

GUJARAT TECHNOLOGICAL UNIVERSITY
BE SEMESTER 1st / 2nd (NEW) EXAMINATION WINTER 2016

Subject Code: 2110005

Date: 31/01/2017

Subject Name: Elements of Electrical Engineering

Time: 10:30 AM TO 1:00 PM

Total Marks: 70

Instructions:

1. Question No. 1 is compulsory. Attempt any four out of remaining Six questions.
2. Make suitable assumptions wherever necessary.
3. Figures to the right indicate full marks.

Q.1 (a) Choose the most appropriate option.**07**

1. If temperature of metal is increased, temperature coefficient of resistance will ____.

(a) increase (b) decrease (c) remain unaffected (d) become zero

2. What is equivalent resistance between points A and B in fig.1? R is in Ω .

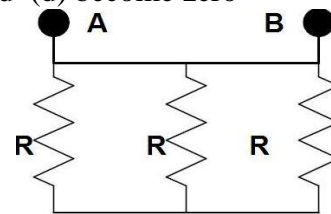
(a) $3R$ (b) $\frac{1}{3R}$ (c) $\frac{R}{3}$ (d) zero

Fig.1

3. Flux linkage per unit current is defined as ____.
4. If a network has an impedance of $Z = 10 \angle -10^\circ \Omega$, which of the following statements is correct?
5. Power consumption over a cycle in purely inductive circuit ____.
6. Halogen lamp is a type of ____.
7. The resistance of human body is about ____.

(a) reluctance (b) inductance (c) permeance (d) magnetomotive force

(a) current lags behind voltage by 10° (b) current leads ahead voltage by 10°

(c) current is in phase with voltage (d) current is in phase opposition with voltage

(a) depends on L (b) depends on supply voltage (c) zero (d) infinity

(a) CFL (b) discharge lamp (c) incandescent lamp (d) LED lamp

(a) 1Ω (b) 10Ω (c) 100Ω (d) 1000Ω **(b) Answer the questions in brief.****07**

1. State principle electrostatic induction.
2. When a permanent magnet is moved continuously back and forth near a stationary coil, emf induces in the coil. What type of induced emf is this?
3. Two incandescent light bulbs of 40 W and 60 W rating are connected in series across the supply main. Which of the bulbs will glow brighter?
4. Define form factor in context with AC circuits.
5. What is relationship between line voltage and phase voltage in case of balanced delta-connected system?
6. If process of three-phase power measurement for balanced load by two wattmeter method shows equal readings of both wattmeters, what will be the power factor of load?
7. State two devices that provide protection against overload and short circuit.

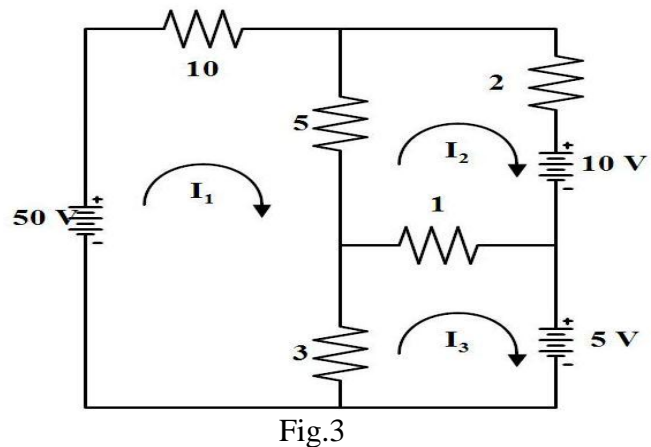
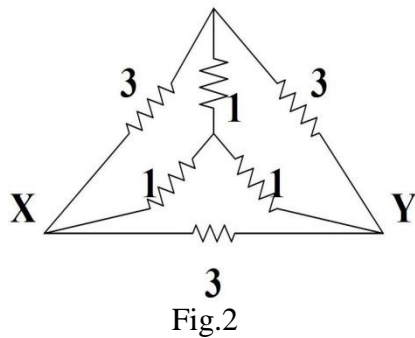
Q.2 (a) State Ohm's law and Kirchoff's laws in context with DC circuits.**03**

- (b) Determine equivalent resistance between points X and Y using star-delta transformation for fig.2. All resistances are in Ω .

04

- (c) Determine mesh currents I_1 , I_2 and I_3 for fig.3. All the resistances are in Ω .

07



- Q.3** (a) State Lenz's and Faraday's laws of electromagnetic induction. 03
 (b) Derive an expression for co-efficient of mutual coupling between two coils having self-inductances of L_1 and L_2 with usual notations. 04
 (c) A steel ring has mean diameter of 2 m. It is wound with a coil having 1000 turns and the current flowing through the coil is 10 A. The relative permeability of the steel is 500. Determine the magnitude of magnetizing force and flux density produced in the ring. 07
- Q.4** (a) Derive an expression of capacitance for parallel plate type construction of capacitor with usual notations. 03
 (b) Discriminate in-phase phasor, lagging phasor and leading phasor with necessary diagram and expression in AC circuit. 04
 (c) Two capacitors of capacitances $8 \mu\text{F}$ and $2 \mu\text{F}$ are connected in series across 100 V DC supply. Now if the supply is removed and the capacitors are connected in parallel, what will be the final charge on each capacitor? 07
- Q.5** (a) Define following terms in context with AC circuits: 03
 (i) RMS value of alternating current (ii) average value of alternating current (c) power factor in case of three-phase balanced system.
 (b) An inductive circuit of resistance 2Ω and inductance of 0.01 H is connected to a 250 V, 50 Hz supply. What is capacitance required to be placed in parallel with this circuit to produce resonance? 04
 (c) What is resonance in AC circuit? Elaborate resonance in case of series R-L-C circuit with the help of phasor diagram and sketch the resonance curve. 07
- Q.6** (a) State different charging methods of battery. Sketch diagram for any one of these methods with all necessary labels. 03
 (b) For a three-phase balanced star-connected system develop the relationship between the following with the help of phasor diagram: 04
 1. Line voltage and phase voltage
 2. Line current and phase current
 (c) A 120 V, 60 W lamp is to be operated on 220 V, 50 Hz supply mains. Calculate what value of (i) non-inductive resistance; (ii) pure inductance; (iii) pure capacitance would be required in order that lamp is run on correct (rated) voltage. Which method is to be preferred out of these three? 07
- Q.7** (a) Enlist various types of lamps and various types of wiring methods. 03
 (b) Two wattmeters are used for measuring three-phase power input to the motor. If readings of meters are 7 kW and 2 kW respectively, calculate input power and power factor of the motor. 04

(c) What are the different methods of earthing? Elaborate pipe earthing method with the help of diagram. **07**
