INDIAN INSTITUTE OF ENGINEERING SCIENCE AND TECHNOLOGY, SHIBPUR

B.TECH-M. TECH DUAL DEGREE 2nd SEMESTER (CE, ME, MetE, MinE, ASE)

FINAL EXAMINATION, April - 2018

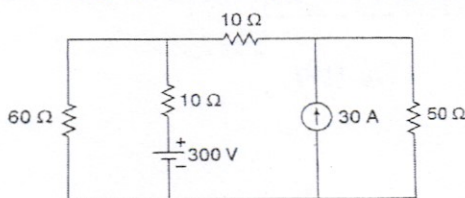BASIC ELECTRICAL ENGINEERING (EE-1201)

FULL MARKS: 70   TIME: 3 Hrs

(i)   Use separate answer script for each half
(ii) Answer any SIX questions taking THREE from each half
(iii) Two marks are reserved for neatness in each half.

First Half

1   a) State and prove Maximum Power Transfer Theorem. Find out the efficiency under the condition of maximum power transfer.

b) Find the current through 50 ohm resistor in the **Fig.-Q1b** using superposition theorem.

Fig. Q1b

[5+6]

2   a) Derive the emf equation of a dc generator.

b) Describe speed control methods for separately excited dc motor.

c) An 8-pole, 400 V shunt motor has 960 wave connected armature conductors. The full load armature current is 40 A and the flux per pole is 0.02 Wb. The armature resistance is 0.15ohm. Calculate the full load speed of the motor.   [4+4+3]

3 a) Explain the principle of operation of a transformer.

b) Draw and explain the phasor diagram of a single phase transformer under lagging p.f.

c) A 1000 kVA transformer has primary and secondary turns of 400 and 100 respectively and induced voltage in the secondary is 1000 V. Find (i) the primary volt, (ii) the primary and secondary full load current and (iii) the secondary current when 100 kW load at 0.8 p.f. is connected at the output.

[3+4+4]

4. a) Explain different components of iron loss in a magnetic circuit.

b) A rectangular iron core is shown in the **Fig. -Q4b**. An air gap of 0.1 cm is cut through the core. The iron path has a mean length of 50 cm. The cross-sectional area of the core is 10 cm^2. It is excited by a coil having 600 turns. The iron core has a relative permeability of 1200. The current in the coil is 2.0A. Calculate (i) the reluctance of the iron part, (ii) the reluctance of the air gap, (iii) total reluctance, (iv) total flux and (v) flux density in the air gap. Neglect leakage and fringing.
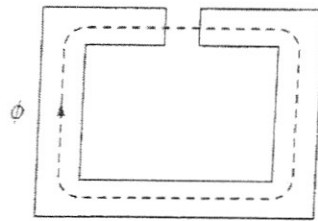

Fig. Q4b   [5+6]

5 Write short notes on: (any two)   [5.5 x 2]
   a) Major constructional parts of a dc machine and their functions
   b) Open circuit and Short circuit test of transformer
   c) Features of indicating instrument.
   d) B-H curve

Second Half

6. (a) Calculate the RMS value, average value, peak factor and form factor of the current waveform as shown in **Fig.- Q6a**.
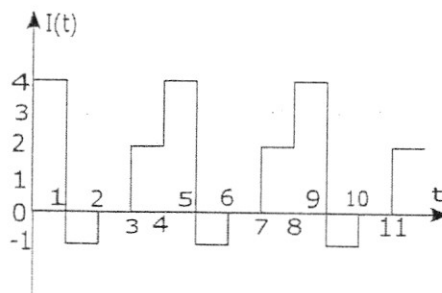

Fig.- Q6a

(b) Three phasors are A=10+j10; B=50 $\underline{/120^0}$ and C= 8-j6. Evaluate (AB)/C and express it in rectangular and polar forms.

[(2+2+1+1)+(3+2)]

7. (a) Two coils, Z_1=(6+j8) ohm and Z_2=(5+j7) ohm, are connected in series with a supply voltage of 220V, 50Hz. Calculate the (i) power factor of the load, (ii) current drawn from the supply, (iii) power factor of each of the coils (iv) the voltage drop across each of the coils and (v) the power absorbed by each of the coils..

(b) Using Thevenin's theorem , determine the current through the load impedance for the network as shown in **Fig. Q7b**.
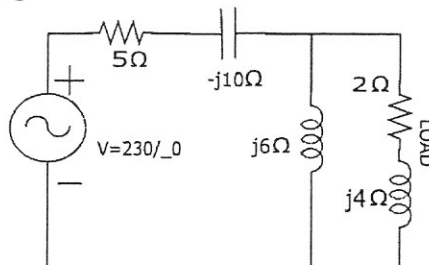

Fig.-Q7b

[(1+2+1+1+1) +(5)]

8. (a) How are the following affected by change in frequency (i) resistance (ii) inductive reactance (iii) capacitive reactance (iv) current in RLC series circuit.

(b) A series RLC circuit with R=10 ohm, L= 10 mH and C= 1 microF has an applied voltage of 200V at resonance frequency, Calculate (i) the resonant frequency (ii) the current in the circuit (iii) the voltage across the R,L and C at resonance (iv) the quality factor and (v) bandwidth of the circuit.

[(1+1+1+1)+ (1+1+3+1+1)]

9. (a) Explain the term "Balanced Three Phase Supply". What is its significance?

(b)A balanced 3-phase load consists of a 5 ohm resistor and 10 ohm reactor(inductive) connected in series with each phase. The supply is 440V, 3-phase , 50Hz . Find (i) the line current (ii) phase current and (iii) the total power for both star and delta connected loads.

[(2+2)+(2+2+3)]

10. (a) A 3-ph, 50Hz, 8 pole induction motor runs with a slip of 2.67% . Find the speed of the following (i) The rotor with respect to stator (ii) the rotor magnetic field with respect to stator (iii) the rotor magnetic field with respect to stator magnetic field (iv) the speed of the rotor magnetic field with respect to stator (v) the stator magnetic field with respect to rotor.

(b) Explain the principle of working of a 3-phase induction motor.

[(1+1+1+1+1) + (6)]

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4/4.