

CBCS SCHEME

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21ELE13/23

First/ Second Semester B.E. Degree Examination, July/August 2022 Basic Electrical Engineering

Time: 3 hrs.

Max. Marks: 100

Note: Answer any FIVE full questions, choosing ONE full question from each module.

Module-1

- 1 a. State and explain ohm's law with its limitations. (06 Marks)
- b. Define form factor. Obtain its value for a sinusoidal voltage. (08 Marks)
- c. A circuit consists of two parallel resistors of 20Ω and 30Ω respectively, connected in series with a 15Ω resistor. If the current through 15Ω resistor is $3A$, find the branch currents, supply voltage and power consumed by 20Ω and 15Ω resistors. (06 Marks)

OR

- 2 a. Prove that, the circuit efficiency during maximum power transfer from source to load is only 50%. (06 Marks)
- b. Show that, the power consumed by a pure capacitor is zero, when connected across A.C. supply. (08 Marks)
- c. For the sine wave, $e = 140 \sin 314t$. Find:
 - (i) Peak value
 - (ii) Frequency
 - (iii) Average value
 - (iv) RMS value
 - (v) Time period
 - (vi) Instantaneous voltage at $t = 3 \text{ ms}$
 (06 Marks)

Module-2

- 3 a. Develop an equation for the power consumed by a R-L series circuit. Draw the waveform of voltage, current and power. (08 Marks)
- b. Deduce the relationship between the line and phase values of voltage and current of a three phase star connected system. (06 Marks)
- c. Two impedances $Z_1 = (150 - j157) \Omega$ and $Z_2 = (100 - j110) \Omega$ are connected in parallel across 200 V , 50 Hz supply. Find:
 - (i) Total current
 - (ii) Branch currents
 - (iii) Total power consumed
 - (iv) Draw phasor diagram
 (06 Marks)

OR

- 4 a. Show that, only two wattmeters are sufficient to measure power in a three phase balanced star connected circuit with the help of neat circuit diagram and phasor diagram. (08 Marks)
- b. A balanced star connected load of $(8 + j6) \Omega$ per phase is connected to a 3-phase, 230 V supply. Find the line current, power factor, active power, reactive power and total power. (06 Marks)
- c. A circuit consists of a resistance of 25Ω and a capacitance of $100 \mu\text{F}$ connected in series. A supply of 200 V , 50 Hz is applied across the circuit. Find:
 - (i) Impedance
 - (ii) Current
 - (iii) Power factor
 - (iv) Power
 - (v) Voltage drop across R and C
 - (vi) Draw phasor diagram.
 (06 Marks)

Module-3

- 5 a. With the help of neat diagram, explain the construction of D.C. generator. (08 Marks)
 b. With usual notations, derive the emf equation of a transformer. (06 Marks)
 c. The field current in a d.c. shunt machine is 2A and the line current is 20A at 200V. Calculate:
 (i) The generated emf when working as generator
 (ii) Torque (N-m) when running at 1500 rpm as motor
 Take the armature resistance as 0.5Ω . (06 Marks)

OR

- 6 a. Explain the losses in a transformer and how to minimize them. On what factor they depend? Give the equations for these losses. (08 Marks)
 b. With usual notations, derive the torque equation of a D.C. motor. (06 Marks)
 c. A transformer is rated at 100 KVA. At full load its copper loss is 1200 Watts and its iron loss is 960 Watts. Calculate:
 (i) The efficiency at full load, UPf
 (ii) The efficiency at half load, 0.8 p.f.
 (iii) The maximum efficiency at 0.85 p.f. for the new load KVA 89 KVA at which maximum efficiency occurs. (06 Marks)

Module-4

- 7 a. With relevant diagram, explain the construction of three phase induction motor. (08 Marks)
 b. Explain the advantages of rotating magnetic field over the rotating armature in a synchronous generator. (06 Marks)
 c. A 10 pole induction motor supplied by a 6 pole alternator which is driven at 1200 rpm. If the motor runs at a slip of 3%, what is its speed and frequency of rotor induced emf. (06 Marks)

OR

- 8 a. Derive an emf equation of a synchronous generator. Explain the significance of winding factor. (08 Marks)
 b. Define slip of a 3-phase induction motor and derive the relation between supply frequency and rotor current frequency. (06 Marks)
 c. A 3-phase, 16 pole alternator has a star connected winding with 144 slots and 10 conductors per slot. The flux per pole is 0.003 webers and the speed is 375 rpm. Find the frequency, phase emf and line emf. (06 Marks)

Module-5

- 9 a. With a single line diagram, explain the power transmission and distribution. (06 Marks)
 b. What is earthing? With a neat diagram, explain pipe earthing. (08 Marks)
 c. Define tariff. Explain briefly the two part tariff with its advantages and disadvantages. (06 Marks)

OR

- 10 a. What is electric shock? Give the list of preventive measures against the shock. (06 Marks)
 b. With neat diagram, explain the working of fuse and RCCB (Residual Current Circuit Breaker). (08 Marks)
 c. A consumer has a maximum demand of 200 KW at 40% load factor. If the tariff is Rs.100 per KW of maximum demand plus 10 paise per KWh. Find the overall cost per KWh. (06 Marks)
