

**SPECIAL SUPPLE B.TECH/AEIE/BT/CE/CHE/CSE/ECE/EE/IT/ME/1ST
& 2ND SEM/ELEC 1001/2018**

**BASIC ELECTRICAL ENGINEERING
(ELEC 1001)**

Time Allotted : 3 hrs

Full Marks : 70

Figures out of the right margin indicate full marks.

*Candidates are required to answer Group A and
any 5 (five) from Group B to E, taking at least one from each group.*

Candidates are required to give answer in their own words as far as practicable.

**Group - A
(Multiple Choice Type Questions)**

1. Choose the correct alternative for the following: **10 × 1 = 10**
- (i) Hysteresis loss in a transformer can be reduced by using
(a) laminated core (b) silicon steel
(c) oil (d) solid steel.
- (ii) In a transformer electric power is transformed from one circuit to another without change in
(a) voltage (b) current
(c) frequency (d) turns.
- (iii) Starter in D.C. motor is used to
(a) reduce starting current (b) increase starting current
(c) increase the speed (d) reduce the speed.
- (iv) When the induction motor is standstill, the slip is
(a) zero (b) 1 (c) infinity (d) 0.5.
- (v) AC voltmeter is normally calibrated in
(a) average value (b) instantaneous value
(c) peak value (d) RMS value.
- (vi) The number of parallel paths in wave connected armature winding of a 4 pole DC machine is
(a) 4 (b) 8 (c) 2 (d) cannot be determine.
- (vii) Energy stored in an inductor is given by
(a) $\frac{1}{2}L^2I$ (b) $\frac{1}{2}LI^2$ (c) LI^2 (d) L^2I

- (viii) If V is the line voltage, I is the line current and ϕ is the angle between them, then the total power measured in a star three-phase load is equal to
 (a) $3VI \cos\phi$ (b) $3VI \sin^2\phi$
 (c) $\sqrt{3}VI \sin\phi$ (d) $\sqrt{3}VI \cos\phi$.
- (ix) If the source is delivering maximum power to load then efficiency of the circuit is
 (a) 25% (b) 50%
 (c) 75% (d) dependent on the circuit parameters.
- (x) Power factor of an A.C. circuit is equal to
 (a) R/X_L (b) R/X_C (c) Z/R (d) R/Z .

Group - B

2. (a) State Superposition Theorem. Find out the current through resistance $R_L = 2\Omega$ in the circuit shown in Fig.1 using Superposition Theorem.

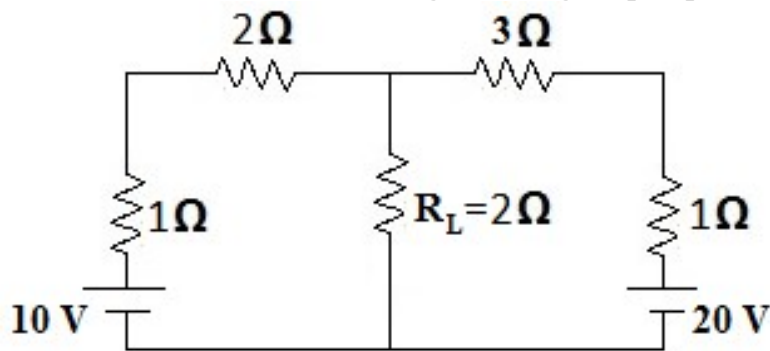


Fig.1

- (b) State and prove Maximum Power Transfer theorem for a DC network.
(2 + 6) + 4 = 12

3. (a) Derive the emf equation of a DC machines.
 (b) An 6-pole lap wound DC generator has 250 armature conductors, a flux of 0.04 mWb per pole and runs at 1200 rpm. Find out the generated emf.
 (c) Draw and explain the Torque-current characteristics of (i) a DC shunt motor and (ii) a DC series motor.

4 + 4 + (2 + 2) = 12

Group - C

4. (a) State and derive Gauss's Law.

- (b) A capacitor is constructed from two square metal plates each of side 100 mm. The plates are separated by a dielectric of thickness 3 m and relative permittivity 5. Calculate the capacitance. If the electric field strength in the dielectric is 12.5 KV/mm, calculate the total charge on each plate.

$$(2 + 4) + (3 + 3) = 12$$

5. (a) Define the self inductance and mutual inductance.

- (b) A coil of 600 turns and of resistance of 20Ω is wound uniformly over a steel ring of mean circumference 30 cm and cross-sectional area 9 cm^2 . It is connected to a supply of 20 V(DC). If the relative permeability of the ring is 1600 find (i) the reluctance, (ii) the magnetic field intensity, (iii) the mmf and (iv) the flux.

$$4 + 8 = 12$$

Group - D

6. A series R-L-C circuit containing a resistance of 12Ω , an inductance of 90 mH and a capacitance of $70 \mu\text{F}$ is connected with a 150V, 60Hz supply. Find out (i) Inductive reactance, (ii) capacitive reactance, (iii) Impedance of the circuit, (iv) current flowing thorough the circuit, (v) Voltage across each elements, (vi) power factor, (vii) active, reactive and apparent power.

$$1 + 1 + 1 + 1 + 3 + 2 + 3 = 12$$

7. (a) Explain the method of measurement of balanced three phase power by two wattmeter method.
- (b) A 3-phase 230V load has a power factor of 0.8 lag. Two wattmeter are used to measure power which shows the input to be 10 KW. Find the reading of each wattmeter.

$$6 + 6 = 12$$

Group - E

8. (a) Derive the e.m.f. equation for a single phase transformer

- (b) A 100 KVA single phase transformer has primary no of turn, $N_1 = 400$ and secondary no of turn, $N_2 = 80$. The primary and secondary resistance and leakage reactance are $R_1 = 0.3 \Omega$, $X_1 = 1.1 \Omega$, $R_2 = 0.01 \Omega$, $X_2 = 0.035 \Omega$ respectively. The applied voltage is 2200 V. Find (i) Total impedance refer to primary, (ii) The Voltage regulation at 0.8 p.f. lagging at full load.

$$6 + 6 = 12$$

9. (a) Explain how rotating magnetic field is produced in a three phase induction motor.
- (b) A 4-pole, 3-phase, 250KW, 440V, 50Hz induction motor has a speed of 1450 rpm on full load. Calculate (i) the speed of the rotating magnetic field, (ii) the slip at full load and (iii) the frequency of the rotor induced emf.

6 + 6 = 12