B.TECH/ AEIE/CSBS/CSE/ECE/IT/1ST SEM/ELEC 1001 /2020

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) A 3-phase 4 wire system supplies a balanced star load. The current in each phase is 5 A. The current in the neutral wire will be
(a) $5\sqrt{3}$ A
(b) 0 A
(c) 15 A
(d) 5 A

(ii) Flux in a magnetic circuit can be compared in an electric circuit to
(a) Resistance
(b) Voltage
(c) Current
(d) Inductance

(iii) For a coil with N-turns the self inductance will be proportional to
(a) N
(b) $1/N$
(c) N^2
(d) $1/N^2$

(iv) Hysteresis loss in a transformer can be reduced by using
(a) laminated core
(b) silicon steel
(c) oil
(d) solid steel

(v) The effective or true power in pure capacitive circuit is
(a) always negative
(b) equal to half of the peak value
(c) zero
(d) equal to the peak value

(vi) Direction of emf generated in a DC generator can be determined from
(a) Lenz's law
(b) Fleming's left hand rule
(c) Kirchhoff's law
(d) Fleming's right hand rule

(vii) In a balanced 3-phase system, three phase voltages are
(a) 30° apart
(b) 120° apart
(c) 90° apart
(d) 60° apart

(viii) For a 200/100 V transformer if the current through high voltage side is 2A then the current through low voltage side will be
(a) 1A (b) 2A
(c) 3A (d) 4A

(ix) In series RLC circuit at resonance
(a) current is maximum, power factor is zero
(b) current is maximum, power factor is unity
(c) current is minimum, power factor is unity
(d) current is minimum, power factor is zero

(x) In a DC series motor the torque developed at 5 A is 15 Nm. If the load current is doubled the new torque is
(a) 45 Nm (b) 60 Nm
(c) 15 Nm (d) 30 Nm

Group – B

2\. (a) Using Superposition theorem, find the current through R_L in the circuit shown in Fig. 1.

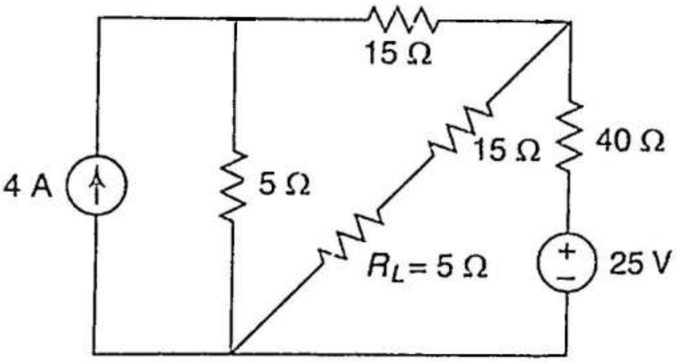

Fig. 1

(b) State and prove Maximum Power Transfer theorem for a DC network. Also prove that the efficiency of the circuit under Maximum Power Transfer condition is 50%.

6 + 6 = 12

3\. (a) A coil of 600 turns and of resistance of 20 Ω is wound uniformly over a steel ring of mean circumference 30 cm and cross-sectional area 8 cm^2 . It is connected to a supply of 20 V (DC). If the relative permeability (μ_r) of the ring material is 1200 and $\mu_0 = 4\pi \times 10^{-7}$, then find out (i) the reluctance, (ii) magnetic field intensity and (iii) MMF.

(b) Two coils having 100 and 250 turns respectively are wound side by side on a closed iron circuit of mean length 4 m with a cross-sectional area of 200 cm^2. Calculate the mutual inductance between the coils. Consider relative permeability of iron as 2700.

(c) The combined inductances of two coils connected in series are 0.80 H and 0.40 H, depending on the relative directions of currents in the coils. If one of the coils, when isolated, has a self-inductance of 0.20 H, then find out (i) the mutual inductance and (ii) the coefficient of coupling K.

6 + 3 + 3 = 12

Group – C

4. (a) Find the average value, rms value, form factor and peak factor of the saw-tooth waveform as shown in Fig. 2 below.

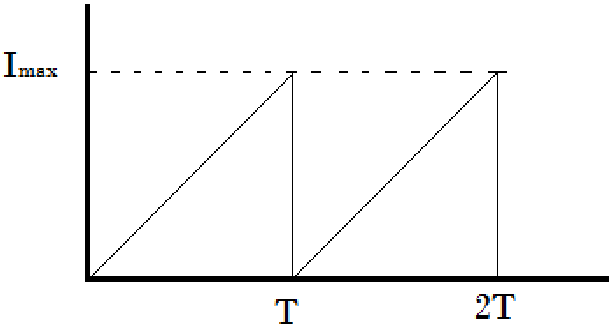

Fig. 2

(b) Draw and explain the Current Vs Frequency and Impedance Vs Frequency graph for series R-L-C circuit. Also indicate the resonant frequency in the graph.

(c) A voltage across a circuit is given by $50\angle 30^0\ V$ and the current through it is $10\angle 70^0\ A$. Determine the (a) active power consumed by the circuit (b) value of resistance of the circuit.

(2 + 2 + 1 + 1) + 4 + (1 + 1) = 12

5. (a) Two circuits, the impedance of which are given by $Z_1 = (10 + j15)\ \Omega$ and $Z_2 = (20 - j15)\ \Omega$ are connected in parallel across 200 V supply. Find the total current and the active power consumed by the circuit.

(b) An RL circuit, when connected to a 250V, 50 Hz a.c. supply, absorbs 100 W; while taking a current of 5A from the supply. Determine the value of resistance, inductance and power factor of the circuit.

(c) Consider the series RLC circuit as shown in Fig. 3 below where voltage across resistance, inductance and capacitance are $V_R = 10\ V$, $V_L = 20\ V$ and $V_C = 25\ V$ respectively. Find supply voltage V in the circuit.

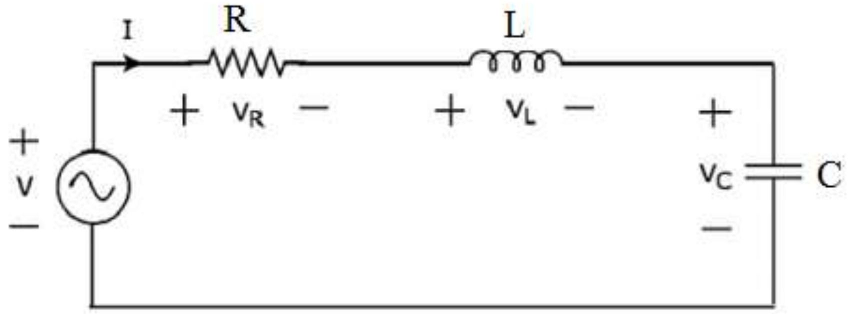

Fig. 3

(4 + 2) + 3 + 3 = 12

Group – D

6. (a) Explain the method of measurement of balanced three phase power by two wattmeter method. Draw the neat circuit diagram.

(b) Three equal impedances (6 + *j* 8) Ω are connected in Star (Y) across a 400 V, 3-phase,50 Hz supply. Calculate (i) the line current and the phase current, (ii) the power factor, (iii) active and reactive powers drawn by the load per phase.

6 + 6= 12

7. (a) Derive the expression for the voltage generated by a dc generator.

(b) A dc series motor has an armature resistance of 0.03 Ω and a series field resistance of 0.04 Ω. The motor is connected to a 400 V supply. The line current is 20 A when the speed of the machine is 1000 rpm. Find the speed of the machine when the line current is 50 A and the excitation is increased by 20%.

5 + 7 = 12

Group – E

8. (a) The following test data is obtained in a 5 kVA, 220/440 V single phase transformer:

Open Circuit test (on L.V. side):	220 V,	2 A,	100W
Short Circuit test (on H.V. side):	40 V,	11.4 A,	200 W

Determine
(i) the equivalent circuit parameters refer to L.V. side
(ii) the full load efficiency at 0.8 p.f. lagging
(iii) the load at which efficiency will be maximum.

(b) A single phase 2200/220 V, 50 Hz transformer has maximum flux density of 0.06 Wb. Determine the number of turns on high voltage and low voltage windings.

(c) Draw the phasor diagram of a transformer for lagging power factor load.

(4 + 2 + 2) + 2 + 2 = 12

9. (a) Describe the operating principle of 3-phase induction motor.

(b) Derive the torque equation of 3-phase induction motor.

(c) A 6-pole, 3-phase, 100KW, 400V, 60Hz induction motor has a rotor speed of 1170 rpm on full load. Calculate (i) the slip at full load, (ii) frequency of rotor induced emf at full load, (iii) speed of the magnetic field with respect to rotor.

5 + 4 + 3 = 12

Department & Section		**Submission Link**
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IT		https://classroom.google.com/c/MTcxNzYwNDE0NTIw/a/MjgzNTYyNDQ4MDcx/details
AEIE/CSE/ECE/IT (BACKLOG) New Syllabus		https://classroom.google.com/c/MjM3Mjc2NDU1OTk0/a/MjcxMDIxMTI4MDMz/details