Govt. College of Engineering, Pune 411 005

F. Y. B. Tech --- Nov. / Dec. 2005 End Semester Examination

Sub : EE 101 – Elements of Electrical Engineering.
Duration – 3 hours; Max. marks = 60

Instructions :

(i) Attempt all the six questions.
(ii) Each question is divided in three parts (a), (b) and (c). For each question, attempt any two parts of the three.
(iii) Figures to the right indicate full marks.

Question No. 1

(a) Define "resistance temperature coefficient". --- (2)

A coil has a resistance of 10 Ω at 30° C and it is 12 Ω at 80° C. Determine its resistance at 120° C. --- (3)

(b) State and explain Kirchhoff's voltage law and current law. --- (2)

For the circuit shown in fig. Q 1 (b), determine resistance between terminals A and B. --- (3)

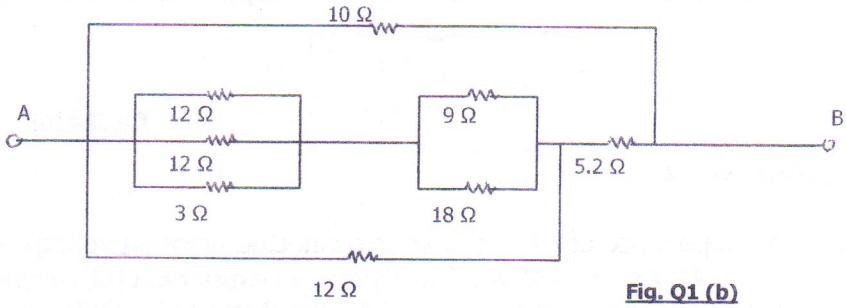

Fig. Q1 (b)

(c) Use Thevenin's Theorem to determine current in 2Ω resistance of the circuit shown in fig. Q 1 (c). --- (5)

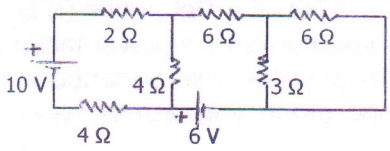

Fig. Q1 (c)

Question No. 2

(a) Derive expressions converting elements of a 'delta' into its equivalent 'star'. --- (3)

Three resistances, 10 Ω, 24 Ω and 36 Ω form a star. Find equivalent delta of this star. --- (3)

(b) Determine the value of voltage across 1 Ω resistance by applying Superposition theorem. (refer Fig. Q 2 (b)). --- (5)

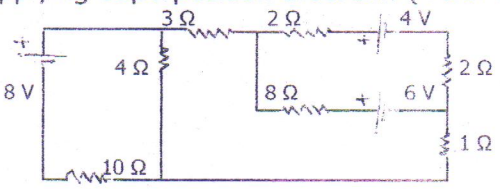

Fig. Q2 (b)

(c) Show that voltage-current relations (as functions of time) for an inductor and for a capacitor are --- (5)

$$i(t) = (1/L)\int_{-\infty}^{t} v(t)\,dt \quad \text{and} \quad v(t) = (1/C)\int_{-\infty}^{t} I(t)\,dt$$

Question No. 3

(a) For an alternating voltage or current, define form factor and peak factor. Prove that for a sine wave, value of the form factor is 1.11. How will you determine r.m.s. value of an alternating quantity having a wave form of any odd shape ? --- (5)

(b) Three impedances (3 + j 4)Ω, (12 - j 5)Ω and (13 + j 0)Ω are connected in parallel across 50 Hz supply. Current taken by the first impedance is 2.6 A. Determine net current taken by this parallel circuit. --- (5)

(c) For the circuit shown in fig. Q 3 (c), determine the value of net impedance as seen through the terminals A and B. Supply frequency ω is 8 rad / sec. --- (5)

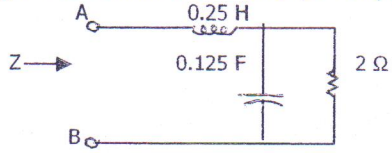

Fig. Q 3 (c)

Question No. 4

(a) An impedance of (8 + j 6) Ω is connected across a voltage of $V = 141.4 \sin(314t + 30^\circ)$. Obtain an expression for current as a function of time and determine the values of current at (i) t = 0.001 sec. (ii) t = 0.002 sec. --- (5)

(b) Three impedances, each of (20 + j 15.658)Ω are connected in star across 440 V, 50 Hz three phase supply. Determine (i) line voltage (ii) phase voltage (iii) line current (iv) phase current (v) power factor and (vi) total power absorbed. Also determine all the values mentioned above, if the three impedances are reconnected in delta across the same supply. --- (5)

(c) State various points of comparison between an electrical circuit and a magnetic circuit. --- (2)

An iron ring of 20 cm mean diameter carries a coil of 500 turns. Relative permeability of the iron is 1500 and cross-sectional radius is 2 cm. Determine current required in the coil to have a flux density of 0.5 T in the core. --- (3)

Question No. 5

(a) Show the equivalent circuit of a working transformer. What do the different parameters shown on the equivalent circuit represent ? Also state various power losses taking place in a transformer and indicate in which parts of the transformer they take place. --- (5)

(b) Define efficiency and regulation of a transformer. How will you determine them in a laboratory test ? What conclusions you will draw from the test results ? There are two transformers. Full load regulation of one of them is 10 % and that of the other is 15 %. Which one is a better transformer ? Why ? --- (5)

(c) With the help of a neat sketch, explain the working of an autotransformer. What are its merits and demerits as compared to a normal transformer ? What are the commercial names of this transformer ? State its applications. --- (5)

Question No. 6

(a) With the help of a neat sketch, show various parts of a D. C. machine. State functions of each part. Also state industrial applications of a (i) D.C. shunt motor (ii) D. C. series motor. --- (5)

(b) Explain the basic principal of working of a three-phase induction motor. Three phase induction motors are very widely used, all over the world. Why is it so ? --- (5)

(c) By showing a circuit diagram, explain how a single phase energy meter is connected to measure energy supplied to a single phase load. --- (3)

A 2 kw water heater is used by a family everyday for 40 minutes. What will be the monthly electricity bill (for 30 days in a month) at Rs. 4/- per unit ? --- (2)
