# II B.Tech I Semester Examinations,May 2011 FUNDAMENTALS OF ELECTRICAL ENGINEERING <br> Common to Bio-Medical Engineering, Instrumentation And Control <br> Engineering, Electronics And Computer Engineering, Electronics And <br> Instrumentation Engineering 

> Answer any FIVE Questions
> All Questions carry equal marks

Max Marks: 75
Time: 3 hours

1. Find currents $I_{1}$ and $I_{2}$ by using nodal analysis(figure 1).


Figure 1:
2. (a) Explain the capacitor start capacitor run induction Motor with neat diagrams.
(b) A 3-phase, 4-pole star connected alternator has 36 slots with 4 conductors per slot. The pitch of the coil is slot less than the pole pitch. Find the no- load terminal voltage at frequency of 50 Hz . The sinusoidally distributed flux per pole is 45 mWb .
$[7+8]$
3. Describe the principle of operation of DC Motor with neat diagrams.
4. (a) Explain the step-up and step-down transformers.
(b) A $2300 / 230 \mathrm{~V}$ transformer of 150 kVA the parameters of circuit model are
$\mathrm{R}_{1}=0.25 \Omega \quad \mathrm{R}_{2}=3 \times 10^{-3} \quad \mathrm{X}_{1}=0.5 \Omega$
$\mathrm{X}_{2}=5 \times 10^{-3} \Omega \quad \mathrm{R}_{0}=10 \mathrm{k} \Omega \quad \mathrm{X}_{0}=1.8 \mathrm{k} \Omega$
Draw the circuit model as seen on the H.V side or equivalent resistance referred to primary side?
5. (a) What are the limitations of superposition theorem and mention its applications?
(b) Determine the Thevenin's equivalent circuit for the given circuit across A and $B$ terminals as shown in below figure 2 .


Figure 2:
6. Find the branch current, total current and total power in the circuit(figure 3) and draw phasor diagram.

7. (a) Derive the power calculations in balanced three phase systems.
(b) A balanced star-connected load is supplied from a symmetrical three phase, 415 V system. The current in each phase is 25 A and lags $30^{\circ}$ behind the phase volvage. Determine
i. impedance in each phase
ii. total power.

Also draw the phasor diagram showing the voltages and currents.
8. Two circuits having same numerical impedance value are joined in parallel. The power factor of one circuit is 0.8 and the other is 0.6 both lagging. Calculate power factor of combination.

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1. In the network shown in Figure 4, determine the value of i, current through $1 \Omega$ resistance indicated with arrow.


- Figure 4:

2. (a) Explain the OCC of a Separately excited DC generators.
(b) A shunt generator delivers 450 A at 230 V and the resistances of the shunt field and armature is $50 \Omega$ and $0.03 \Omega$ respectively. Calculate the generated e.m.f.
$[7+8]$
3. (a) Explain the procedure to verify maximum Power transfer theorem.
(b) Use Millman's theorem to calculate voltage drop across the 40 ohms resistor of the circuit shown in below figure 5 .
[6+9]


Figure 5:
4. Two identical coils connected in series gave an inductance of 800 mH and when one of the coils is reversed gave an inductance of 400 mH . Determine self inductance, mutual inductance between the coils and coefficient of coupling.
5. (a) Explain the three phase balanced star connection and drive the necessary expressions.
(b) A load impedance of $(4+\mathrm{j} 3) \Omega$ each is connected in star and a supply voltage of $440 \mathrm{~V}, 50 \mathrm{~Hz}$ is applied to the load. Find
i. line currents
ii. the power factor
iii. active power
iv. reactive volt amperes
v. apparent power

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[7+8]
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6. (a) Explain about phase angle of a sinusoidal quantity .
(b) Briefly discuss about addition \& subtraction of phasors, and giye examples.

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[8+7]
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7. The following test results are obtained on a 6600 V alternator.

| OC voltage in volts | 3100 | 4900 | 6400 | 7500 | 8300 |
| :---: | :---: | :---: | :---: | :---: | :---: |
| Field current in amps | 16 | 25 | 37.5 | 50 | 70 |

A field current of 20 Amps is required to circulate full load current as short circuit of armature. Calculate full load regulation at 0.8 p.f lag by synchronous impedance method. (Assume the rating of alternator as 1MVA)
8. (a) Draw the torque-slip characteristics of 3-phase induction motor and explain.
(b) A 6-pole, 3-phase, 50 Hz induction motor is running at full-load with a slip of 4\%. The rotoris star-connected and its resistance and standstill reactance are $0.2 \Omega$ and $2.5 \Omega$ per phase. The e.m.f. between slip rings is 120 V . Find the rotor current per phase and p.f., assuming the slip rings are short-circuited.

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1. (a) Define armature reaction, synchronous reactance and synchronous impedance?
(b) A 3-phase, $100 \mathrm{kVA}, 400 \mathrm{~V}, 50 \mathrm{~Hz}$, star connected alternator has per phase armature resistance of $0.2 \Omega$ and synchronous reactance of $1 \Omega$. Calculate the induced emf, when the machine is supplying rated current at load power factor of unity. Draw the phasor diagram.
2. Determine the current through all the resistances in the following network (Figure 6 ) using source transformation method.
[15]


Figure 6:
3. (a) State and explain the superposition theorem.
(b) Calculate the change in current for the network shown in below figure 7 using compensation theorem when the reactance has changed to j15 ohms. [7+8]


Figure 7:
4. Explain the terms impedance, admittance, reactance and susceptance.
5. (a) Derive the condition for maximum regulation of single phase transformer.
(b) A 100 kVA , single-phase transformer with ratio of $10000 / 200 \mathrm{~V}, 50 \mathrm{~Hz}$, requires 300 V at the h.v. side to circulate full load current with l.v. winding shorted, and the corresponding intake is 1000 W . Calculate the percentage regulation and secondary terminal voltage on full load at 0.8 p.f lagging? $\quad[6+9]$
6. (a) Derive the EMF equation of DC generator.
(b) A 6 pole lap wound D.C. generator has 400 conductors on its armature. The flux per pole is 0.02 wb . Calculate
i. The speed at which the generator must be run to generate 400 V .
ii. What would be the speed if the generator were wave-wound to generate 200V?
7. Explain about various terms associated with magnetic circuits.
8. A star connected balanced three phase generator with an impedance of $(1+\mathrm{j} 2)$ ohms/ph is connected to star connected balanced load with an impedance of $(15+\mathrm{j} 25)$ ohms $/ \mathrm{ph}$. Assuming a positive sequence for the source voltages and that $V_{a}=$ $230 \angle 0^{\circ}$. Determine the
(a) line voltages
(b) line currents

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Time: 3 hours
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1. (a) Discuss the construction of core type single phase transformer.
(b) A transformer having 150 turns on primary and 70 turns on secondary the primary winding is excited by the $230 \mathrm{~V}, 50 \mathrm{~Hz}$ supply and secondary side a load impedance of 6 ohms is connected. Neglect the losses of transformer. Calculate
i. primary and secondary currents
ii. their power factor and also
iii. primary and secondary real powers.
2. (a) Distinguish between RYB and RBY Phase sequence.
(b) A balanced mesh comected load of $(8+\mathrm{j} 9) \Omega$ per phase connected to a 3 -phase, 440 V supply. Find
i. line current
ii. power factor
iii. active power
iv. reactive power
v. total volt amperes.

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[5+10]
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3. For the network shown in figure 8, determine the node voltage $V_{1}, V_{2}$ and the power dissipated in each resistor.


Figure 8:
4. Derive the expression for coefficient of copling between pair of magetically coupled coils.
5. Explain about the response of a inductor to sinusoidal excitation.
6. (a) Explain on what parameters the frequency of induced emf in the armature conductors depends and state the relation between them?
(b) A $1000 \mathrm{kVA}, 3300 \mathrm{~V}, 50 \mathrm{~Hz}, 3$ - phase star connected alternator has a resistance of $0.1 \Omega / \mathrm{ph}$ and synchronous reactance of $2.5 \Omega / \mathrm{ph}$. Find out the $\%$ change in terminal voltage when the rated output is 1000 kVA at 0.8 p.f lags thrown off. The speed and excitation remain unchanged.
7. (a) Explain the compound DC generator with neat circuit diagram.
(b) The armature of a 4-pole wave wound d.c generator is required to generate an e.m.f of 480 V on open circuit when revolving at a speed of 620 rpm . Calculate the magnetic flux per pole required. The armature has 160 slots with 2 coil sides per slot and each coil consisting of three turns. The armature is wavewound.
[6+9]
8. Determine the Thevenin's equivalent eircuit across terminals AB for the circuit in below figure 9 .


Figure 9:

