

28/AE/CME/M-2022-9

Booklet Series

Candidate's Roll Number

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B

Serial No.

200055

Question Booklet

Paper—V

ELECTRICAL ENGINEERING

(Objective)

Time Allowed : 1 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. **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 12 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. If an instrument has cramped scale for larger values, then it follows
 - (A) logarithmic law
 - (B) square law
 - (C) linear law
 - (D) uniform law
 2. The minimum number of single-phase wattmeters needed to measure the total active power in a three-phase, three-wire circuit consisting of three-phase, star-connected unbalanced load is
 - (A) 3
 - (B) 1
 - (C) 2
 - (D) 4
 3. Two wattmeters are used to measure three-phase power in a balanced star-connected load. One of the wattmeters showed negative reading with normal connection. The reason for this may be
 - (A) the power factor of the load is less than 0.5
 - (B) the power factor of the load is zero
 - (C) the power factor of the load is 1.0
 - (D) the power factor of the load is 0.5
 4. A moving-coil ammeter can be used to measure
 - (A) direct and alternating current
 - (B) low-frequency alternating current
 - (C) high-frequency alternating current
 - (D) DC current
 5. Which of the following instruments has the same calibration in AC and DC?
 - (A) Induction type
 - (B) Moving-iron type
 - (C) Moving-coil type
 - (D) Electro-dynamometer type
 6. Two equal sinusoidal voltages of same frequency which have a phase difference of 90° are fed to channels 1 and 2 of an oscilloscope. With voltage, time and all the other settings being the same, what pattern will be observed if the oscilloscope is operated in X-Y mode?
 - (A) Parabola
 - (B) Circle
 - (C) Ellipse
 - (D) Straight line

7. A stable closed Lissajous pattern on an oscilloscope has 5 horizontal and 2 vertical tangencies. If the frequency of horizontal input is 6 kHz, what is the frequency of vertical input?

- (A) 10 kHz
- (B) 12.5 kHz
- (C) 2.4 kHz
- (D) 15 kHz

8. A $4\frac{1}{2}$ digital ammeter is used for current measurements. What is its resolution?

- (A) 0.045%
- (B) 0.01%
- (C) 0.1%
- (D) 0.45%

9. The excitation frequency of an LVDT is 2 kHz. Then what is the limiting value of the maximum frequency of displacement?

- (A) 200 Hz
- (B) 2.5 kHz
- (C) 1.5 kHz
- (D) 2 kHz

10. A thermometer is calibrated from 150 °C to 200 °C. The accuracy specified is $\pm 0.25\%$. Then what is the maximum static error in measurement?

- (A) ± 0.0125 °C
- (B) ± 0.5 °C
- (C) ± 0.375 °C
- (D) ± 0.125 °C

11. A thermocouple temperature indicator has a time constant of 1 s when the reference junction is at room temperature. It is dipped in hot bath of 120 °C. If the room temperature is 20 °C, what will be the reading of the thermocouple type temperature indicator after 1 s?

- (A) 98.2 °C
- (B) 80 °C
- (C) 63.2 °C
- (D) 100 °C

12. The desirable properties of transformer core material are

- (A) low permeability and high hysteresis loss
- (B) low permeability and low hysteresis loss
- (C) high permeability and high hysteresis loss
- (D) high permeability and low hysteresis loss

13. The material used for the manufacture of grounding wire is

- (A) galvanized steel
- (B) cast iron
- (C) aluminium
- (D) stainless steel



14. The material used for core of a current transformer should have

- (A) high reluctance and low iron loss
- (B) low reluctance and low iron loss
- (C) high reluctance and high iron loss
- (D) low reluctance and high iron loss

15. The material used for fuse must have

- (A) high melting point and high conductivity
- (B) low melting point and low conductivity
- (C) low melting point and high conductivity
- (D) high melting point and low conductivity

16. GaAs belongs to which category of material?

- (A) Superconductor
- (B) Conductor
- (C) Insulator
- (D) Semiconductor

17. The correct relationship of magnetic susceptibility is

- (A) magnetization \times magnetizing force
- (B) magnetization/magnetizing force
- (C) magnetizing force/magnetization
- (D) magnetization + magnetizing force

18. In which type of material, the dipoles are aligned antiparallel to each other?

- (A) Antiferromagnetic
- (B) Ferromagnetic
- (C) Diamagnetic
- (D) Ferrimagnetic

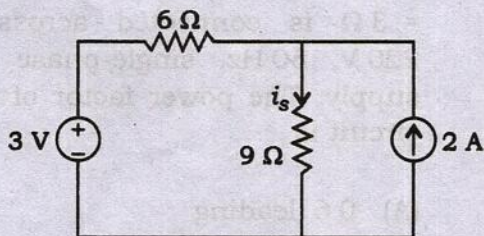
19. The voltage and current in a single-phase AC circuit are given by $(50 + j20)$ V and $(20 + j50)$ A respectively. The power of the circuit can be expressed in complex form as

- (A) $(2500 - j0)$ W
- (B) $(2000 - j2100)$ W
- (C) $(0 - j2500)$ W
- (D) $(2100 - j2000)$ W

20. Which of the following circuits has no transients?

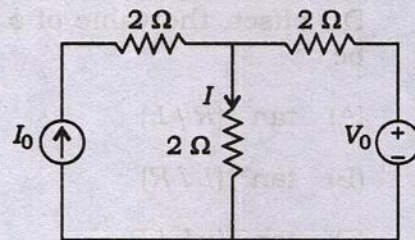
- (A) Circuit consisting of resistance and capacitance
- (B) Pure resistive circuit
- (C) Circuit consisting of resistance, inductance and capacitance
- (D) Circuit consisting of inductance and capacitance

21. The current i_s in the following circuit is



- (A) 1 A
- (B) 0.2 A
- (C) 2 A
- (D) 0.8 A

22. In the circuit below, when $V_0 = 0$ V, $I = 4$ A. Find the current when $V_0 = 20$ V.



- (A) 4 A
- (B) 7 A
- (C) 5 A
- (D) 9 A



23. A series R-C circuit excited by a DC voltage of 10 V has a time constant of τ second. The voltage across the capacitor after one time constant is given as

- (A) $(1 - e^{-1})$ V
- (B) $10(1 - e^{-1})$ V
- (C) $(1 - 10e^{-1})$ V
- (D) $(10 - e^{-1})$ V

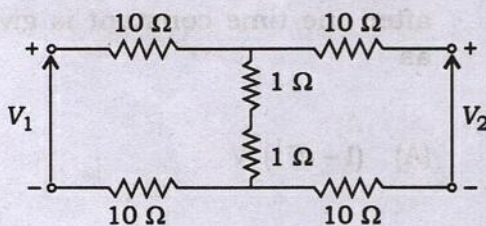
24. Let $v(t) = \sin(\omega t + \phi)$ be the voltage applied to an R - L series circuit with $i(t=0) = 0$. For $t \geq 0$, the resulting $i(t)$ to contain no DC offset, the value of ϕ should be

- (A) $\tan^{-1}(R/L)$
- (B) $\tan^{-1}(L/R)$
- (C) $\tan^{-1}(\omega L/R)$
- (D) $\tan^{-1}(R/\omega L)$

25. Transient response of a system is mainly due to

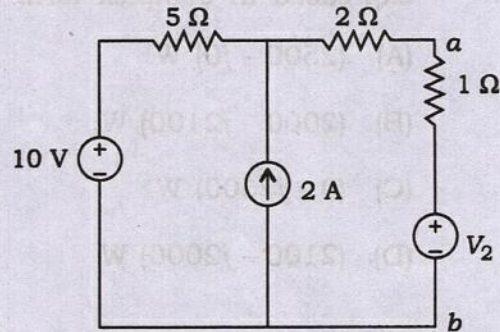
- (A) inertia forces
- (B) internal forces
- (C) stored energy
- (D) friction

26. The input and output driving point impedances of the network shown below are respectively



- (A) 22Ω , 11Ω
- (B) 22Ω , 22Ω
- (C) 22Ω , 2Ω
- (D) 2Ω , 22Ω

27. In the circuit shown below, the internal resistance across the open-circuited terminals (a, b) and Thevenin's voltage between the terminals (a, b) are



- (A) 1Ω and 11 V
- (B) 1.43Ω and 12 V
- (C) 8Ω and 10 V
- (D) 7Ω and 20 V

28. An R - L - C series circuit consisting of $R = 4 \Omega$, inductive reactance = 6Ω and capacitive reactance = 3Ω is connected across a 220 V , 50 Hz , single-phase AC supply. The power factor of the circuit is

- (A) 0.6 leading
- (B) 0.8 lagging
- (C) 0.8 leading
- (D) 0.6 lagging

29. A series R - L - C circuit resonates at 1.5 kHz and consumes 50 W from 50 V AC source operating at resonant frequency. The bandwidth is 0.75 kHz. Then the values of the circuit elements R and L are

- (A) 50 Ω and 16.6 mH
- (B) 2.5 Ω and 1.06 mH
- (C) 50 Ω and 10.6 mH
- (D) 25 Ω and 5.31 mH

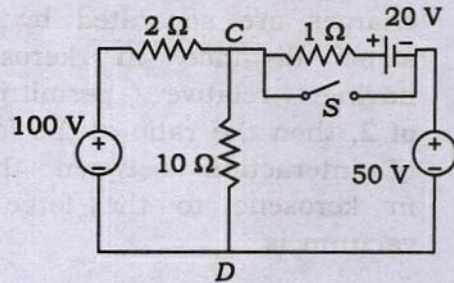
30. In a tank circuit, the peak value of circulating current is given by (where V is the initial voltage to which the capacitor is charged, C is the capacitance of the tank circuit and L is the inductance of the tank circuit)

- (A) $I = V / \sqrt{LC}$
- (B) $I = V \sqrt{C/L}$
- (C) $I = V \sqrt{L/C}$
- (D) $I = V \sqrt{LC}$

31. A coil having a resistance of 8 Ω and inductance of 2 H is switched across a 48 V DC supply. The time constant of the circuit and the final value of current in the circuit are

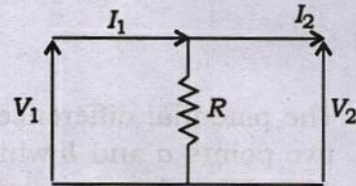
- (A) 0.25 s and 8 A
- (B) 0.4 s and 24 A
- (C) 0.2 s and 4.8 A
- (D) 0.25 s and 6 A

32. In the circuit shown below, the voltage across CD , when the switch S is closed, is



- (A) 50 V
- (B) 150 V
- (C) 70 V
- (D) 100 V

33. The Z parameters of the network shown below are



- (A) $Z_{11} = 2R, Z_{22} = 2R,$
 $Z_{12} = 2R, Z_{21} = 2R$
- (B) $Z_{11} = R, Z_{22} = R,$
 $Z_{12} = R, Z_{21} = R$
- (C) $Z_{11} = 2R, Z_{22} = 2R,$
 $Z_{12} = R, Z_{21} = R$
- (D) $Z_{11} = R, Z_{22} = R,$
 $Z_{12} = 2R, Z_{21} = 2R$



34. Two charges 6×10^{-8} coulomb and 3×10^{-5} coulomb are located 20 cm apart in vacuum. If these charges are separated by the same distance in kerosene having relative permittivity of 2, then the ratio of the force of interaction between them in kerosene to the force in vacuum is
- (A) 0.41
(B) 1.62
(C) 0.5
(D) 0.81
35. The potential difference between two points a and b which are at distances 0.5 m and 0.2 m respectively from a negative charge of 10×10^{-10} coulomb is
- (A) 27 V, point a at a higher potential than point b
(B) 14 V, point b at a higher potential than point a
(C) 27 V, point b at a higher potential than point a
(D) 14 V, point a at a higher potential than point b
36. Two parallel conducting plates 2 cm apart situated in air are connected to a source of constant voltage of 50 kV. The electric field intensity between the plates is
- (A) 25 kV/cm
(B) 50 kV/cm
(C) 200 kV/cm
(D) 100 kV/cm
37. Four positive charges 10^{-9} C each, are located in $x-y$ plane at points (0, 0), (0, 1), (1, 1) and (1, 0) m. Then the electric field and potential at (0.5, 0.5) m is
- (A) 0 and 18 V
(B) 0 and 25.5 V
(C) 0 and 12.5 V
(D) 0 and 51 V
38. Two coupled coils of self-inductances 1.2 H and 0.3 H have a coefficient of coupling of 0.6. Then the mutual inductance between the two coils and the ratio of number of turns in the two coils are
- (A) 2 H and 6
(B) 0.216 H and 4
(C) 0.36 H and 2
(D) 0.6 H and 3

39. The temperature below which certain materials are antiferromagnetic and above which they are paramagnetic, is called
- (A) Weiss
(B) Curie
(C) Neel
(D) transition
40. The current through an inductor of inductance 6 H varies linearly at a rate of 0.5 A/s. What will be the flux linkage in the system after the current has flowed for two seconds?
- (A) 24 Wb-turn
(B) 6 Wb-turn
(C) 12 Wb-turn
(D) 3 Wb-turn
41. In a certain circuit, a flux of 2 Wb is produced by a current of 2 A. If only the linear dimensions of the magnetic circuit are doubled, then for producing the same flux, what is the current required?
- (A) 3 A
(B) 4 A
(C) 1 A
(D) 2 A
42. A coil with 80 turns wound over a ferromagnetic core of relative permeability of 400 has an inductance of 80 mH. If the number of coil turns is doubled and core is replaced by a new ferromagnetic core of relative permeability of 800, then the inductance of the coil in H will be
- (A) 1.60
(B) 0.40
(C) 0.32
(D) 0.64
43. Two coils having 500 and 1000 turns are placed close to each other such that 80% of the flux produced by one coil links the other. If a current of 20 A flowing through the first coil produces a flux of 0.5 mWb, then what is the inductance of the other coil?
- (A) 0.1 H
(B) 0.05 H
(C) 0.02 H
(D) 0.0125 H
44. A 0–20 A ammeter has a guaranteed error of 2% of full-scale deflection. Then what is the limiting error when it reads 5 A?
- (A) 8%
(B) 16%
(C) 10%
(D) 12%

45. An analogue ammeter has a linear scale of 100 divisions. Its full-scale reading is 10 V. What is the resolution of the meter, if one-fourth of a division can be read?

- (A) 0.01
- (B) 0.025
- (C) 0.05
- (D) 0.075

46. A second-order system with zero damping ratio would

- (A) oscillate with decreasing frequency
- (B) not oscillate at all
- (C) oscillate at normal frequency
- (D) oscillate with increasing frequency

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

- (A) remain constant
- (B) increase
- (C) decrease
- (D) increase and then decrease

48. A moving-coil instrument has a resistance of $5\ \Omega$ and gives a full-scale reading of 100 mA. It is desired to use this meter as a voltmeter for a range of 0 to 500 V. The resistance required is

- (A) $5\ \Omega$ in parallel
- (B) $5\ \Omega$ in series
- (C) $4995\ \Omega$ in parallel
- (D) $4995\ \Omega$ in series

49. In an Anderson bridge, unknown inductance is measured in terms of

- (A) known inductance alone
- (B) known inductance and resistance
- (C) known capacitance and resistance
- (D) known resistance alone

50. Which of the following can be measured with the help of piezoelectric crystal?

- (A) Flow
- (B) Temperature
- (C) Acceleration
- (D) Flow rate

SPACE FOR ROUGH WORK

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