

3218

MAY 2025

3218 Time Allowed MAY 2025

2.5 Hours

203(N)

3218

FUNDAMENTALS OF ELECTRICAL & ELECTRONICS ENGINEERING

Time Allowed: 2.5 Hours

Fundamentals of Electrical Engg

Full Marks: 60

3218

Answer to Question No. 1 of Group A must be written in the main answer script. In Question No. 1, out of 2 marks for each MCQ, 1 mark is allotted for right answer and 1 mark is allotted for correct explanation of the answer.

Answer any Five (05) Questions from Group-B.

Answers to questions

GROUP-A

3) number

Type of

AC/DC

1. Choose the correct answer from the given alternatives and explain your answer (any ten): $2 \times 10 = 20$

i) A wire has resistance of 16Ω . It is bent in the form of a circle. The effective resistance between two points on any diameter of the circle is a) 32Ω , b) 16Ω , c) 8Ω , d) 4Ω

ii) If 110V is applied across 220V, 100W bulb, the power consumed by it will be a) 100W, b) 50W, c) 25W, d) 12.5W.

iii) A current of 10A enters a parallel combination of two resistances of 2Ω and 3Ω . Then the currents through resistances will be a) 4A and 6A, b) 6A and 4A, c) 2A and 8A, d) 5A and 5A

iv) The SI unit of reluctance is a) AT/Wb, b) AT/m, c) AT, d) N/Wb

v) A magnetic circuit requires 800 AT to produce certain amount of magnetic flux. If the magnetizing coil of 100 turns has 5Ω resistance, the voltage to be applied to the exciting coil must be a) 40V, b) 20V, c) 10V, d) 5V

vi) Which of the following is a correct representation of peak value in an AC Circuit?
a) RMS value / Peak factor
b) RMS value \times Form factor
c) RMS value / Form factor
d) RMS value \times Peak factor

vii) If the supply frequency increases, the value of inductive reactance
a) decreases
b) increases
c) does not change
d) becomes zero

R Peak value

in an AC circuit

RMS value

viii) The advantage of star-connected AC supply system is that a) line current is equal to phase current, b) it is a simple arrangement, c) voltages at two levels can be used, d) phase sequence can easily be changed.

ix) Transformer core is assembled with laminated sheet so as to a) reduce hysteresis loss, b) eddy current loss, c) reduce copper loss, d) ensure good magnetic coupling between the windings.

x) Which of the following dc motor is used in Railway Electric Traction? a) dc shunt motor, b) dc series motor, c) dc compound motor, d) separately excited dc motor

xi) Potential barrier at a p-n junction is established due to a) majority carriers, b) minority carriers, c) both (a) and (b), d) donor and acceptor ions.

xii) In common emitter configuration, BJT acts as a a) voltage controlled voltage source b) current controlled voltage source c) voltage controlled current source d) current controlled current source

1. ~~Opamp~~ ~~Opamp~~ ~~Opamp~~
2. ~~Opamp~~ ~~Opamp~~ ~~Opamp~~
3. ~~Opamp~~ ~~Opamp~~ ~~Opamp~~
4. ~~Opamp~~ ~~Opamp~~ ~~Opamp~~
5. ~~Opamp~~ ~~Opamp~~ ~~Opamp~~
6. ~~Opamp~~ ~~Opamp~~ ~~Opamp~~

- xiii) CMRR for an OP-AMP should be a) as large as possible b) close to zero c) close to unity d) as small as possible.
- xiv) If two inputs of a NOR gate is tied up, it will act as a a) NOT gate, b) OR gate, c) NAND gate, d) Ex-NOR gate
- xv) A bulb in a stair-case has two switches, one switch being at the ground floor and the other at the first floor. The bulb can be turned on and off by any one of the switches. The logic of switching of the bulb resembles a) An AND gate, b) An OR gate, c) an XOR gate, d) A NAND gate.

GROUP-B
Answer any Five (05) questions.

2. (a) What is a parallel circuit?
 (b) Why all electrical equipments are connected in parallel to the supply?
 (c) A resistor of 6Ω is connected in series with a parallel combination of 15Ω and 10Ω resistors. The whole circuit is connected across a 30V supply. Determine current flowing through 15Ω resistor. [2+2+4]
3. (a) With neat diagrams state Fleming's Left Hand Rule.
 (b) What is dynamically induced emf?
 (c) An iron ring or toroid 0.2 m in diameter and 10 sq. cm cross-sectional area of the core is wound with 250 turns of wire. If the flux density in the core is to be 1 T and relative permeability of iron is 500, what is the exciting current required to be passed in the winding? Further, determine the self-inductance.
 [2+2+4]
4. (a) Define (i) cycle, (ii) frequency, (iii) form factor of a sinusoidally varying quantity and state their units (if any).
 (b) A coil of resistance 10Ω and inductance 0.1 H is connected in series with a capacitor $10\mu\text{F}$. This whole combination is connected with 240V, 50 Hz supply. Calculate (i) impedance, (ii) current, (iii) angle of phase difference, (iv) power factor and (v) consumed power. [3+5]
5. (a) Define power factor. What is the range of power factor?
 (b) In an AC circuit current $i = 20 \cos(2t - 30^\circ)$ and applied voltage $v = 200 \cos(2t + 30^\circ)$. Calculate (i) the impedance, (ii) the resistance, (iii) the reactance, (iv) the power factor, (v) the phase angle between voltage and current and (vi) the power absorbed. [2+6]
6. (a) With neat waveforms of sinusoidal supply voltage, circuit current and instantaneous power, show that average power consumed by a purely inductive circuit is zero.
 (b) What do you understand by the term 3-phase balanced AC supply?
 (c) A three-phase, star-connected AC motor draws 5.6 kW when the line voltage is 220 V and the line current is 18.2 A. Determine the power factor of the motor. [4+2+2]
7. (a) Why does a transformer has iron core?
 (b) Among all electrical machines, efficiency of transformers is maximum. Why?
 (c) A single phase, 50Hz, transformer has 50 and 250 turns on low voltage and high voltage windings respectively. If low voltage winding is connected to 230V, 50Hz AC supply, calculate (i) peak value of flux and (ii) flux density in the core with net cross-sectional area 250 sq.cm. (iii) Also determine the low voltage winding current when current in the other winding is 100A. [2+2+4]
8. (a) What is an ideal diode? Draw its V-I characteristic.
 (b) Neatly draw forward and reversed biased characteristics of a practical diode.
 (c) Why silicon is preferred over germanium while fabricating semiconductor devices.
 [3+3+2]

9. (a) Draw the pin diagram of OP AMP IC 741 and label each pin.
(b) Write down the features of an ideal OP AMP. [4+4]
10. (a) Give the logic symbol, Boolean expression and truth table of (i) two input NAND gate and (ii) two input EX NOR gate.
(b) Explain the phrase-“NAND and NOR gates are called universal gates”. [(3+3)+2]