



Name :

Roll No. :

Invigilator's Signature :

**CS/B.Tech/SEM-1/EE-101/2009-10
2009**

BASIC ELECTRICAL ENGINEERING

Time Allotted : 3 Hours

Full Marks : 70

The figures in the margin indicate full marks.

*Candidates are required to give their answers in their own words
as far as practicable.*

GROUP – A

(Multiple Choice Type Questions)

1. Choose the correct alternatives for any *ten* of the following :
 $10 \times 1 = 10$

- i) In series R-L-C circuit, the power factor at resonance is
- | | |
|----------|---------|
| a) unity | b) zero |
| c) 0.5 | d) 0.75 |
- ii) In a transformer, electric power is transformed from one circuit to another without change in
- | | |
|--------------|------------|
| a) voltage | b) current |
| c) frequency | d) turns. |



- iii) The efficiency of a transformer is maximum when
- copper losses are zero
 - iron losses are zero
 - copper losses are 50% of the iron losses
 - copper losses are equal to iron losses.
- iv) For any medium, the electric flux \vec{D} is related to electric intensity \vec{E} by the equation
- $\vec{D} = \epsilon_0 \vec{E}$
 - $\vec{D} = \epsilon_0 \epsilon_n \vec{E}$
 - $\vec{D} = \vec{E} / \epsilon_0 \epsilon_n$
 - $\vec{D} = \epsilon_0 \frac{\vec{E}}{\epsilon_n}$
- v) The direction of *emf* generated in a *dc* generator can be determined from
- Lenz's law
 - Kirchhoff's law
 - Fleming's left hand rule
 - Fleming's right hand rule.
- vi) The reluctance of a magnetic circuit depends on its
- length
 - cross-sectional area and length
 - resistivity
 - cross-sectional area.



- vii) The core of a *dc* machine is laminated to reduce
- copper loss
 - eddy current loss
 - hysteresis loss
 - thermal loss.
- viii) If $e_1 = A \sin \omega t$ and $e_2 = B \sin (\omega t - \phi)$, then
- e_1 lags e_2 by ϕ
 - e_2 lags e_1 by ϕ
 - e_2 leads e_1 by ϕ
 - e_1 is in phase with e_2 .
- ix) In three-phase induction motor
- 3-phase supply is to be given to the stator winding & *dc* supply to the rotor winding
 - only 3-phase supply is to be given to the stator winding
 - 3-phase supply is to be given to both stator and rotor winding
 - 3-phase supply is to be given to rotor winding.
- x) Three resistors of 4Ω , 6Ω , and 8Ω are connected in parallel. In which resistor power dissipation is maximum ?
- 4Ω
 - 6Ω
 - 8Ω
 - equal in all resistors.

- ## GROUP – B

Answer any *three* of the following. $3 \times 5 = 15$

- 4



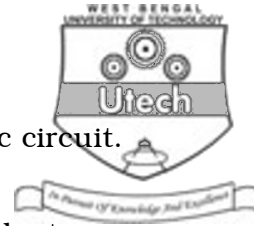
5. Derive the expression of (i) average (ii) R.M.S. value of a half-wave rectified voltage wave. 5
6. Show that power in a three-phase balanced system can be measured by two wattmeters. 5

GROUP – C

(Long Answer Type Questions)

Answer any *three* of the following. $3 \times 15 = 45$

7. a) Find the current through resistance (R_2) for the network shown in the figure using the superposition theorem.
- b) Find the value of R_2 for which the power transfer across R_2 is maximum. Find the value of this maximum power. 8 + 7



8. a) Compare magnetic circuit with electric circuit.
- b) Define self-inductance and mutual inductance.
- c) An iron ring of mean length 50 cm has an air-gap of 1 mm and a winding of 200 turns. The relative permeability of iron is 300 when 1 amp current flows through the coil. Determine the flux density. 4 + 4 + 7
9. a) Draw neatly the phasor diagram of a single-phase transformer connected with lagging power factor load.
- b) The open circuit and short circuit test data of a 5 kVA, 200/400 volts, 50 Hz, single-phase transformer are
- i) O.C. test : Primary voltage = 200 volts, $I = 0.75$ A, $W = 75$ W
- ii) S.C. test : Primary voltage = 18 volts, S.C. current on the secondary side = 12.5 A, $W = 60$ W.
- Find the parameters of the equivalent circuit referred to the primary and draw the equivalent circuit. 5 + 10
10. a) What do you mean by back *emf* ?
- b) Deduce the *emf* equation of a *dc* generator.



- c) A 4-pole, 220 V, DC shunt motor has armature and shunt field resistance of 0.2Ω and 220Ω respectively. It takes 20 A at 220 V from a source while running at a speed of 1000 rpm, Find

i) field current

ii) armature current

iii) back *emf*

iv) torque developed.

3 + 4 + 8

11. a) Draw the circuit diagram, waveform of voltage and current, phases diagram of (i) purely resistive circuit (ii) purely inductive circuit (iii) purely capacitive circuit, supplied by sinusoidal voltage.

- b) A coil takes a current of 2A when connected to a 240 V, 50 Hz sinusoidal supply and consumes 200 W. Calculate the resistance, impedance and inductance of the coil.

- c) Deduce the expression of resonance frequency in RLC series circuit.

6 + 6 + 3

12. a) A 3-phase induction motor is self-starting motor. In spite of that why we use various starters to start the 3-phase induction motor ?

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- b) Explain the supply frequency control method of speed control of 3-phase induction motor.
- c) A 6-pole, 50 Hz induction motor has no-load speed 980 rpm and full-load speed 960 rpm.

Calculate :

- i) synchronous speed
- ii) no-load slip
- iii) full-load slip
- iv) frequency of rotor at full-load. 3 + 5 + 7
