Code : 031201

B.Tech. 2nd Semester Exam., 2014

BASIC ELECTRICAL ENGINEERING

Time : 3 hours *Full Marks* : 70

Instructions :

(i) All questions carry equal marks.

(ii) There are ***NINE*** *questions in this paper.*

(iii) Attempt ***FIVE*** *questions in all.*

(iv) Question No. ***1*** *is compulsory.*

1. Choose the correct answer (any *seven*) :

(a) The r.m.s. value of the voltage $V(t) = 3 + 4\cos(3t)$ is

(i) $5V$

(ii) $7V$

(iii) $(3 + 2\sqrt{2})V$

(iv) $\sqrt{17}V$

(b) Under the condition of maximum power transfer, the efficiency is

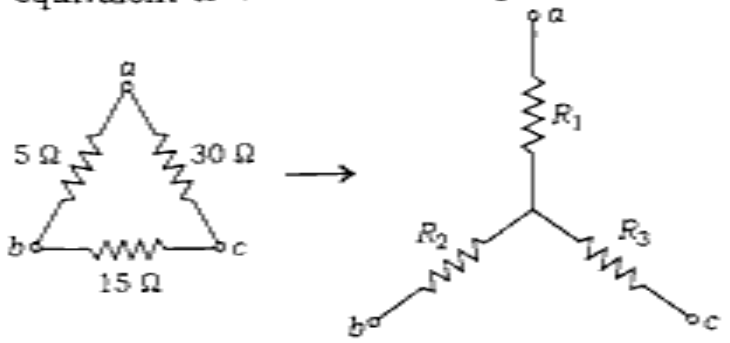
(i) 0%

(ii) 25%

(iii) 50%

(iv) 100%

(c) A delta-connected network with the wye equivalent is shown in the figure below :



The resistances R_1, R_2 and R_3 are respectively

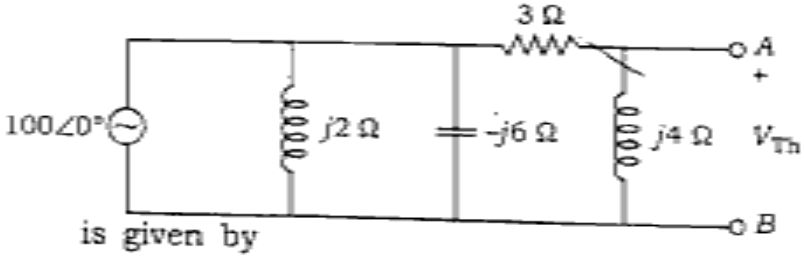
(i) 1·5 Ω, 3 Ω and 9 Ω

(ii) 3 Ω, 9 Ω and 1·5 Ω

(iii) 9 Ω, 3 Ω and 1·5 Ω

(iv) 3 Ω, 1·5 Ω and 9 Ω

(d) Thevenin's equivalent voltage V_{Th} appearing between the terminals A and B of the network shown in the figure below



is given by

(i) $j16(3 - j4)$

(ii) $j16(3 + j4)$

(iii) $16(3 + j4)$

(iv) $16(3 - j4)$

(e) A 3-ϕ, 4-wire star-connected load takes line current of $5\angle 60°$ A, $5\angle -60°$ A, and $5\angle 0°$ A. The neutral current is given by

(i) 0 A

(ii) 5 A

(iii) 10 A

(iv) 15 A

(f) In the measurement of power on balanced load by two-wattmeter method in a 3-ϕ circuit, readings of wattmeters are 3 kW and 1 kW respectively, the latter being obtained by reversing the connections of current coil. The power factor of the load is

(i) 0·277

(ii) 0·554

(iii) 0·625

(iv) 0·866

(g) In a series *R-L-C* circuit at resonance, at half-power frequencies, power into the series circuit at the given voltage is

(i) one-fourth of maximum power possible

(ii) one-third of maximum power possible

(iii) one half of maximum power possible

(iv) three-fourth of maximum power possible

(h) A moving coil ammeter has a resistance of 0·1 Ω including that of its leads. The meter reads up to 100 mA. The shunt resistance required to give full-scale range of 1 A is

(i) 0·011 Ω

(ii) 0·11 Ω

(iii) 1·11 Ω

(iv) 11·1 Ω

(i) The pointer of an indicating instrument is made of

(i) silver

(ii) soft steel

(iii) aluminium

(iv) copper

(j) If the transformer frequency is changed from 50 Hz to 60 Hz, the ratio of eddy-current loss at 50 Hz to 60 Hz at constant voltage is

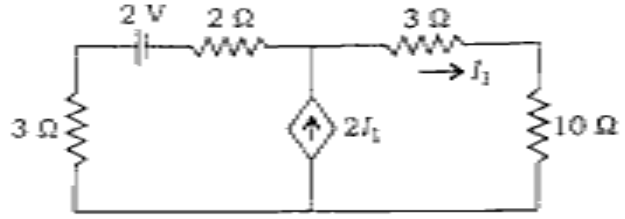
(i) 5/6

(ii) 6/5

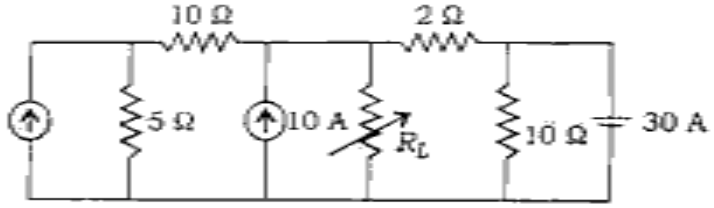
(iii) 25/36

(iv) 36/25

2. Find Norton's equivalent network and hence find the current in the 10 Ω-resistor of the figure shown below :

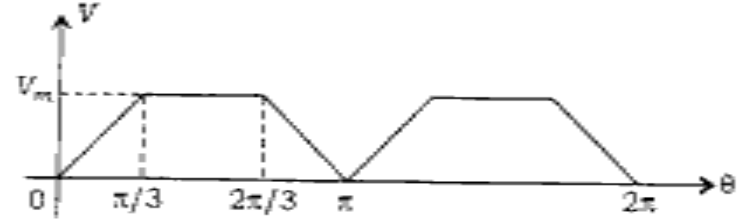


3. Find the value of R_L for maximum power transfer and calculate the maximum power of the figure shown below :



4. For either series or the parallel *R-L-C* circuit, evaluate the half-power frequencies ω_1 and ω_2 in terms of quality factor and resonant frequency ω_0.

5. Find average value and r.m.s. value of the following waveforms :



6. A 415-V, 50-Hz, 3-ϕ voltage is applied to three star-connected identical impedances. Each impedance consists of a resistance of 15 Ω, a capacitance of 177 μF and an inductance of 0·1 henry in series. Find the *(i)* phase current, *(ii)* line current, *(iii)* power factor, *(iv)* active power, *(v)* reactive power and *(vi)* total VA. Draw a neat phasor diagram. If the same impedances are connected in delta, find the *(i)* line current and *(ii)* power consumed.

7. A moving coil instrument has a resistance of 10 Ω and gives full-scale deflection when carrying a current of 50 mA. Show how it can be adapted to measure *(a)* voltage up to 750 V and *(b)* current up to 100 A.

8. Two similar coupled coils have a coupling coefficient of 0·25. When these are connected in series cumulatively, the total inductance is 80 mH. Calculate the *(a)* self-inductance of each coil, *(b)* total inductance when the coils are connected differentially and *(c)* when the coils are connected in parallel (with similar polarity ends joined together).

9. Write short notes on any *two* of the following :

(a) Coupled circuits

(b) Resonance and Q-factor

(c) Power measurement by two-wattmeter method

(d) Thevenin's theorem and Norton's theorem

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