MAULANA ABUL KALAM AZAD UNIVERSITY OF TECHNOLOGY, WEST BENGAL

Paper Code : ES-201

BASIC ELECTRICAL AND ELECTRONIC ENGINEERING–II

Time Allotted: 3 Hours

Full Marks: 70

The figures in the margin indicate full marks.
Candidates are required to give their answers in their own words as far as practicable

Part-I

Group - A

(Multiple Choice Type Questions)

1. **Choose the correct alternatives for *any five* of the following:** 1×5=5

(i) The emf induced in the armature of a DC generator is inversely proportional to

(a) pole flux
(b) field current
(c) number of armature parallel paths
(d) number of dummy coils

(ii) With the increase in load, the speed of a DC shunt motor

(a) reduces slightly
(b) remains constant
(c) increases slightly
(d) increases proportionately

(iii) The phase relationship between the primary and secondary voltages of a transformer is

(a) 90° out of phase
(b) in the same phase
(c) 180° out of phase
(d) 270° out of phase

(iv) At start, the slip of the induction motor is

(a) zero
(b) 0.5
(c) one
(d) infinite

(v) The force between two charges is 120 N. If the distance between the charges is doubled, the force will be

(a) 60 N
(b) 30 N
(c) 40 N
(d) 15 N

(vi) The expression for total power output of a delta connected system in terms of phase voltage & current is given by

(a) $3V_p I_p \cos\phi$ (b) $\sqrt{3}\, V_p I_p \cos\phi$

(c) $\frac{1}{\sqrt{3}}\, V_p I_p \cos\phi$ (d) $\frac{1}{3}\, V_p I_p \cos\phi$

Group – B

(Short Answer Type Questions)

Answer *any two* questions. 5×2=10

2. Explain that "The main flux in a transformer remains practically invariable under all conditions of load"

3. A six pole, 12 kW, 240 V DC machine is wave-connected. If this machine is now lap-connected, all other things remaining the same, calculate the voltage and current ratings.

4. (a) State the difference between "Electric Potential and Electric Potential difference"
   (b) Deduce an expression of energy stored in a capacitor. 2+3=5

5. Discuss how a rotating field is produced in a 3-phase induction motor

Group – C

(Long Answer Type Questions)

Answer *any two* questions 10×2=20

6. (a) Why is the starting torque of a DC series motor more than that of a DC shunt motor of the same rating?

   (b) A 6-pole, 440 V DC motor has 936 wave wound armature conductors. The useful flux per pole is 25 m wb. The torque developed is 446.35 Nm. Calculate the following if armature resistance is 0.5 ohm.

   (i) Armature current

   (ii) Speed 3+7=10

7. (a) Can a transformer work on dc? Justify.

   (b) A 230V, 50Hz, transformer has 200 primary turns. It draws 5A at 0.25 pf lagging at no load. Determine

   (i) maximum value of flux in the core

   (ii) core loss

   (iii) magnetising current

   (iv) Exciting resistance & reactance of the transformer 2+8=10

8. (a) Can induction motor (3 phase) run at synchronous speed? Explain your answer

   (b) An 8 Hp, 3 phase, 4 pols squirrel cage induction motor is connected to 400V, 50Hz supply the motor is operating at full load with slip 5%. Calculate the following

   (i) The speed of the revolving field relative to the stator structure

   (ii) The frequency of the rotor current

   (iii) The speed of the rotor mmf relative to the rotor structure

   (iv) The speed of the rotor mmf relative to the stator structure 2+8=10

9. (a) Explain with relevant phasor diagram & circuit diagram, the principle of power measurement by two watt meter method.

(b) Derive an expression for the electric field at a point due to uniformly charged spherical shell using Gauss' law. 6+4=10

Part-II

Group – A

(Multiple Choice Type Questions)

1. Choose the correct answer of *any five* of the following 1×5=5

(i) The relationship between JFET Parameters is

(a) Amplification factor = AC Drain resistance × Transconductance

(b) Transconductance = AC Drain resistance × Amplification factor

(c) Amplification factor = AC Drain resistance ÷ Transconductance

(d) None of these

(ii) A transconductance type amplifier converts:

(a) voltage to current (b) current to voltage

(c) current to current (d) voltage to voltage

(iii) CMRR of an ideal OP-AMP is

(a) Zero (b) One

(c) Infinity (d) None of these

(iv) In an amplifier feedback always helps to

(a) decrease its input resistance (b) control its output

(c) increase its gain (d) decrease the bandwidth

(v) The voltage gain of a voltage follower circuit is

(a) Infinite (b) 10^6

(c) 10^3 (d) 1

(vi) Convert the binary number $(1001.0010)_2$ to decimal.

(a) 90·125 (b) 9·125

(c) 9·120 (d) 9·255

Group – B

(Short Answer Type Questions)

Answer *any two* questions. 5×2=10

2. Draw and explain the drain characteristics and transfer characteristics of a *n*-channel depletion MOSFET.

3. (a) Prove that a 2-input NOR gate is an universal gate.

(b) Design an EX-OR gate using minimum number 2-input NAND gates. 3+2=5

4. Define CMRR and Slew rate of an op-amp. Calculate the common mode gain of an op-amp, if its CMRR is 80 dB and differential voltage gain is 50000. 2+3=5

5. Define the transconductance, output resistance and voltage amplification factor of a JFET. Calculate the value of transconductance, if saturation current I_{DSS} is 8 mA and value of pinch-off voltage is – 4V. 3+2=5

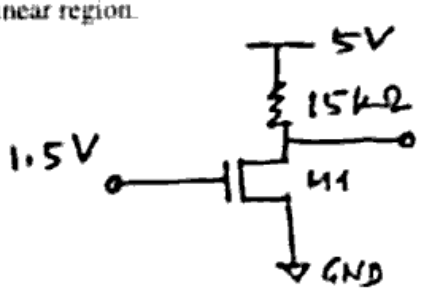
6. State the Barkhausen Criteria. Explain the gain-bandwidth product using the frequency response of an amplifier. 2+3=5

Group – C

(Long Answer Type Questions)

Answer *any two* questions. 10×2=20

7. Write down the drain current equation of JFET. Draw and explain the transfer and drain characteristics of JFET. Calculate I_D and V_{DS} if $K_n = \frac{1}{2}\frac{\mu_n \epsilon_0 \epsilon_{ox}}{t_{ox}} = 100\ \mu A/V^2$, threshold voltage $V_{th} = 0.6V$ and $W/L = 3$ for the enhancement type n-MOSFET M1 in the circuit given below. Verify whether the circuit is operating in the saturation or linear region. 5+5=10



8. (a) Draw and explain the operation of an OP-AMP as a substractor circuit
   (b) Draw and explain the Open-loop characteristic of OP-AMP
   (c) The differential voltage gain of an OP-AMP is 50000. If its CMRR is 30 dB, calculate common mode gain of OP-AMP. 5+3+2=10

9. (a) The open loop gain of an amplifier is 1600 and the feedback ratio is 0.04. If 25% of the open loop gain is changed due to temperature variation, calculate the % change in gain of the amplifier with feedback.
   (b) Mention five improvements of an amplifier circuit using negative feedback
   (c) Mention important characteristics of an ideal operational amplifier 5+3+2=10

10. Write short notes on *any two* of the following 5×2=10
   (a) Full-adder using all NAND gates
   (b) Voltage follower circuit using OP-AMP
   (c) OP-AMP as a differentiator circuit
   (d) Channel inversion