

**BACHELOR OF ENGINEERING IN CHEMICAL ENGINEERING EXAMINATION (Old), 2017**  
(1<sup>st</sup> Year 2<sup>nd</sup> Semester)

**SUBJECT : ELECTRICAL TECHNOLOGY B**

Time : Three hours

Full Marks -100  
(50 marks for each part)

Use separate answer-script for each part

No. of question	<p align="center"><b>Part I</b> <u>Answer any three questions.</u> Two marks reserved for neatness and well organized answer.</p>	Marks
1. a)	State Thevenin's Theorem.	2
b)	Determine the current through $15\Omega$ resistor in the following circuit using "Thevenin's theorem". <div style="text-align: center;"> </div>	8
c)	Find the current through $15\Omega$ resistor in the following circuit using Superposition's theorem. <div style="text-align: center;"> </div>	6
2. a)	Draw and label a pure sinusoidal waveform of current. Deduce the relation between R.M.S. and average value(s) of the current waveform in terms of its maximum value.	8
b)	A balanced star connected load is supplied from a symmetric 3-phase, 400 V system. The current in each phase is 30 amps, and lags $30^\circ$ behind the phase voltage. Find the phase voltage and total power consumption of the load.	8

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3.a)	An iron ring has a mean diameter of 30 cm and a cross sectional area of $6 \text{ cm}^2$ . It is wound with a coil of 2000 turns. An air gap of 1.5 mm width is cut in the ring. Determine the current required in the coil to produce a flux of 0.48 mWb in the air gap. Consider the relative permeability of iron under this condition as 800. Neglect leakage and fringing.	8
b)	Mention similarities and dissimilarities between electric and magnetic circuits.	4
c)	How eddy current loss and hysteresis loss are minimized in any electrical machine?	4
4. a)	A resistance(R), inductance (L)=0.10 H and capacitance(C) are connected in series combination. The current flowing through the circuit is $14.14 \cos(3000t-75^\circ)\text{A}$ for the supply voltage of $500 \cos(3000t-15^\circ)\text{V}$ . Draw the phasor diagram and find the value of R and C.	8
b)	How power consumption and power factor of any three phase electrical circuit are measured using two wattmeter method? Assume balanced load and sinusoidal voltage and current waveform for the three phase circuit.	8
5.	Write short notes on:	
a)	Hysteresis loop.	8
b)	Maxwell's mesh current method.	8

**B.E. CHEMICAL ENGINEERING FIRST YEAR SECOND SEMESTER (OLD) - 2017****ELECTRICAL TECHNOLOGY - B**

Time: Three hours

(50 marks for each Part)

Full Marks: 100

Use a separate Answer-Script for each Part

**PART- II**Answer question no. 1 and *any two* from the rest of the questions*Two marks* are reserved for neatness and well organized answers.

- I. Multiple choice questions (Answer any ten) [10x1=10]
- I. Breather mounted on transformer tank contains  
 (a) water                      (b) any liquid                      (c) silica gel                      (d) oil
- II. A 25 KVA transformer has a voltage ratio of 3300/400 Volt. Find the primary current  
 (a) 6.25A                      (b) 62.5A                      (c) 7.58A                      (d) 75.8A
- III. The armature reaction of a dc machine is neutralized by using  
 (a) Armature windings      (b) compensating windings      (c) field windings      (d) all of them
- IV. The direction of rotation of a dc motor is reversed by reversing the connection of  
 (a) armature winding      (b) field winding                      (c) both of them      (d) any one of them
- V. Transformer core is laminated in order to reduce  
 (a) core loss                      (b) eddy current loss                      (c) hysteresis loss                      (d) cost
- VI. Friction loss in a transformer is  
 (a) 20% of total loss      (b) 10% of total loss                      (c) equal to iron loss      (d) nil
- VII. If the secondary terminal of a 5:1 step down transformer is connected to the primary of a 2:1 step down transformer, the step down ratio of both transformer is  
 (a) 2.5 : 1                      (b) 3 : 1                      (c) 10 : 1                      (d) 7 : 1
- VIII. The commutator bars of a dc machine are made of  
 (a) Carbon                      (b) Copper                      (c) cast iron                      (d) silicon steel
- IX. Low voltage windings are placed nearer the core in case of a concentric winding because  
 (a) it reduces leakage flux                      (b) it reduces hysteresis loss  
 (c) it reduces eddy current loss                      (d) it reduces insulation requirement
- X. Silicon steel is preferred for transformer core because  
 (a) it decreases tensile strength                      (b) it decreases permeability  
 (c) it reduces resistivity of core                      (d) it reduces hysteresis & eddy current loss

- XI. The phase relationship between primary and secondary voltage of a transformer is  
 (a)  $180^\circ$  out of phase      (b) primary voltage lagging secondary voltage by  $90^\circ$   
 (c) same phase      (d) primary voltage leading secondary voltage by  $90^\circ$
2. (a) Draw and explain the phasor diagram of a single phase transformer for leading power factor under load condition.  
 (b) A 33 KVA 2200/220 V single phase transformer has the following parameters:  
 Primary winding (h.v. side): resistance =  $2.4 \Omega$ ; leakage reactance =  $6.00 \Omega$   
 Secondary winding (l.v. side): resistance =  $0.02 \Omega$ ; leakage reactance =  $0.07 \Omega$ .
- Find the primary resistance and leakage reactance referred to secondary.
  - Find the secondary resistance and leakage reactance referred to primary.
  - Find the equivalent resistance and equivalent reactance referred to (i) primary and (ii) secondary. (10+9)
3. (a) Discuss the starting methods of a 3 phase induction motor.  
 (b) Derive an expression for the torque developed in an induction motor and hence draw the torque speed characteristics. (10+9)
4. (a) With a neat sketch, draw the essential parts of a DC generator. Label the parts.  
 (b) Classify DC machines by the type of excitation. Draw equivalent circuit in all cases. (8+2+9)
5. (a) Discuss the no load characteristic of a separately excited DC generator.  
 (b) Discuss the functions of  
 (i) Conservator of a transformer      (ii) Interpoles of a dc machine  
 (iii) Yoke of a dc machine      (iv) Breather of a transformer  
 (c) What are the types of transformer by their core construction? Distinguish between them. (6+8+5)