon_0 \vec{E} + \vec{P}$

(D) $E = D + \varepsilon_0 \vec{P}$

8. The sensitivity of LVDT is mainly due to

(A) magnetic shielding of the core

(B) exact cancellation of secondary voltages

(C) permeability of the core

(D) insulation used in the winding

9. Attenuation and p[illegible] [illegible] received [illegible] of telemetering are [illegible] important [illegible]

(A) length of the cable used

(B) impedance of the cable

(C) mode of data transfer

(D) All of the ab[illegible]

10. When two-wattmeter method of measurement of power used to measure power in a balanced three-phase circuit, if the wattmeter readings are zero and positive maxim respectively, then

(A) the power consumed in the circuit is zero

(B) the power factor of the circuit is zero

(C) the power factor is unity

(D) the power factor is 0·5 lagging

11. Fermi level for extrinsic semiconductor depends on

(A) donor element

(B) impurity concentration

(C) temperature

(D) All of the above

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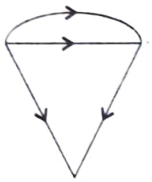
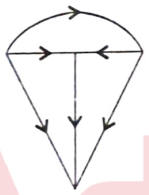
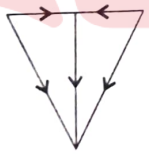
12. The incident matrix of a graph is given below :

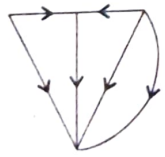
	a	*b*	*c*	*d*	*e*	*f*
1	+1	0	+1	0	0	+1
2	−1	−1	0	+1	0	0
3	0	+1	0	0	+1	−1
4	0	0	−1	−1	−1	0

The corresponding graph is

(A) 

(B) 

(C) 

(D) 

13. The impulse response of the transfer function 1 is

(A) an impulse function

(B) a step function

(C) a pulse function

(D) Cannot be determined

14. The technique of adding a precise amount of time between the trigger point and the beginning of the scope sweep in a CRO is known as

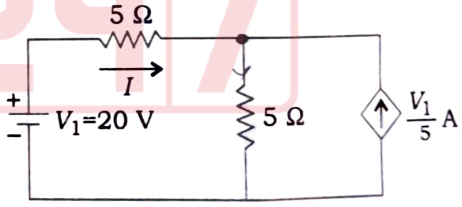
(A) free running sweep

(B) delayed sweep

(C) triggered sweep

(D) non-sawtooth sweep

15. The dependent current source shown in the figure below



(A) delivers 80 W

(B) absorbs 80 W

(C) delivers 40 W

(D) absorbs 40 W

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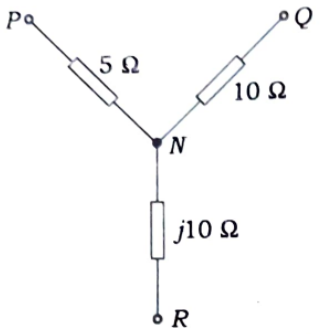
16. In the delta equivalent of the given star-connected circuit, Z_{QR} is equal to



(A) 40 Ω

(B) $(20 + j\,10)\,\Omega$

(C) $\left(5 + j\frac{10}{3}\right)\Omega$

(D) $(10 + j\,30)\,\Omega$

17. A circuit draws a current I when a single-phase a.c. voltage V is applied to it. If the power factor is $\cos\phi$, then the dimensions of $VI\cos\phi$ would be

(A) $M^1L^3T^{-2}$

(B) $M^1L^2T^3$

(C) $M^1L^3T^3$

(D) $M^1L^2T^{-3}$

18. The point form of Maxwell's first equation for time-varying field is

(A) $\vec{\nabla} \cdot D = \rho$

(B) $\vec{\nabla} \times D = \rho$

(C) $\vec{\nabla} \cdot D = J + \frac{\partial D}{\partial t}$

(D) $\vec{\nabla} \cdot D = 0$

19. For a lossy transmission line, the characteristic impedance does ***not*** depend on

(A) the operating frequency of the line

(B) the conductivity of the conductor

(C) the conductivity of the dielectric separating the conductor

(D) the length of the line

20. If a wire is placed parallel to the lines of force in a magnetic field and a current flows in the wire, then

(A) the wire will experience a force in the direction of the magnetic field

(B) the wire will not experience any force at all

(C) the wire will experience a force in the direction opposite to the field .

(D) it will experience a force in the direction perpendicular to the lines of force

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21. Which one of the following equations is ***not*** Maxwell's equation for a static electro-magnetic field in a linear homogeneous medium?

(A) $\vec{\nabla} \cdot B = 0$

(B) $\vec{\nabla} \times D = 0$

(C) $\oint B \cdot dl = (\mu_0 / 4\pi) I$

(D) $\vec{\nabla} \cdot A = \mu_0 J$

22. Consider the following statements for piezoelectric materials :

1. All piezoelectric materials are ferroelectric materials also.
2. Piezoelectric materials have high value of dielectric constant.

Which of the above statements is/are correct?

(A) 1 only

(B) 2 only

(C) Both 1 and 2

(D) Neither 1 nor 2

23. For a given dielectric with increase in temperature, the ionic polarizability

(A) increases

(B) decreases

(C) remains same

(D) fluctuates

24. The conduction current density in a conducting medium is given by

(A) $J = \sigma E$

(B) $J = \sigma / E$

(C) $J = E / \sigma$

(D) $J = \sigma^2 / E$

25. A charge q is located at the centre of a cube. The electric flux through any face is

(A) $\frac{4\pi q}{6(4\pi\varepsilon_0)}$

(B) $\frac{\pi q}{6(4\pi\varepsilon_0)}$

(C) $\frac{q}{6(4\pi\varepsilon_0)}$

(D) $\frac{2\pi q}{6(4\pi\varepsilon_0)}$

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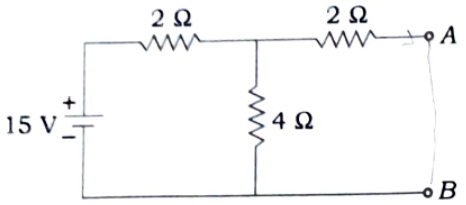
26. In the following circuit, the values of Norton's current I_N and Norton's resistance R_N across AB are



(A) 3 A, $\frac{10}{3}\ \Omega$

(B) 10 A, 4 Ω

(C) 1·5 A, 6 Ω

(D) 1·5 A, 4 Ω

27. The average drift velocity v_d of electrons in a metal is related to electric field E and collision time τ as

(A) $v_d = -\frac{Q_e E \tau}{m_e}$

(B) $v_d = -m_e Q_e \tau$

(C) $v_d = -\frac{m_e Q_e \tau}{2E}$

(D) $v_d = -\frac{Q_e E \tau}{2m_e}$

28. With increase in temperature, the magnetic susceptibility of a ferromagnetic material will

(A) increase

(B) decrease

(C) increase initially and then decrease

(D) remain constant

29. The Poynting vector P is equal to

(A) $E \cdot H$

(B) $E \times H$

(C) E / H

(D) H / E

30. The electronic polarizability of an inert gas atom is proportional to which one of the following? (R is the radius of the atom)

(A) R

(B) R^2

(C) R^3

(D) $\sqrt{R}$

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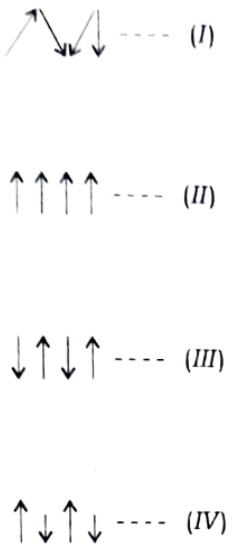
31. The following figures give the schematic arrangements of spins of four different types of magnetic materials :



The ferromagnetic and ferrimagnetic materials refer to the arrangements

(A) *I* and *II* respectively

(B) *II* and *III* respectively

(C) *I* and *III* respectively

(D) *II* and *IV* respectively

32. The transmission coefficient in terms of intrinsic impedance η is expressed as (where η_1 and η_2 are intrinsic impedances of two mediums)

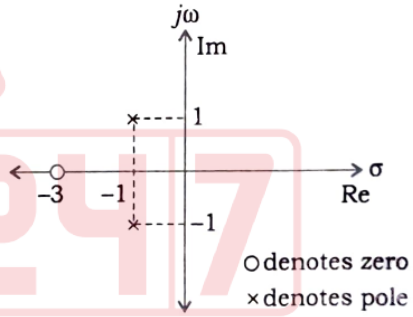
(A) $\tau_E = \dfrac{\eta_1}{\eta_1 + \eta_2}$

(B) $\tau_E = \dfrac{\eta_2}{\eta_1 + \eta_2}$

(C) $\tau_E = \dfrac{2\eta_2}{\eta_1 + \eta_2}$

(D) $\tau_E = \dfrac{2\eta_1}{\eta_1 + \eta_2}$

33. The driving-point impedance $Z(s)$ of a network has a pole-zero location as shown in the given figure :



If $Z(0) = 3$, then $Z(s)$ is

(A) $Z(s) = \dfrac{3(s+3)}{s^2+2s+3}$

(B) $Z(s) = \dfrac{2(s+3)}{s^2+2s+2}$

(C) $Z(s) = \dfrac{3(s-3)}{s^2-2s-2}$

(D) $Z(s) = \dfrac{2(s-3)}{s^2-2s-3}$

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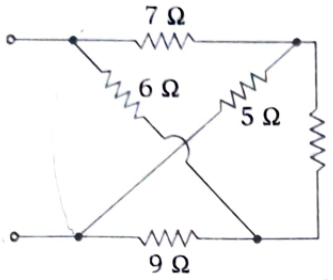
34. In the lattice network, the value of R_L for the maximum power transfer to it is



(A) 6·67 Ω

(B) 9 Ω

(C) 6·52 Ω

(D) 8 Ω

35. The gauge factor of a strain gauge is defined as the ratio of per unit change in the

(A) conductivity to per unit change in the applied force acting on the element

(B) resistance to per unit change in the length of the element

(C) stress to per unit change in the strain of the element

(D) current to per unit change in the length of the element

36. Current $I(t) = 2e^{-2(t-3)}\,u(t-3)$ A for $t > 0$ and voltage $V(t)$ is given as $2\delta(t-3)$. The circuit components are

(A) R and C

(B) R and L

(C) L and C

(D) R only

37. A short-circuit admittance matrix of a two-port network is

$$\begin{bmatrix} 0 & -\frac{1}{2} \\ \frac{1}{2} & 0 \end{bmatrix}$$

The two-port network is

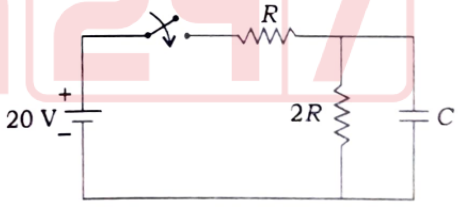
(A) non-reciprocal and passive

(B) non-reciprocal and active

(C) reciprocal and passive

(D) reciprocal and active

38. The time constant of the network shown in the figure below is



(A) $2RC$

(B) $3RC$

(C) $\frac{RC}{2}$

(D) $\frac{2RC}{3}$

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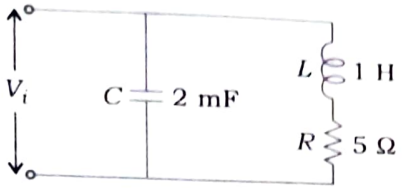
39. Consider the circuit as shown in the figure below :



The Q-factor of the inductor is

(A) $\sqrt{20}$

(B) $\sqrt{18}$

(C) $\sqrt{50}$

(D) $\sqrt{49}$

40. A pitot static tube is used for measuring the velocity of a gas flowing in a duct. The velocity is proportional to

(A) the square root of the total pressure measured by the tube

(B) the total pressure measured by the tube

(C) the difference between the total and static pressures

(D) the square root of difference between the total and static pressures

41. Which bridge is used to determine frequency?

(A) Anderson bridge

(B) De Sauty's bridge

(C) Wien's bridge

(D) Campbell's bridge

42. The energy gap of a super-conductor

(A) is independent of temperature

(B) increases with temperature

(C) is maximum at critical temperature

(D) is minimum at critical temperature

43. The time-independent electric field intensity is conservative in nature. Which of the following is true to satisfy this?

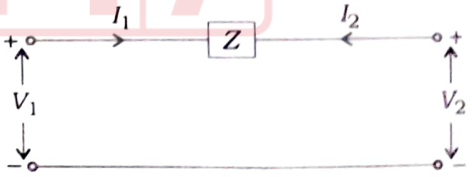
(A) $\nabla \times E = 0$

(B) $\nabla \cdot E = 0$

(C) $\nabla \times E \neq 0$

(D) $\nabla \cdot E \neq 0$

44. Which one of the following parameters does ***not*** exist for the two-port network shown in the figure below?



(A) h

(B) y

(C) z

(D) None of the above

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45. The minimum change in the measured variable which produces an effective response of the instrument is known as

(A) deviation

(B) drift

(C) resolution

(D) dead zone

46. For a given frequency, the deflecting torque of an induction ammeter is directly proportional to

(A) $(\text{current})^2$

(B) $(\text{current})^3$

(C) $\sqrt{\text{current}}$

(D) current

47. Which of the following potentials does ***not*** satisfy Laplace's equation?

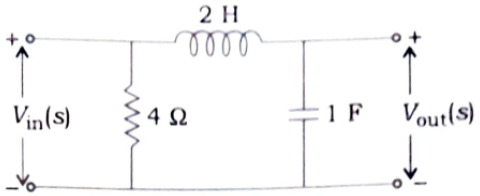
(A) $V = 2x + 5$

(B) $V = \frac{10}{r}$

(C) $V = 10xy$

(D) $V = r\cos\phi$

48. The voltage transfer function of the network shown in the figure below is



(A) $\frac{1}{1+2s}$

(B) $1+4s$

(C) $6-s$

(D) $\frac{1}{1+2s^2}$

49. The minimum value of input which is necessary to cause a detectable change from zero output is called

(A) least count

(B) resolution

(C) threshold

(D) drift

50. Which of the following meters has the lowest pressure drop for a given range of flow?

(A) Orifice meter

(B) Venturi meter

(C) Flow nozzle meter

(D) Rotameter

* * *