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First/Second Semester B.E. Degree Examination, July/August 2004

Common to all branches Basic Electrical Engineering

Time: 3 hrs.]

[Max.Marks : 100

- Note:** 1. Answer any FIVE full questions.
2. All questions carry EQUAL marks.

1. (a) State and explain Faraday's Laws of electromagnetic induction. (5 Marks)
- (b) Define
 - i) Fleming's right hand rule
 - ii) Self inductance
 - iii) Coefficient of coupling
 - iv) RMS value of an A.C quantity
 - v) P.f. of an a.c.circuit. (5 Marks)
- (c) A coil of 1000 turns is wound on a silicon steel ring of relative permeability 1200. The ring has a mean diameter of 10cm and cross sectional area of 12 sq.cm. When a current of 4 amperes flows through the coil, find
 - i) Flux in the core
 - ii) Inductance of the coil
 - iii) the emf induced in the coil if the flux falls to zero in 15 milli seconds.
 - iv) Now, if another similar coil is placed such that 70% magnetic coupling exists between the coils, find the mutual inductance. (10 Marks)
2. (a) An alternating voltage of $e \equiv E_m \sin \omega t$ is applied across a pure inductor of L Henries.
 - i) Derive an expression for the resulting current.
 - ii) What is its active power consumption?
 - iii) Draw the phase diagram.
 - iv) Show the wave forms of voltage, current and power. (8 Marks)
- (b) A single phase voltage of $(200 + j0)V$ at 50Hz is applied to a circuit comprizing of a resistance of 20Ω , inductance of 20mH and a capacitance of $150\mu F$ connected in series. Find,
 - i) impedance of the circuit
 - ii) Current drawn from supply
 - iii) power factor
 - iv) Power drawn
 - v) Energy stored in inductor and capacitor and draw voltage diagram. (12 Marks)
3. (a) State the advantages of 3-phase system. (4 Marks)
- (b) Obtain the numerical relationship between the line and phase quantities of a balanced Δ connected load (6 Marks)

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- (c) 2 wattmeters are connected to measure the input to a 3- ϕ , 20HP, 50Hz Induction motor which works at a full load efficiency of 90% and a power factor of 0.85. Find the readings of the 2 wattmeters. (10 Marks)
4. (a) With a neat diagram, explain the construction and working principle of a dynamometer wattmeter. (8 Marks)
- (b) Define domestic wiring. What important factors are to be considered in domestic wiring? Mention the different types of wiring in practice. (6 Marks)
- (c) What do you understand by "Earthing"? With a neat diagram explain plate earthing. (6 Marks)
5. (a) Make a list of all the parts of a d.c. machine and write the functional use of each part. (6 Marks)
- (b) A 4 pole lap connected D.C generator has 600 armature conductors and runs at 1200 rpm. This generator has a total flux of 0.24 wb in it.
- Derive the emf equation of the generator from fundamentals.
 - Calculate the emf induced in the above D.C. generator.
 - Find the speed at which it should be driven to produce the same emf when wave connected. (7 Marks)
- (c) A 4 pole, 220V, lap connected D.C. shunt motor has 36 slots, each slot containing 16 conductors. It draws 40A from the supply. The field resistance and armature resistances are 110Ω and 0.1Ω respectively. The motor develops an output power of 6kW. The flux per pole is 40mwb. Calculate
- the speed
 - torque developed by the armature and
 - the shaft torque. (7 Marks)
6. (a) Explain the necessity of starter for D.C. motor. With a neat internal wiring diagram of a three point starter explain how it works. (8 Marks)
- (b) Explain the constructional details and types of a synchronous machine. (7 Marks)
- (c) A 6 pole, 3 phase star connected alternator has an armature with 90 slots and 12 conductors/slot. It revolves at 1000 rpm, the flux/pole being 0.5wb. Calculate the line value of emf generated. if the distribution factor is 0.96 and pitch factor 0.97. (5 Marks)
7. (a) Derive the emf equation of 1- ϕ transformer. (6 Marks)
- (b) Define the transformation ratio and regulation of a transformer. (1 Marks)
- (c) A 500kVA transformer has an efficiency of 92% at full load, unity p.f and at half full load, 0.9pf. Determine its efficiency at 80% of full load and 0.95pf (10 Marks)
8. (a) Explain the working principle of 3 phase induction motor and state the field of applications of Induction motors. (7 Marks)
- (b) What are the various methods of starting squirrel cage induction motors? With a neat diagram explain star - delta starter. (7 Marks)
- (c) The frequency of the voltage applied to 4-pole induction motor is 50Hz and that of the rotor induced emf is 1.5Hz. What is the slip and at what speed the motor is running? (6 Marks)

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