B.E./B.Tech.Degree Examinations, November/December 2010  
Regulations 2008  
Second Semester  
Common to EEE, E & I and I & C branches  
**EE2151 Circuit Theory**  
Time: Three Hours Maximum: 100 Marks  
Answer ALL Questions

**Part A – (10 x 2 = 20 Marks)**  
1. How are the following a®ected by change of frequency?  
(a) Resistance (b) Inductive reactance.  
2. Distinguish between a mesh and loop of a circuit.  
3. Transform the circuit shown below, from ¢ to Y.  
4. State Maximum power transfer theorem.  
5. Determine the resonant frequency for the series circuit consisting of R = 10 ­, L =  
0.5 mH and C = 10 ¹F.  
6. Two inductively coupled coils have self inductances L1 = 50 mH and L2 = 200 mH.  
If the coe±cient of coupling is 0.5, compute the value of mutual inductance between  
the coils.  
7. Determine the Laplace transform for the unit step function u(t).  
8. Consider two cases of RC parallel circuit shown below,  
¯rst case when DC voltage is applied and second case when AC voltage i s applied.  
Compare how the capacitor gets charged in the two cases.  
9. Three inductive coils each having resistance of 16 ­ and reactance of j12 ­ are  
connected in star across a 400 V, 3Á, 50 Hz supply. Calculate phase voltage.  
10. De¯ne power factor of a circuit.  
**Part B – (5 x 16 = 80 Marks)**  
11. (a) (i) Determine the current IL in the circuit shown in ¯gure below.  
(8)  
(ii) For the circuit shown in ¯gure below,  
determine the total current IT , phase angle and power factor.  
(8)  
OR  
11. (b) (i) Find the current through the source and capacitance in the network shown  
below, using mesh current analysis. (8)  
(ii) Compute V1 and V2 in the circuit shown below, using nodal analysis. (8)  
12. (a) Convert the network shown below, into a ¼-connected equivalent circuit. (16)  
OR  
12. (b) (i) Calculate the current through the 2­ resistor in the circuit shown below,  
using superposition theorem. (8)  
(ii) Calculate the current through the 2­ resistor in the circuit shown below,  
using Thevenin’s theorem. (8)  
13. (a) (i) For the tank circuit shown below, ¯nd the resonance frequency, fr. (10)  
(ii) Determine the quality factor of a coil for the series circuit consisting of R  
= 10 ­, L = 0.1 H and C = 10 ¹F. Derive the formula used. (6)  
OR  
13. (b) (i) Derive the relationship between self inductance, mutual inductance and  
coe±cient of coupling. (8)  
(ii) Consider the single tuned circuit shown below and determine (1) the  
resonant frequency and (2) the output voltage at resonance. Assume  
RS À !rL1, and K = 0.9. (8)  
14. (a) (i) Derive the necessary equations for the response of RL circuit to step input  
and also draw the current response curve. Using your result, write down  
the expression for current in the circuit shown below, when the switch is  
closed at time t = 0.  
(8)  
(ii) A step voltage v(t) = 100 u(t) i s applied to a series RLC circuit with L =  
10 H, R = 2 ­ and C = 5 F. The initial current in the circuit is zero, but  
there is an initial voltage of 50 V on the capacitor in a direction, which  
opposes the applied source. Find the expression for the current in the  
circuit. (8)  
OR  
14. (b) Derive an expression for the current response of RLC series circuit with sinu-  
soidal excitation. From the results, discuss the nature of transient and steady  
state responses. Comment on the phase angle involved. (16)  
15. (a) (i) Prove that a three phase balanced load draws three times as much power  
when connected in delta, as it would draw when connected in star. (8)  
(ii) Determine the line current, power factor and total power when a 3-phase  
400 V supply i s given to a balanced load of impedance (8 + j6)­ in each  
branch i s connected in Star. (8)  
OR  
15. (b) (i) A three-phase four-wire 120 V ABC system feeds an unbalanced Y-connected  
load with ZA = 5\0± ­, ZB = 10\30± ­, and ZC = 20\60± ­. Obtain the  
four line currents. (8)  
(ii) Three impedances Z1 = (17:32+j10), Z2 = (20+j34:64) and Z3 = (0¡j10)  
ohms are delta connected to a 400 V, three phase system. Determine the  
phase currents, line currents and total power consumed by the load. (8)