Total No. of printed pages = 4

CAI-301/PoE&EE/3rd Sem/2016/N

PRINCIPLES OF ELECTRICAL AND ELECTRONICS ENGINEERING

Full Marks – 70

Pass Marks – 28

Time – Three hours

The figures in the margin indicate full marks for the questions.

Answer any *five* questions.

1. (a) What do you mean by resistivity of a material ? What is the unit of it ? 4

   (b) A potential difference of 10V is applied across a 2.5Ω resistor. Calculate the current, the power dissipated and the energy transformed into heat in 5 minutes. 5

   (c) Two resistors are connected in parallel and a voltage of 200V is applied to the terminals. The total current taken is 25A and the power dissipated in one of the resistors is 1500W. What is the resistance of each element ? 5

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2. (a) Define RMS value. Derive the RMS value of a sinusoidal waveform. 4

(b) An alternating current of frequency 50 Hz has a maximum value of $200\sqrt{2}$ A. Reckoning the time from the instant the current is zero and becoming positive, find the time taken by the current to reach a value of 141·4A for first and second time. 5

(c) Find the polar form of (–8 –6j). Also draw the phasor diagram. 5

3. (a) Derive the expression of impedance of pure capacitor when sinusoidal voltage is applied across it. 4

(b) Find an expression for the current when a voltage represented by $v = 283 \sin 100\lambda t$ is applied to a coil having $R = 50\Omega$ and $L = 0{\cdot}159H$. 5

(c) One coil having a resistance of 10Ω and an inductance of 0·2H is connected to a 100V, 50 Hz supply. Calculate :

(i) the impedance of the coil

(ii) the phase difference between the current and the applied voltage. 5

4. (a) Give the concept of single-phase ideal transformer. 4

(b) In a certain 50 KVA transformer, the number of turns on the primary and secondary windings are 834 and 58 respectively. If the primary is connected to 3300V supply, find the

(i) secondary voltage

(ii) primary and secondary current when the transformer is fully loaded. Neglect the losses. 10

5. (a) Write the operation of full wave bridge rectifier with suitable diagrams. 7

(b) The four diodes used in bridge rectifier circuit have forward resistance which may be considered constant at 1Ω and an infinite reverse resistance. The alternating supply voltage is 240V rms and resistive lod is 48Ω. Calculate :

(i) mean load current

(ii) rectifier efficiency

(iii) power dissipated in each diode. 7

6. (a) Draw a block diagarm of an unbiased npn BJT. Identify each part of the device and show the depletion regions and barrier voltages. Briefly explain. 7

(b) Calculate the values of I_C and I_E for a BJT with $\alpha_{dc} = 0{\cdot}97$ and $I_B = 50\mu A$. Determine B_{dc} for the device. 7

7. (a) What are the active materials of a lead-acid cell ? 3

(b) What are the chemical reactions during charging and discharging of lead-acid cell ? 4

(c) What are the indications of a fully charged lead-acid cell ? 5

(d) What are the applications of lead-acid batteries ? 2