

Booklet No. 87130203

**JEEDEC—2018**

**Subject : ELECTRICAL ENGINEERING**

Time : 2 hours

Full Marks : 100

***Instructions***

1. All questions are of objective type having four answer options for each. Only one option is correct. Correct answer will carry full marks 2. In case of incorrect answer or any combination of more than one answer,  $\frac{1}{2}$  mark will be deducted.
2. Questions must be answered on OMR sheet by darkening the appropriate bubble marked A, B, C or D.
3. Use only Black/Blue ball point pen to mark the answer by complete filling up of the respective bubbles.
4. Do not make any stray mark on the OMR.
5. Write question booklet number and your roll number carefully in the specified locations of the OMR. Also fill appropriate bubbles.
6. Write your name (in block letter), name of the examination centre and put your full signature in appropriate boxes in the OMR.
7. The OMRs will be processed by electronic means. Hence it is liable to become invalid if there is any mistake in the question booklet number or roll number entered or if there is any mistake in filling corresponding bubbles. Also it may become invalid if there is any discrepancy in the name of the candidate, name of the examination centre or signature of the candidate vis-a-vis what is given in the candidate's admit card. The OMR may also become invalid due to folding or putting stray marks on it or any damage to it. The consequence of such invalidation due to incorrect marking or careless handling by the candidate will be sole responsibility of candidate.
8. Candidates are not allowed to carry any written or printed material, calculator, docu-pen, log table, any communication device like mobile phones etc. inside the examination hall. Any candidate found with such items will be reported against and his/her candidature will be summarily cancelled.
9. Rough Work must be done on the question paper itself. Additional blank pages are given in the question paper for Rough Work.
10. Hand over the OMR to the invigilator before leaving the Examination Hall.

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**SPACE FOR ROUGH WORK**

1. The dimension of e.m.f. is

(A)  $L^{-2} M^{-1} T^4 I^2$

(B)  $L^2 M^{-1} T^4 I^2$

(C)  $L^{-2} M^{-1} T^4 I^1$

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

2. If two unequal resistances are connected in parallel, value of the equivalent resistance will be

(A) smaller than the small resistance

(B) larger than the large resistance

(C) equal to average of the two resistances

(D) equal to product of the two resistances

3. The electromagnetic energy stored in an inductor having inductance  $L$  and with current  $I$  flowing can be expressed as

(A)  $L I^2$

(B)  $L^2 I$

(C)  $\frac{1}{2} L I^2$

(D)  $\frac{1}{2} L I^3$

4. An open loop system has a gain of 10 and a bandwidth of 90 Hz. When it is converted to a closed loop system, its gain becomes 5. Then bandwidth of the closed loop system will be approximately

(A) 900 Hz

(B) 180 Hz

(C) 50 Hz

(D) 450 Hz

5. Power dissipated in a resistance is 100 W. The current through the resistance is increased by two times. The power dissipation in the resistance will be

(A) 200 W

(B) 50 W

(C) 400 W

(D) 500 W

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6. A wire of length 50 cm moves at right angles to its length at 40 m/s in a uniform magnetic field of  $1\text{Wb/m}^2$ . Calculate the e.m.f. induced in the conductor when the direction of motion is perpendicular to the field
- (A) 100 V (B) 20 V  
(C) 40 V (D) 50 V
7. Which of the following is the analogous quantity for 'mass element' in force-voltage analogy?
- (A) Resistance (B) Capacitance  
(C) Inductance (D) Current
8. A resonating circuit is made by connecting a resistor, inductor and a capacitor in series. If the resonating frequency is 50 Hz and the inductance value is 0.1H, the circuit capacitance will be
- (A)  $\approx 301\ \mu\text{F}$  (B)  $\approx 101\ \mu\text{F}$   
(C)  $\approx 350\ \mu\text{F}$  (D)  $\approx 150\ \mu\text{F}$
9. A commonly used instrument to measure the temperature inside the boiler in a thermal power plant is
- (A) RTD (B) Thermocouple  
(C) Thermostat (D) Pyrometer
10. A thyristor can be modeled
- (A) with two bipolar junction transistors  
(B) with three bipolar junction transistors  
(C) with one diode and two bipolar junction transistors  
(D) with two diodes

11. In a circuit, one lossless inductor is in series with a perfect capacitor and the combination is in parallel with a resistance. A 100 V, 50 Hz source is connected across the combination. What is the r.m.s current flowing through the  $L$ - $C$  branch if  $L=0.1\text{H}$ ,  $C=10$  micro farad and  $R=100$  ohm
- (A)  $\approx 0.35$  A (B)  $\approx 3.5$  A  
(C)  $\approx 35$  A (D) 350 A
12. The current range of a PMMC ammeter can be extended by using
- (A) Shunt (B) CT  
(C) Multiplier (D) PT
13. The expression of total power in two-wattmeter measurement of power for a three-phase balanced load is
- (A)  $W_1 + W_2$  (B)  $W_1 - W_2$   
(C)  $2(W_1 - W_2)$  (D)  $2W_1 - W_2$
14. In a balanced three-phase load connected to 200 V, 50 Hz three-phase supply, the line current is 115.5 A. When the power is measured by two-wattmeter method, one of the wattmeter reads 20 kW and the other 10 kW. The power factor of the load is
- (A) zero (B) unity  
(C) 0.5 (D) 0.866
15. Five cells are connected in series in a row and then four such rows are connected in parallel to feed the current to a resistive load of  $1.25 \Omega$ . Each cell has an e.m.f. of 1.5 V with internal resistance of  $0.2 \Omega$ . The current through the load will be
- (A) 3.33 A (B) 23.33 A  
(C) 5 A (D) 1 A

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16. Three resistances of 12 ohm each are connected in delta. The power delivered to the load for a balanced three-phase power supply is 4000 W. If the delta connected load is transformed to an equivalent star connected load, then power delivered to the load for the same supply system is
- (A) 4000 W (B) 12000 W  
(C) 2000 W (D) 8000 W
17. The hysteresis loss in a d.c. machine takes place in
- (i) armature core  
(ii) pole shoe  
(iii) yoke  
(iv) pole body
- (A) (i) and (ii) (B) (i), (ii) and (iv)  
(C) (ii), (iii) and (iv) (D) (iii) and (iv)
18. The resistance of the current coil of a wattmeter is
- (A) higher than the resistance of voltage coil  
(B) lower than the resistance of voltage coil  
(C) equal to the resistance of the voltage coil  
(D) None of the above
19. The CC amplifier has
- (A) only current gain  
(B) only voltage gain  
(C) both current gain and voltage gain  
(D) no voltage or current gain
20. If the r.m.s. of AC supply voltage applied to the input of a single-phase bridge rectifier is 230 V, the PIV appearing across any diode is
- (A)  $\approx 650\text{V}$  (B)  $\approx 325\text{V}$   
(C)  $\approx 1000\text{V}$  (D)  $\approx 230\text{V}$

21. Number of semiconductor layers of different doping level and type in a thyristor is
- (A) three (B) four  
(C) six (D) two
22. The cycloconverter is a power electronics equipment used as
- (A) DC to AC converter  
(B) AC to AC r.m.s converter  
(C) power frequency changer  
(D) AC to DC converter
23. For a two-input TTL NAND logic gate, if two of the inputs are kept open, the output will give
- (A) Logic low (B) Logic high  
(C) Approximately 5 V (D) No logic state output
24. The current of an a.c. circuit is  $i = 10\cos\left(\omega t - \frac{\pi}{6}\right)$  amps. The current is drawn from an AC voltage source  $v = 10\sin\left(\omega t - \frac{\pi}{6}\right)$ . The average power drawn from the source is
- (A) 100 W (B) 0 W  
(C) 10 W (D) 50 W
25. A moving coil instrument gives full scale deflection for 1 mA current. The coil resistance is  $100 \Omega$ . This instrument is to be used as a voltmeter to measure 500 V maximum. This can be achieved by
- (A)  $500 \Omega$  connected in parallel to the coil  
(B)  $499900 \Omega$  is connected in series to the coil  
(C)  $499900 \Omega$  is connected in parallel to the coil  
(D)  $500 \Omega$  is connected in series to the coil

26. The number of conductors per parallel path in a 4-pole 24 armature conductors, lap connected d.c. generator is
- (A) 2 (B) 4  
(C) 6 (D) 12
27. If the back e.m.f. of a d.c. motor suddenly vanishes, then the motor will
- (A) stop  
(B) burn due to heat produced by excessive current  
(C) draw normal current  
(D) run slowly
28. HV winding of a 3- $\phi$  transformer is placed away from the core and over the LV winding
- (A) to reduce insulation cost  
(B) to obtain more output  
(C) to reduce oil requirement  
(D) to obtain better cooling
29. The distribution transformer operates at a maximum flux density of about
- (A) 0.4 Wb/m<sup>2</sup> (B) 3.5 Wb/m<sup>2</sup>  
(C) 0.08 Wb/m<sup>2</sup> (D) 1.2 Wb/m<sup>2</sup>
30. If  $\Phi_m$  is the maximum flux produced by peak current in each phase of a 3- $\phi$  system, then the magnitude of rotating magnetic field is
- (A)  $\frac{\sqrt{3}}{2} \Phi_m$  (B)  $\frac{2}{3} \Phi_m$   
(C)  $\frac{3}{2} \Phi_m$  (D)  $\frac{2}{\sqrt{3}} \Phi_m$



31. The coil pitch factor for a  $\frac{2}{3}$ rd pitched winding of a synchronous alternator is
- (A) 0.966 (B) 0.866
- (C) 0.951 (D) 1.0
32. A synchronous motor is started by utilizing the torque developed in
- (A) the high-speed steam-turbine
- (B) the damper winding on the stator
- (C) the low-speed water-turbine
- (D) the damper winding on the rotor
33. For same power transmission, same power factor and same power loss, if the transmission voltage is increased by  $m$  times, then the cost of copper conductor is
- (A) increased by  $m^2$  times
- (B) decreased by  $m^2$  times
- (C) increased by  $m$  times
- (D) decreased by  $m$  times
34. For bulk power transmission in EHV a.c. system, the transmission line uses
- (A) single solid conductor
- (B) single stranded conductor
- (C) bundle hollow conductor
- (D) bundle stranded conductor
35. LSOH is a type of insulation used in cable. LSOH stands for
- (A) low smoke hydroxyl
- (B) low smoke oil hydrogen
- (C) low smoke zero halogen
- (D) low smoke zero hydrogen

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36. Load power factor at a substation can be improved by installing

- (A) an unloaded under-excited synchronous motor
- (B) a static inductor
- (C) an unloaded over-excited synchronous motor
- (D) an unloaded slip ring induction motor

37. Of the following, the non-renewable source of energy is

- (A) Natural gas
- (B) Hydropower
- (C) Solar energy
- (D) Ocean wave energy

38. The maximum demand of a power system is 15 MW. If the load factor is 60%, then the energy consumption per annum is

- (A)  $7.884 \times 10^7$  kWh
- (B)  $2.19 \times 10^8$  kWh
- (C)  $7.884 \times 10^4$  kWh
- (D)  $2.19 \times 10^5$  kWh

39. The torque which is not essential in indicating instrument is

- (A) deflecting torque
- (B) braking torque
- (C) controlling torque
- (D) damping torque

40. The air gap between the poles and the iron core at the two sides in a PMMC instrument is about

- (A) 0.05 inch
- (B) 0.5 inch
- (C) 0.005 inch
- (D) 1.0 inch

41. Which of the following is not a part of attraction type moving iron instrument?
- (A) Coil
  - (B) Iron disc
  - (C) Spring
  - (D) Aluminium disc
42. To obtain total reactive power of a balanced 3- $\phi$  system by one wattmeter method, the reading of the wattmeter should be
- (A) divided by  $\sqrt{3}$
  - (B) divided by 3
  - (C) multiplied by  $\sqrt{3}$
  - (D) multiplied by 3
43. Two holes are cut in the disc on opposite sides of the spindle of an induction type energy meter to
- (A) provide additional driving torque
  - (B) prevent creeping
  - (C) dissipate heat due to eddy currents induced in the disc
  - (D) reduce phase angle error
44. The resistance of a precision grade ammeter shunt can be best measured by
- (A) Multimeter
  - (B) Carey-Foster bridge
  - (C) highly sensitive Wheatstone bridge
  - (D) Kelvin double bridge
45. A fault involving all the three-phases of a 3- $\phi$  system and the ground is known as
- (A) Symmetrical fault
  - (B) Unsymmetrical fault
  - (C) Line-to-ground fault
  - (D) Unbalanced fault

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46. The phenomenon of current chopping is associated with
- (A) Isolator
  - (B) Circuit breaker
  - (C) Differential relay
  - (D) HRC fuse
47. In SF<sub>6</sub> circuit breaker, the arc is extinguished by SF<sub>6</sub> gas under a pressure of
- (A) 35 kg/cm<sup>2</sup>
  - (B) 22 kg/cm<sup>2</sup>
  - (C) 8 kg/cm<sup>2</sup>
  - (D) 14 kg/cm<sup>2</sup>
48. If the power circuit fault current is 1800 A and an over-current relay is set at 150% and the CT ratio is 120/1, then the PSM is
- (A) 15
  - (B) 0.1
  - (C) 10
  - (D) 0.5
49. The operation of distance relay is governed by the
- (A) Current
  - (B) Power
  - (C) Product of applied voltage and current
  - (D) Ratio of applied voltage to current
50. Frame leakage protective scheme is provided for the protection of
- (A) Bus bar
  - (B) Induction motor
  - (C) Transformer
  - (D) Lightning arrester