

(Following Paper ID and Roll No. to be filled in your Answer Book)

**PAPER ID : 2302**

Roll No. 

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**B. Tech.**

**(SEMESTER-II) THEORY EXAMINATION, 2011-12**

**ELECTRICAL ENGINEERING**

*Time : 3 Hours ]*

*[ Total Marks : 100*

**Note :** Attempt questions from **all** sections. Assume missing data, if any.

**SECTION – A**

1. Answer **all** parts in few sentences/words. **10 × 2 = 20**
- (a) What are the respective values of internal resistances of ideal voltage and ideal current sources ? Explain. Is it possible to convert an ideal voltage source into an ideal current source or vice-versa ?
- (b) Name the circuit laws on which mesh-method and nodal-method are respectively based. A network is found to have a total of seven branches and four junctions (ie. independent nodes). Which method is preferred for solving network ?
- (c) Given are the source voltage, source current and the power factor of the network, write the expressions for apparent and real power drawn from source.
- (d) Draw the phasor diagrams for purely inductive and purely capacitive circuits. What will be the power drawn from the source ?
- (e) A 1-phase transformer is rated as 25 kVA, 600/200 V, 50 Hz. Calculate the impedance of the load in ohms to fully load the transformer when connected to (a) 600 V side (b) 200 V side (use IT model).
- (f) Define the band-width of a resonant circuit. Give the relationship of quality factor in terms of band-width and resonance frequency.
- (g) Among moving-coil and moving-iron instruments, which one is suitable for both a.c. and d.c. measurements ? Why ?

- (h) Give at least one typical application for d.c. series motor and d.c. shunt motor and draw their speed torque characteristics.
- (i) In a large industrial set-up, largest capacity 3-phase induction motor is being replaced by equal capacity synchronous motor. What advantages and disadvantages would be seen ?
- (j) With the help of phasor diagram or otherwise, explain how the power drawn from 3-phase source to a balanced 3-phase network is constant at all instants ?

### SECTION – B

2. Answer any **three** parts of the following

$3 \times 10 = 30$

- (a) A circuit has an arrangement of its elements as in Fig. 1. Find the Thevenin's equivalent considering  $R_4$  as the variable resistance. Find also that value of  $R_4$  which results a maximum power drawn from the circuit.

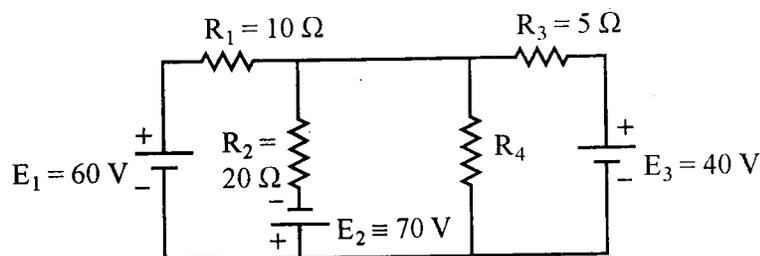


Fig. 1

- (b) A coil of resistance  $8 \Omega$  and inductance  $0.1 \text{ H}$  is connected in series with a condenser of capacitance  $160 \mu\text{F}$  across  $230 \text{ V}$ ,  $50 \text{ Hz}$  supply. Calculate complex impedance, current + power factor.
- (c) A  $400 \text{ V}$ , 3-phase source supplies power to both delta- and a wye = connected loads, connected in parallel. All the phase impedances are identical and equal to  $(5 + j8.66) \text{ ohms}$ . Compute total line current and power drawn from source.
- (d) The following test results were obtained on
- a     $20 \text{ kVA}$ ,  $2200/220 \text{ V}$  transformer ;
- O. C. Test (LV) :  $220 \text{ V}$ ,  $1.1 \text{ A}$ ,  $125 \text{ W}$
- S. C. Test (HV)  $52.7$ ,  $8.4 \text{ A}$ ,  $287 \text{ W}$

The transformer is loaded at 0.8 p.f. on secondary side with a voltage of 220 V. Determine the efficiency at 80 percent of full load, the maximum efficiency and load at which it occurs.

- (e) A d.c. shunt generator delivers 50 kW at 250 V and 400 rpm. The armature and field resistances are  $0.02 \Omega$  and  $50 \Omega$  respectively. Calculate the speed of the machine running as shunt motor and taking 50 kW input at 250 V. Allow brush contact drop of 1 volt per brush.

### SECTION – C

Answer **all** questions of this section.

$5 \times 10 = 50$

3. Attempt any **two** parts of the following :

- (a) State and explain the Norton's theorem.  
 (b) Determine the voltages  $V_1$  and  $V_2$  in Fig. 2.

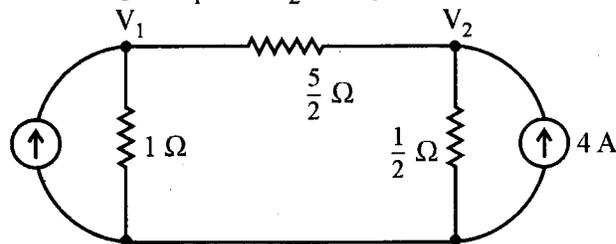


Fig. 2

- (c) Define terms : mmf, flux and reluctance and give their (2) relationship.

4. A voltage of  $V(t) = 10 \sin \omega t$  is applied to a series RLC circuit. At resonant frequency of the circuit the maximum voltage across capacitor is found to be 500 V. More over, the band width is known to be 400 rad/sec. and the impedance at resonance is  $100 \Omega$ . Attempt any two parts of the following :

- (a) Find the resonant frequency.  
 (b) Compute the upper and lower limits of the band width.  
 (c) Determine the values of L and C for this circuit.

5. Attempt any **one** part of the following :

- (a) List out main components of power supply system with a brief description of level of voltages etc, Also – discuss the advantages of power improvement with the help of circuit & phasor diagram.  
 (b) Derive the expressions for the power delivered and p.f. for the balance 3 phase network. If there is an indication that one of the wattmeter readings is negative, then what corrective action is to be taken to read the power correctly and what is the indication of p.f. of the network at this situation ?

6. Attempt any **two** parts of the following :
- (a) A moving coil meter has full scale deflection of 15 mA and a resistance of  $5 \Omega$ . Find the resistance which should be suitably connected with instrument to make the meter usable as an ammeter of 10 A range and same meter as a voltmeter of 100 V range. Indicate their suitable connection, accordingly.
  - (b) A 20 A, 220 V, single-phase energy meter is tested. The number of revolutions per KWh. is 240. When the load is 3000 W, the disc makes 12 revolutions in 62 seconds. Find the percentage error.
  - (c) A 12-pole alternator is coupled to an engine running at 500 rpm. It supplies a 3 phase induction having full load speed of 1440 rpm. Find percentage slip and number of poles of the motor.
7. Attempt any **two** parts of the following :
- (a) Develop the expression of e.m.f. generated for a d.c. machine and give factors on which the amount of so generated e.m.f. depends on a machine.
  - (b) Show that the frequency of the rotor induced e.m.f. in an induction motor is slip times its stator frequency.
  - (c) Why there is problem of starting the single-phase motor ? Describe its one commonly used method of starting.