

**II B.Tech II Semester Supplementary Examinations, April/May 2005**  
**ELECTRICAL SCIENCE**  
( Common to Civil Engineering, Mechanical Engineering, Mechatronics and  
Production Engineering)

**Time: 3 hours****Max Marks: 70**

**Answer any FIVE Questions**  
**All Questions carry equal marks**

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1. (a) Derive the formula for magnetic force of a long straight conductor.  
(b) A current of 15A is passing along a straight wire. Calculate the force on a unit magnetic pole placed 0.15 m from the wire.
2. (a) What is meant by Active power, reactive power and apparent power.  
(b) A coil of  $R = 4\Omega$ ,  $X_L = 3\Omega$  connected in series with a condenser of  $R = 8\Omega$ ,  $X_C = 8\Omega$ , this combination is connected to  $4\Omega$  resistor. Across this series circuit a voltage  $100\angle 0$  is applied. Calculate
  - i. current
  - ii. voltage drops across coil, condenser and resistor and
  - iii. power absorbed by the circuit. Take voltage vector along the reference axis.
3. (a) Sketch and explain the external characteristics of a d.c series generator.  
(b) In a 220V supply system, a series generator, working on a linear portion of its magnetisation characteristic is employed as booster. The generator characteristic is such that the induced emf increases by one volt for every increase of 6A of load current through the generator. The total armature circuit resistance of the generator is 0.02ohms. If the supply voltage remains constant, find the voltage supplied to consumer at a load current of 96A. Calculate also the power supplied by the booster itself.
4. (a) Explain in detail the speed control of dc shunt motors.  
(b) A 500V shunt motor runs at its normal speed of 250 rpm when the armature current is 200A. The resistance of the armature is  $0.12\Omega$ . Calculate the speed when a resistance is inserted in the field reducing the shunt field to 80% of normal value and armature current is 100A.
5. (a) Distinguish between the efficiency and Regulation of a Transformer. Show how power affects both of them with necessary equations.  
(b) The efficiency of a 250 KVA, Single phase Transformer is 96% when delivering full-load at 0.8 power factor lagging and 97.2% when delivering half full load at unity power factor. Determine the efficiency at 75% of full load at 0.8 power factor lagging.
6. (a) Explain the operation of a synchronous Generator.

- (b) A 3-phase star-connected alternator, is rated at 1,600 KV A and 13,500 V. The armature effective resistance, and synchronous reactance are 1.5 Ohms, and 30 Ohms respectively per phase. Calculate the percentage regulation for a load of 1,280 KW at p.f. of 0.8 leading.
7. (a) Explain Pessimistic method of finding regulation of a given alternator.
- (b) The effective resistance of a 2200V, 50Hz, 440KVA, 1 – phase alternator is 0.5 Ohms. On short circuit a field current of 40 Amps gives the full load current of 200Amps. The EMF on open circuit with the same field excitation is 1160V. Calculate
- Synchronous impedance
  - Synchronous reactance
  - % regulation at 0.707 PF leading.
8. Two wattmeters connected to measure the input to a balanced three phase circuit indicate 2500W and 500W respectively. Find the power factor of the circuit.
- when both readings are positive and
  - when the later readings is obtained after reversing the connections to the current coil of one instrument. Draw the phasor and connection diagrams.

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