Hall Ticket Number:

Code No. : 21211

VASAVI COLLEGE OF ENGINEERING *(Autonomous)*, HYDERABAD

B.E. (E.E.E.) II Year I-Semester (Main & Backlog) Examinations, Nov./Dec.-2016

Electrical Circuits - I

Time: **3** hours Max. Marks: **70**

*Note: Answer **ALL** questions in **Part-A** and any **FIVE** from **Part-B***

Part-A (10 × 2 = 20 Marks)

1. Define super mesh and super node.
2. A capacitor is composed of two plates separated by a sheet of insulating material 2.5mm thick and of relative permittivity 4. The distance between the plates is increased to allow of the insertion of a second sheet 5mm thick and of relative permittivity ε_r. If the capacitance so formed is one third of the original capacitance. Find ε.
3. Two sinusoidal currents are given as $i_1 = 100\ \text{Sin}(\omega t + \frac{\pi}{4})$ and $i_2 = 50\ \text{Sin}\ (\omega t - \frac{\pi}{6})$. What is the phase difference between two quantities?
4. Explain the meaning of leading power factor.
5. Find the Norton's current in the circuit shown in fig 1 below.

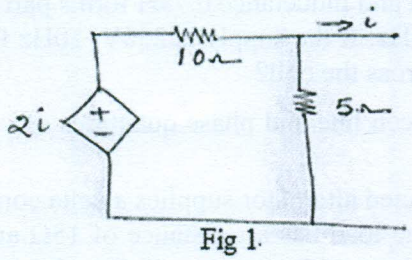

Fig 1.

6. State and explain Reciprocity theorem.
7. In a series RLC circuit, if C is increased what happens to the resonant frequency?
8. Determine the quality factor of a coil for the series circuit consisting of R=12 Ω, L= 0.1 H and C = 10 μF.
9. The impedance matrices of two, two-port networks are given by $\begin{bmatrix} 3 & 2 \\ 2 & 3 \end{bmatrix}$ and $\begin{bmatrix} 15 & 5 \\ 5 & 25 \end{bmatrix}$. If the two networks are connected in series. Determine the impedance matrix of the combination.
10. A balanced 3-phase star connected load of 150kW takes a leading current of 100A with a line voltage of 1100V, 50Hz. Find the circuit constants of the load per phase.

Part-B (5 × 10 = 50 Marks)
(All bits carry equal marks)

11. a) Explain mesh analysis using a suitable example.
    b) In the network shown in fig.2, all sources are time invariant. Determine the value of i_2.

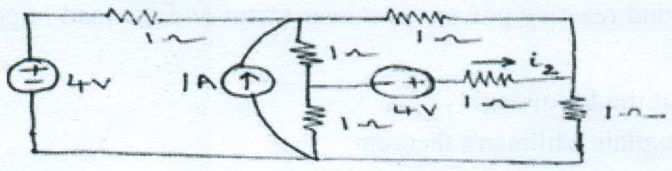

Fig 2

12. a) A symmetrical triangular voltage wave with peak amplitude of 200V and frequency of 50KHz is applied across a 0.02μF capacitor. Calculate the RMS value of the current flowing in the capacitor.

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b) A reactor has a resistance of 5 Ω and an inductance of 0.04H. Find a suitable shunt circuit such that the current taken by the combination will be 20A at 100V at all frequencies.

13. a) Find the Thevenin's equivalent circuit for the circuit shown in Fig. 3.

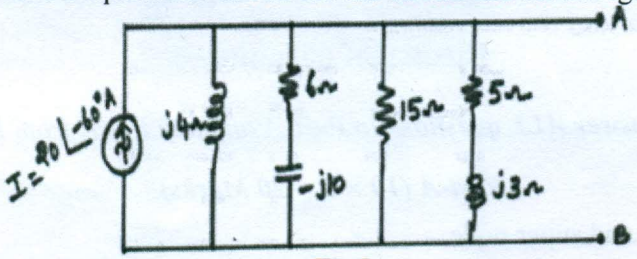

Fig 3

b) Determine the value of Load impedance Z_L for maximum power transfer when it is connected across a source of $V_S = 100\angle 45^0$ volts and $Z_s = 15\angle 30^0$. Also determine the value of maximum power transferred.

14. a) Two combined inductances of two coils connected in series is 0.6H or 0.1 H, depending upon the relative directions of the currents in the coils. If one of the coils when isolated has a self inductance of 0.2H calculate *i)* the mutual inductance and *ii)* the coupling coefficient.

b) A coil of resistance 50 Ω and inductance 0.75H forms part of a series circuit for which the resonant frequency is 55Hz. If the supply is 250V, 50Hz find i) the line current ii) power factor and iii) voltage across the coil?

15. a) Derive the relation between line and phase quantities of voltages and currents for a delta connected system.

b) A three phase star connected alternator supplies a delta connected load with a 415V, 50Hz supply. Each phase of the load has a resistance of 15Ω and reactance of 25Ω. Calculate
i) the current in each phase of the load; *ii)* the alternator phase voltage and current;
iii) the power factor of the load; *iv)* the total power taken by the load.

16. a) Determine the Node voltages of the circuit shown in Fig. 4.

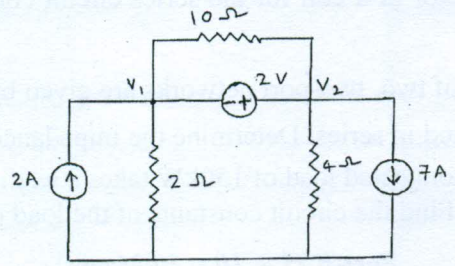

Fig. 4

b) The voltage across a load is $\vartheta(t) = 60\sin(\omega t - 10^0)$ and the current through the element in the direction of the voltage drop is $i(t) = 1.5\sin(\omega t + 50^0)$A. Find i) Complex, apparent, real and reactive powers ii) Power factor and the load impedance iii) Draw the power triangle.

17. Answer any ***two*** of the following:
    a) State and explain Millman's theorem
    b) A 380 V, 3 wire, star connected system has the following phase impedances $Z_R = (4.9 + j2.1)\Omega, Z_Y = j1.8\Omega$ *and* $Z_B = 3.3\Omega$. Find the loads on the equivalent delta-connected system phase sequence is RYB. (RY : 9.5 kW at pf of 0.5 lag; YB : 24.2 kW at pf of 0.8 lag; BR : 0.05 kW at pf of 0.87 lead.)
    c) Derive the relationship for z-parameters in terms of ABCD parameters.