

**1st  
Semester  
QUESTION PAPERS**

**Bachelor of Engineering**

**Elements of Electrical Engineering  
2008-2014**



**GUJARAT TECHNOLOGICAL UNIVERSITY****B.E. Sem- 1<sup>st</sup> Regular Examination January 2011****Subject code: 110005****Subject Name: Elements of Electrical Engineering****Date: 07/ 01 /2011****Time: 10.30 am - 01.00 pm****Total Marks: 70****Instructions:**

1. Attempt all questions.
2. Make suitable assumptions wherever necessary.
3. Figures to the right indicate full marks.

**Q.1** (a) Three resistances  $R_{ab}$ ,  $R_{bc}$  and  $R_{ca}$  are connected in star. Obtain their equivalent for delta resistances. **08**

(b) A 100V, 60W bulb is connected in series with a 100V, 100W bulb and the combination is connected across the 200V mains. Find the values of resistance that should be connected across the first bulb, so that each bulb may get proper current at the proper voltage. **06**

**Q.2** (a) Compare electric circuit and magnetic circuit by their similarities and dissimilarities. **07**

(b) Derive an expression for the energy stored in an inductor of self inductance 'L' henry carrying the current of 'I' amperes. **07**

**OR**

(b) A mild steel ring of 30 cm mean circumference has a cross-sectional area of 6 cm<sup>2</sup> and has a winding of 500 turns on it. The ring is cut through at a point so as to provide an air-gap of 1 mm in the magnetic circuit. It is found that a current of 4 A in the winding, produces a flux density of 1 T in the air-gap. Find (i) the relative permeability of the mild steel and (ii) inductance of the winding. ( $\mu_0 = 4\pi \times 10^{-7}$ ) **07**

**Q.3** (a) State coulomb's law of electrostatics. **02**

(b) Define capacitance. Derive an expression for the total capacitance of a group of capacitance when (i) they are connected in series (ii) they are connected in parallel. **06**

(c) A series combination having  $R = 2 \text{ M } \Omega$  and  $C = 0.01 \text{ } \mu\text{F}$  is connected across d.c. voltage source of 50V. Determine capacitor voltage and charging current after 0.02 s, 0.04 s and 0.06 s. **06**

**OR**

**Q.3** (a) Explain the variations of watt-meter readings for 3-phase power measurement by two watt-meter method as power factor takes the values of unity, 0.5, between 0.5 & 0 and 0. **07**

(b) A 3-phase load consists of three similar inductive coils of resistances of 50  $\Omega$  and inductance 0.3 H. The supply is 415 V 50 Hz. Calculate:(i) the line current (ii)the power factor and the total power when the load is star connected. **07**

**Q.4** (a) Explain with the aid of a phasor diagram the phenomenon of resonance in a circuit containing an inductor, a capacitor and a resistor in series. **07**

- (b) A circuit consists of a  $4\ \mu\text{F}$  capacitor in parallel with a coil of resistance  $40\ \Omega$  and inductance  $0.25\ \text{H}$ . If the voltage applied to the circuit at resonance frequency is  $230\ \text{V}$ , calculate the current in each branch, supply current and the current magnification. **07**

**OR**

- Q.4** (a) Distinguish between (i) apparent power (ii) active power and (iii) reactive power. **03**
- (b) Prove that average power consumption in pure inductor is zero when a.c. voltage is applied. **06**
- (c) A capacitor of  $100\ \mu\text{F}$  is connected across a  $200\text{V}$ ,  $50\text{Hz}$  single phase supply. Calculate (i) the reactance of the capacitor (ii) r.m.s. value of current and (iii) the maximum current. **05**

- Q.5** (a) Name various types of wiring systems commonly used in and explain any one of them in detail. **07**
- (b) State and explain different illumination schemes used for domestic purpose. **07**

**OR**

- Q.5** (a) Briefly discuss following terms: **08**
- |                    |                         |
|--------------------|-------------------------|
| (i) Luminous Flux  | (ii) Luminous intensity |
| (iii) ILLumination | (iv) Luminance          |
- (b) With help of diagram explain working of Earth Leakage Circuit Breaker (ELCB). **06**

**GUJARAT TECHNOLOGICAL UNIVERSITY**

B.E. First Semester Examination January 2010

Subject Code : 110005

Subject Name: Elements of Electrical Engineering

Date: 06 / 01 / 2010

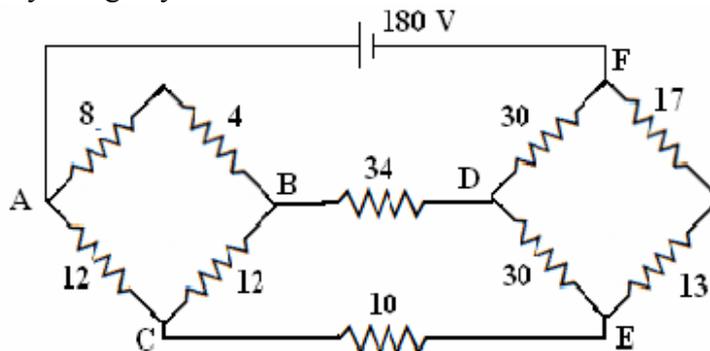
Time: 11.00 am – 1.30pm

Total Marks: 70

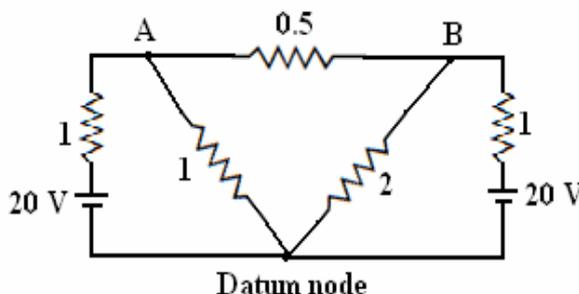
**Instructions:**

1. Attempt all questions.
2. Make suitable assumptions wherever necessary and justify the same.
3. Figures to the right indicate full marks.

- Q.1 (a)** Calculate the current flowing through the  $10\ \Omega$  resistor of circuit shown below, by using any method. Values of resistors are in ohm. **05**



- (b)** Calculate the value of branch currents for the network shown below, using nodal analysis. Values of resistors are in ohm. **05**



- (c)** Giving reason in brief, state the effect of increase in temperature on the resistance of (i) pure metals (ii) insulators (iii) semiconductors **04**

- Q.2 (a)** With reference to electrostatic and capacitance: (i) State Coulomb's laws **07**  
 (ii) Define:- (a) electric field intensity (b) electric potential  
 (c) potential gradient (d) permittivity (e) capacitance
- (b)** Three capacitors have capacitance of 10, 50 and 25  $\mu\text{F}$ . **07**  
 Calculate: (i) charge on each capacitor when they are connected in parallel to a 250 V supply (ii) total capacitance and (iii) potential difference across each capacitor when they are connected in series.

**OR**

- (b)** A resistor of 2 M $\Omega$  is connected in series with a capacitor of 0.01  $\mu\text{F}$  across d.c. voltage source of 50 V. Calculate: (a) capacitor voltage after 0.02 sec, 0.04 sec, 0.06 sec and 1 hour. (b) charging current after 0.02 sec, 0.04 sec, 0.06 sec and 0.1 sec. **07**

- Q.3 (a)** State similarities and dissimilarities between electric circuit and magnetic circuit. **05**
- (b)** Draw B-H curve (Magnetising curve) of a magnetic material and label the figure. Define all the terms relevant to this curve. **05**

- (c) State Faraday's laws of electromagnetic induction. What do you understand by statically induced emf and dynamically induced emf? 04

OR

- Q.3 (a) A mild steel ring of 30 cm mean circumference has a cross-section area of  $6 \text{ cm}^2$  and has a winding of 500 turns on it. The ring is cut through at a point so as to provide an air-gap of 1 mm in the magnetic circuit. It is found that a current of 4 A in the winding, produces a flux density of 1 tesla in the air-gap. Calculate: (i) the relative permeability of the mild steel and (ii) inductance of the winding. 05

- (b) A d.c. current of 1 ampere is passed through a coil of 5000 turns and produces a flux of 0.1 mWb. Calculate the inductance of the coil. What would be the voltage developed across the coil if the current were interrupted in  $10^{-3}$  second? Find the energy stored in the coil. What would be the maximum voltage developed across the coil if a capacitor of  $10 \mu\text{F}$  were connected across the switch interrupting the d.c. current? 05

- (c) State the components of iron loss taking place in the magnetic circuit. Also state the remedies to reduce these losses. 04

- Q.4 (a) Add the following currents as waves and as vectors 05

$$i_1 = 7 \sin \omega t \quad \text{and} \quad i_2 = 10 \sin (\omega t + \pi/3)$$

- (b) Voltage and current for a circuit with two pure elements in series are expressed as follows: 05

$$v(t) = 170 \sin (6280 t + \pi/3) \text{ volts}$$

$$i(t) = 8.5 \sin (6280 t + \pi/2) \text{ amps}$$

Sketch the two waveforms. Determine: (i) the frequency (ii) power factor stating its nature (iii) values of the elements.

- (c) An inductive coil draws 10 A current and consume 1 KW power from a 200 V, 50 Hz, a. c. supply. Determine: (i) the impedance in cartesian and polar form (ii) power factor (iii) reactive and apparent power. 04

OR

- Q.4 (a) Two impedances given by  $Z_1 = (10 + j5) \Omega$  and  $Z_2 = (8 + j6) \Omega$  are connected in parallel across a voltage of  $V = (200 + j0)$  volts. Calculate the circuit current, branch currents and power factor of each branch. Sketch the vector diagram with vectors in appropriate proportion. 07

- (b) Explain the phenomena of resonance in a.c. parallel circuit. Derive the mathematical expression of resonant frequency. Sketch the graphical representation of parallel resonance. 07

- Q.5 (a) Derive the relation between phase and line values of voltages and currents in case of 3-phase (i) star (ii) delta connection. 05

- (b) Prove that the sum of readings of two wattmeters connected to measure power in 3-phase a.c. circuit, gives total power consumed by the circuit. 05

- (c) Using schematic block diagram, briefly explain charging of battery from a.c. supply mains. 04

OR

- Q.5 (a) Three  $100 \Omega$  non-inductive resistances are connected in (a) star (b) delta, across a 400 V, 50 Hz, 3-phase supply mains. Calculate the power taken from the supply system in each case. 05

- (b) Draw a schematic block diagram showing positioning of major equipments in domestic wiring. Label the diagram. Also draw the circuit for controlling one lamp from two points (stair case wiring). 05

- (c) Give comparison between fuse and MCB with regard to protection in wiring installation. 04

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Seat No.: \_\_\_\_\_

Enrolment No. \_\_\_\_\_

## GUJARAT TECHNOLOGICAL UNIVERSITY

B.E. Sem-I Remedial examination March 2009

**Subject code: 110005**

**Subject Name: Elements of Electrical Engineering.**

Date: 19 / 03 / 2009

Time: 02:00pm To 04:30pm

**Instructions:**

**Total Marks: 70**

1. Attempt all questions.
2. Make suitable assumptions wherever necessary.
3. Figures to the right indicate full marks.

<b>Q1. (A)</b>	Derive an expression for the capacitance of a parallel plate capacitor with plate area 'A' and distance of separation between the plates 'd' in M.K.S.	<b>(07)</b>
<b>(B)</b>	Two capacitors having 8 $\mu\text{F}$ and 4 $\mu\text{F}$ are connected in series and charged from a constant voltage of 210 Volts supply. Calculate (a) The voltage across each capacitor (b) The charge on each capacitor.	<b>(07)</b>
<b>OR</b>		
<b>(B)</b>	A capacitor of 10 $\mu\text{F}$ is connected to a DC supply through a resistance of 1.1 M $\Omega$ . Calculate the time taken for the capacitor to reach 90 % of its final charge.	<b>(07)</b>
<b>Q2(A)</b>	Prove that if a DC current of 'I' amperes is super-imposed in a conductor by an AC current of maximum value 'I' amperes, the root mean square (rms) value of the resultant is $(\sqrt{3}/\sqrt{2})I$ .	<b>(07)</b>
<b>(B)</b>	Two branches numbered '1' and '2' having impedances of $3 + j4 \Omega$ and $3 - j4 \Omega$ respectively are connected to a 230 Volt, 50 Hz rms source. Find out : (i) The total current drawn from the source. (ii) Power factor of that current. (iii) Draw the phasor diagram for $I_1$ , $I_2$ , the total current and supply voltage.	<b>(07)</b>
<b>Q3 (A)</b>	State and explain Kirchoff's voltage and current laws.	<b>(05)</b>
<b>(B)</b>	Draw Wheatstone's bridge network ABCD as follows: Resistance between terminals A-B, B-C, C-D, D-A and B-D are 10, 30, 15, 20 and 40 ohms respectively. A 2 volt battery of negligible resistance is connected between terminals A and C. Determine the value and direction of the current in the 40 $\Omega$ resistor.	<b>(05)</b>
<b>(C)</b>	Show that $R_t = R_0(1 + \alpha t)$ . Notations have usual meaning. The resistance of tungsten filament of a lamp is 20 $\Omega$ at the room temperature of 20° C. What is the operating temperature of the	<b>(04)</b>

	filament if the resistance temperature co-efficient of tungsten is $0.005/^{\circ}\text{C}$ at $20^{\circ}\text{C}$ . The base of the lamp is marked 120 Volt, 50 W.	
	<b>OR</b>	
<b>Q3 (A)</b>	Draw the circuit diagram of tubelight with the wiring of choke and starter. Explain the functioning of the circuit.	<b>(05)</b>
<b>(B)</b>	Explain the biological effect of electric current keeping the electric safety in view. Explain plate earthing.	<b>(05)</b>
<b>(C)</b>	Sketch the staircase wiring.	<b>(04)</b>
<b>Q4 (A)</b>	Give the comparison between electric and magnetic circuit.	<b>(05)</b>
<b>(B)</b>	Give the comparison of series resonance and parallel resonance.	<b>(05)</b>
<b>(C)</b>	State and explain Faraday's laws of electromagnetic induction.	<b>(04)</b>
	<b>OR</b>	
<b>Q4 (A)</b>	Two coils having 100 and 1000 turns respectively have a common magnetic circuit of 25 cm. diameter and $625\text{ cm}^2$ cross-section and a constant relative permeability of 2000. Calculate (i) The self inductance of both the coils. (ii) The mutual inductance between them if the co-efficient of coupling is 0.5.	<b>(07)</b>
<b>(B)</b>	Write down the line value and phase value relationship of voltages and currents in 3 phase star and delta connected systems.	<b>(07)</b>
<b>Q5 (A)</b>	Draw and explain the wiring diagram of supply mains with energy meter and distribution box.	<b>(07)</b>
<b>(B)</b>	Give the circuit diagram of ELCB. Explain its working in brief.	<b>(07)</b>
	<b>OR</b>	
<b>Q5 (A)</b>	Explain the construction and working of any type of battery you know. What is its voltage when it is fully charged ?	<b>(07)</b>
<b>(B)</b>	The input power to a 3 phase load is measured by two wattmeter method. The ratio of the readings of the two wattmeters connected for 3 phase balanced load is 4:1. The load is inductive. Find the load power factor.	<b>(07)</b>

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**GUJARAT TECHNOLOGICAL UNIVERSITY****B.E. Sem-I Remedial Examination March / April 2010****Subject code: 110005****Subject Name: Elements of Electrical Engineering****Date: 05 / 04 / 2010****Time: 12.00 Noon – 02.30 pm****Total Marks: 70****Instructions:**

1. Attempt all questions.
2. Make suitable assumptions wherever necessary.
3. Figures to the right indicate full marks.

**Q.1 (a)** Explain effect of temperature on resistance. Define temperature co-efficient & obtain expression  $\alpha_{t_2} = \frac{1}{1/ \alpha_{t_1} + (t_2 - t_1)}$  **07**

**(b)** Explain KCL and KVL. **04**

**(c)** Why are domestic appliances connected in parallel **03**

**Q.2 (a)** Derive expression for delta to star conversion of resistive network. **06**

**(b)** A parallel plate capacitor has a plate area of 4 cm<sup>2</sup>. The plates are separated by Three slabs of different dielectric materials of thicknesses 0.3, 0.4 , & 0.3 mm With relative permittivities of 3, 2.5 and 2 respectively. Calculate the capacitance of each material and the voltage across them if the supply is 200 V **08**

**OR**

**(b)** Derive equation for charging of capacitor in RC circuit. also define time constant of circuit. **08**

**Q.3 (a)** An iron ring of 40 cm mean diameter and 7 cm<sup>2</sup> cross section has an air gap of 2 mm. It is informally wound with 750 turns of wire and carries a current of 3A The iron takes 60% of the total mmf. Neglect magnetic leakage. Find the total mmf, magnetic flux , reluctance and flux density. **07**

**(b)** State & explain Faraday's laws of electromagnetic induction. **04**

**(c)** Explain magnetic hysteresis. **03**

**OR**

**Q.3 (a)** Define following terms with respect to a.c.waveform **06**

(i) Frequency (ii) Power factor (iii) R.M.S. value (iv) Amplitude  
(v) Average value (vi) Form Factor.

**(b)** A circuit takes a current of 3A at a power factor of 0.6 lagging when connected to 115V, 50Hz supply. Another circuit takes a current of 5A at a power factor of 0.707 leading when connected to same supply. If the two circuits are connected in series across 230V, 50 Hz supply. Calculate the (i) current (ii) power consumed (iii) Power factor. **08**

**Q.4 (a)** Explain the method of measuring 3- $\Phi$  power by two wattmeters. **07**

**(b)** Prove that current through pure inductor is always lagging by 90° to its voltage and power consumed is zero. **07**

**OR**

- Q.4** (a) Three impedances  $Z_1 = 5-j10 \Omega$ ,  $Z_2 = 2+j20 \Omega$  and  $Z_3 = 4+j2 \Omega$  are connected in parallel. If the total current is 20A, Find the current shared by each. **06**
- (b) Explain in brief (i) self inductance (ii) Mutual inductance **04**
- (c) Compare series and parallel resonance. **04**
- Q.5** (a) Discuss the various types of lighting scheme **06**
- (b) Explain various types of grouping of cells, also discuss rating of battery. **08**
- OR**
- Q.5** (a) Draw staircase lighting schematic diagram. **03**
- (b) What is the importance of earthing in electrical laboratory ? **04**
- (c) Explain working of ELCB & MCB **07**

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Seat No.: \_\_\_\_\_

Enrolment No. \_\_\_\_\_

(EE-8)

**GUJARAT TECHNOLOGICAL UNIVERSITY**

**B.E. all Sem-I Examination December 08/January 09**

**Elements of Electrical Engineering (110005)**

**DATE: 31-12-2008, Wednesday TIME: 12.00 to 2.30 p.m. MAX. MARKS: 70**

**Instructions:**

- 1. Attempt all questions.**
- 2. Make suitable assumptions wherever necessary.**
- 3. Figures to the right indicate full marks.**
- 4. Symbols have their usual meanings.**

**Q.1**

- (a) Define temperature co-efficient of resistance. How resistances of different materials vary with temperature? Prove that  $\alpha_t = \alpha_0/(1 + \alpha_0 t)$  **08**
- (b) Explain the following terms: (i) Magnetomotive force (ii) Magnetic field Intensity (iii) Reluctance **06**

**Q.2**

- (a) Derive the expression for the voltage across the capacitor at any instant after the application of **dc** voltage **V** to a circuit having a capacitance **C** in series with resistance **R**. **07**
- (b) An iron ring having a cross sectional area of **5cm × 4cm** and a mean diameter of **18 cm** has a coil of **270** turns uniformly wound over it. A current of **1.27 A** flows through the coil which produces a flux of **1.13 mWb** in the ring. Find the reluctance of the circuit, the absolute and relative permeabilities of iron **07**

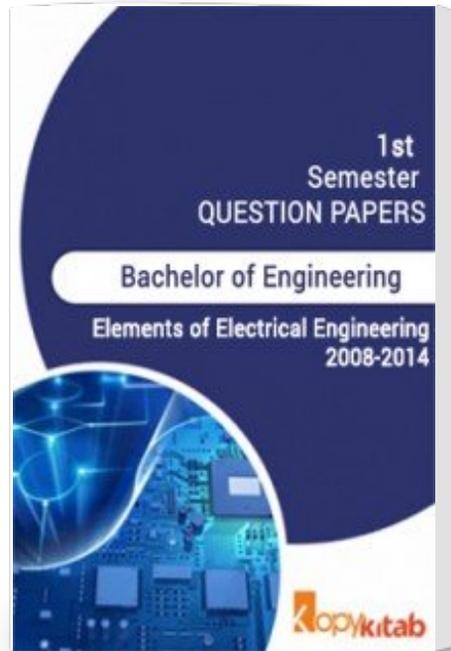
**OR**

- (b) Two inductive coils are connected in parallel. Derive the expression for total inductance when (i) coils are in parallel aiding connection (ii) coils are in parallel opposing connection **07**

**Q.3**

- (a) Explain the method of transforming a star network of resistances into delta network and vice versa. **09**
- (b) For the network shown in *figure 1*, determine the current supplied by the battery using star-delta transformation. (All resistances are in **ohms**) **05**

# Elements of Electrical Engineering 2008 to 2014



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