10/CME/M–2025-09

Question Booklet

ELECTRICAL ENGINEERING

Paper – V

Booklet Serial No.

3640147

Booklet Series

I

Candidate's Roll Number

Time Allowed : 01 Hour

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. An Answer Sheet has been supplied inside the question booklet to mark the answers. **You must write your Roll Number and encode it and write other particulars in the space provided in the Answer Sheet, failing which your Answer Sheet will not be evaluated.**
5. **Immediately after commencement of the examination, you should check up your Question Booklet and attached answer sheet and ensure that the Question Booklet Series is printed on the top left-hand corner of the Booklet and the series encoded in answer sheet are same. Also please check that the Booklet contains 12 printed pages including two pages (Page Nos. 11 and 12) for Rough Work and no page or question is missing or unprinted or torn or repeated or question booklet and answer sheet have different series. If you find any defect in this Booklet and attached answer sheet, get it replaced immediately by a complete Booklet with OMR sheet of the same series.**
6. 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.
7. Questions and their responses are printed in English version in this Booklet. Each question comprises of **four** responses — (A), (B), (C) and (D). You are to select ONLY ONE correct response and mark it 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.
8. In the Answer Sheet, there are **four** circles — Ⓐ, Ⓑ, Ⓒ and Ⓓ against each question. To answer the questions, you are to mark with **Black/Blue ink ballpoint pen ONLY ONE circle** of your choice for each question. Select only one response for each question and mark it in your Answer Sheet. If you mark more than one circle for one question, the answer will be treated as wrong. **Use Black/Blue ink ballpoint pen only to mark the answer in the Answer Sheet. Any erasure or change is not allowed.**
9. 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.
10. 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.
11. Candidates must assure before leaving the Examination Hall that their Answer Sheets will be kept in Self Adhesive LDPE Bag and completely packed/sealed in their presence.

1. An atom of polarizibility α is placed in a homogeneous field E. The energy stored in a polarized atom is equal to which value ?

(A) $\frac{\alpha E^2}{4}$

(B) $\frac{\alpha^2 E^2}{2}$

(C) $\frac{1}{2}\alpha E^2$

(D) αE^2

2. When a source is delivering maximum power to a load, the efficiency of the circuit is always

(A) 75 %

(B) 50 %

(C) 100 %

(D) None of the above

3. Characteristics impedance of a transmission line is 50 Ω. Input impedance of the open circuited line is 100 + j150 Ω. When the transmission line is short circuited, then value of the input impedance is

(A) 100 + j150 Ω

(B) 7.69 + j11.54 Ω

(C) 7.69 – j11.54 Ω

(D) 50 Ω

4. A 100 μA ammeter has an internal resistance of 100 Ω. For extending its range to measure 1100 μA, the shunt resistance required is

(A) 9.09 Ω

(B) 1100 Ω

(C) 1000 Ω

(D) 10 Ω

5. In a series RLC circuit, if the resistance R and inductance L are constants but capacitance C decreases, the correct statement(s)

(A) Damping ratio decreases

(B) Natural frequency increases

(C) Peak overshoot is unaffected

(D) Time constant remains unchanged

6. Which of the following materials requires the lowest value of the magnetic field strength to magnetize ?

(A) Silver

(B) Tungsten

(C) Sodium Chloride

(D) Nickel

7. If the electric field intensity is given by $E = xa_x + ya_y + za_z$ V/m. The potential difference between point A(3,0,0) and B(1,2,3) is

(A) 2.0 V

(B) –5 V

(C) 1 V

(D) –2.5 V

8. Divergence of a vector $P = x^2yza_x + xza_z$ is

(A) 2xyz + y

(B) 2xyz + x

(C) 2xy + z

(D) xyz + x

9. By connecting a fixed resistance of suitable value across a thermistor cause

(A) Decrease sensitivity, improve linearity

(B) Increase sensitivity, improvement of linearity

(C) Compensate self-heating effect

(D) Decrease sensitivity, reduction of linearity

10. A confidence interval level is 0.95, then the values lying outside the confidence interval are

(A) 1 in 20

(B) 1 in 100

(C) 1 in 1000

(D) 1 in 5

11. Solder is an alloy of

(A) Nickel, copper and zinc

(B) Tin and lead

(C) Copper and aluminium

(D) Silver, copper and lead

12. A dynamometer type wattmeter respond to the

(A) Average value of reactive power

(B) Average value of active power

(C) Peak value of apparent power

(D) Average value of apparent power

13. Which of the following functions does ***not*** satisfy the wave equation ?

(A) $\cos(y + t)$

(B) $(y + t)$

(C) $(y + x)$

(D) $\cos^2(y + t)$

14. The penetration depth of electromagnetic wave in a medium having conductivity σ at 1 MHz frequency is 24 cm. The penetration depth at 9 MHz frequency is

(A) 216 cm

(B) 2.666 cm

(C) 8 cm

(D) 6.25 cm

15. For a linear time invariant system initially at rest when subjected to a unit step input give response $c(t) = te^{-1}$ $(t > = 0)$. The transfer function of the system is

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

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

(C) $\frac{1}{s(s+1)}$

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

16. At Neel temperature

(A) Susceptibility is maximum

(B) Permeability is maximum

(C) Susceptibility is minimum

(D) Permeability is minimum

17. Efficiency of a parabolic disc antenna having 1 m diameter at 20 GHz is 75%. The gain of the antenna is

(A) 45 dB

(B) 25 dB

(C) 35 dB

(D) 15 dB

18. Theorem states that any linear, non linear, passive, active, time varying and time invariant, the addition of instantaneous power is zero called

(A) Tellegen's theorem

(B) Reciprocity theorem

(C) Thevenin's theorem

(D) Compensation theorem

19. The unit of the ratio $\frac{L}{R}$, where L and R are the inductance and resistance associated with an electric circuit, is the following

(A) Hertz

(B) Second

(C) Henry-Ohm

(D) Unit less

20. By saying that the electrostatic field is conservative we don't mean that

(A) Its curl is identically zero

(B) The work done in a closed path inside the field is zero

(C) The potential difference between any two point is zero

(D) It is the gradient of a scalar potential

21. The voltmeter of choice for measuring the voltage of a 100 V dc source is

(A) 100 V, 2 mA

(B) 100 V, 10 kΩ/V

(C) 100 V, 1 kΩ/V

(D) 100 V, 1 mA

22. Iron has the relative permeability

(A) 3000

(B) 4000

(C) 5000

(D) 2000

23. Bragg's condition for diffraction is given by

(A) $2 \sin\theta = \lambda$

(B) $2 \sin\theta = n\lambda$

(C) $a \sin\theta = n\lambda$

(D) $2d \sin\theta = n\lambda$

24. For polar materials dielectric constant is normally

(A) Close to zero

(B) Infinite

(C) High

(D) Close to unity

25. A Schering bridge used for testing a porcelain insulator should be shielded by a metallic screen so that

(A) Earth's magnetic field does not affect measurement results

(B) To protect the operator for conducting experiment

(C) External electrostatic field does not affect measurement results

(D) No crack develops during testing

26. Norton's theorem states that a complex network connected to a load can be replaced with an equivalent impedance

(A) in series with a current source

(B) in series with a voltage source

(C) in parallel with a current source

(D) in parallel with a voltage source

27. A carbon resistor used in electric circuit contains

(A) Finely divided carbon black

(B) Carbon crystals

(C) Pulverized coal

(D) Solid carbon granules

28. Relation between electric susceptibility (χ_e) and relative permittivity (ε_r) is

(A) $\chi_e = \varepsilon_r + \varepsilon_0$

(B) $\chi_e = \varepsilon_r - 1$

(C) $\chi_e = \varepsilon_r / \varepsilon_0$

(D) $\chi_e = \varepsilon_r \varepsilon_0$

29. A linear time invariant system has an impulse response e^{3t} for $t > 0$. Its initial condition is zero and the input is e^{2t}, the output for $t > 0$ is

(A) $e^{3t} - e^{2t}$

(B) $e^{3t} + e^{2t}$

(C) e^{2t}

(D) e^{3t}

30. In cylindrical coordinates, the equation $\frac{\partial^2\psi}{\partial\rho^2}+\frac{1}{\rho}\frac{\partial\psi}{\partial\rho}+\frac{\partial^2\psi}{\partial z^2}+10=0$ is called

(A) Laplace's equation

(B) Poisson's equation

(C) Lorenz's equation

(D) Maxwell equation

31. A temperature probe having first order response with a time 2s is given a step input from 100°C to 0°C. The temperature in °C after 5s is

(A) 77.9°C

(B) 0°C

(C) 70.9°C

(D) 50.9°C

32. Two magnetically uncoupled inductive coils having quality factors q_1 and q_2 respectively at a given frequency. Their respective resistances are R_1 and R_2. If two inductive coils are connected in series, the equivalent quality factor for series combination is

(A) $q_1/R_1 + q_2/R_2$

(B) $q_1R_2 + q_2R_1$

(C) $\frac{(q_1R_1+q_2R_2)}{(R_1+R_2)}$

(D) $q_1R_1 + q_2R_2$

33. An advantage of permanent magnet moving coil instrument is that is

(A) has high torque/weight ratio

(B) has low torque/weight ratio

(C) can be used for both A.C. and D.C.

(D) free from friction error

34. The material for making permanent magnets should have

(A) Low retentivity and high coercivity

(B) High retentivity and high coercivity

(C) Low retentivity and low coercivity

(D) High retentivity and low coercivity

35. Which of the following statements is true for a measuring instrument ?

(A) If it is linear, it is sensitive

(B) If it has a digital display, it is accurate

(C) Null method of measurement, offers high input impedance

(D) If it is precise, it is accurate

36. Which of the following is ***not*** a scalar field ?

(A) Light intensity in a drawing room

(B) Humidity of a city

(C) Temperature distribution in a room

(D) Displacement of mosquito in space

37. Hygrometer can be used for the measurement of

(A) Pressure

(B) Temperature

(C) Sound

(D) Humidity

38. The thermocouple that has highest temperature range is

(A) Iron-Chromel

(B) Platinum Rhodium Platinum

(C) Alumel-Chromel

(D) Copper-Constantan

39. The ideal current source has the internal resistance

(A) infinity

(B) small enough finite

(C) variable

(D) zero

40. A strain gauge bridge measures the strain in a cantilever when the gauge is fixed with strain ε, the gauge resistance increases from 110 Ω to 110.52 Ω. If the gauge factor is 2.0, then the strain in the cantilever will be

(A) 3.36×10^{-3}

(B) 2.56×10^{-3}

(C) 2.80×10^{-3}

(D) 2.36×10^{-3}

41. A bar magnet with coercivity 5×10^3 A/m is desired to demagnetized by inserting it inside a 10 cm long solenoid having 500 turns. Current required to demagnetize is

(A) 1.0 A

(B) 2.0 A

(C) 2.5 A

(D) 1.5 A

42. To measure 2 V, if one select 0 –100 V range voltmeter which is accurate within ± 1%, the error in the measurement of the voltage may be

(A) ± 0.02%

(B) ± 1%

(C) ± 2%

(D) ± 50%

43. The damping ratio of a series RLC circuit is

(A) $\frac{R}{2}\sqrt{\frac{C}{L}}$

(B) $\frac{2L}{R^2C}$

(C) $\frac{2}{R}\sqrt{\frac{L}{C}}$

(D) $\frac{R^2C}{2L}$

44. The electric field on the surface of a perfect conductor is 8 V/m. The conductor is immersed in transformer oil with $\varepsilon = 4\varepsilon_0$. The surface charge density on the conductor is

(A) $\rho = 2.83 \times 10^{-10}$ C/m^2

(B) $\rho = 4.83 \times 10^{-12}$ C/m^2

(C) $\rho = 4$ C/m^2

(D) $\rho = 0$ C/m^2

45. A single channel digital oscilloscope uses a 10 bit 10^7 samples per second analog to digital converter. For 10 kHz sine wave input. The number of samples taken per cycle is

(A) 10^3

(B) 10^4

(C) 10^2

(D) 10^7

46. The average power delivered to a complex impedance (4 – 3j) by an ac current source of amplitude $4\cos(10\pi t + 100)$A is

(A) 32 W

(B) 50 W

(C) 44 W

(D) 45 W

47. The hysteresis loop for the permanent magnet materials is

(A) Tall and narrow

(B) Tall and wide

(C) Short and narrow

(D) Short and wide

48. Where surface $\rho = 1$ and $z = 1$ intersect is

(A) A circle

(B) A semi-infinite plane

(C) A cylinder

(D) An infinite plane

49. In a constant voltage transformer, the output voltage remains constant due to

(A) Input inductor

(B) Saturation

(C) Tapped winding

(D) Capacitor

50. The value of $\int_{-\infty}^{t} f(t)\,\delta(t-\tau)\,d\tau$

(A) f(t)

(B) zero

(C) not defined

(D) none of the above

SPACE FOR ROUGH WORK

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