Code No: NR220205 **NR**

II B.Tech II Semester Supplementary Examinations, November/December 2005
ELECTRO MECHANICS-II
(Electrical & Electronic Engineering)

Time: 3 hours **Max Marks: 80**

Answer any FIVE Questions
All Questions carry equal marks
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1. (a) Explain the working principle of transformer and derive the emf equation.
   (b) A single phase 50 Hz transformer has 100 turns on the primary and 400 turns on the secondary winding. The net cross-sectional area of core is 250 cm^2. If the primary winding is connected to a 230 V 50 Hz supply, determine
      i. The EMF induced in the secondary winding
      ii. The maximum value of flux density in the core. [8+8]

2. (a) Explain various losses and derive the condition for minimum efficiency of a transformer .
   (b) The efficiency at unity power factor of 6600/384 volts 100 KVA 50 Hz single phase transformer is 98% both at full load and at half full load. The power factor on no load is 0.2 and the full load regulation at a lagging power factor of 0.8 is 4 %. Draw the equivalent circuit referred to L.V. side and insert all the values. [8+8]

3. (a) Explain the procedure for conducting Sumpner's test along with all precautions to be taken while conducting the test with neat diagram.
   (b) The corrected instrument readings obtained from short circuit test on 10 KVA, 450/125V, 50Hz transformer are 9.65V, 22.2A, 120W, with low voltage winding short circuited. Compute voltage regulation for an 85% lagging load at 50% load. [8+8]

4. A Δ/Y connected bank of 3 identical 60 KVA, 2000/100V, 50Hz transformers is fed with power through a feeder whose impedance is 0.75 + j0.25Ω per phase. The voltage at the sending end of the feeder is held fixed at 2 KV line-to-line. The short circuit test when conducted on one of the transformers with its L.V. terminals short circuited gave the following results:

$$V_{hv} = 40 \text{ V} \qquad f = 50\text{Hz}$$
$$I_{hv} = 35 \text{ A} \qquad P = 800 \text{ W}$$

   (a) Find the secondary line-to-line voltage when the bank delivers rated current 2A balanced 3-phase u.p.f. load.
   (b) Calculate the currents in the transformer in the primary and secondary windings and in the feeder wires on the occurrence of a solid 3-phase short circuit at the secondary line terminals. [7+9]

5. (a) With the help of neat sketch, explain the constructional features of a three-phase induction motors. [7]

   (b) A 3-phase, 4-pole, 415 V, 50 Hz, delta connected induction motor running at a slip of 4%. The stator winding is delta connected with 240 conductors per phase, and the rotor winding is star connected with 48 conductors per phase. The per phase rotor winding resistance is 0.013 ohms and a leakage reactance of 0.048 ohms at standstill. Calculate the following:

   i. The per phase rotor emf at standstill with the rotor open circuit,
   ii. The rotor emf and current at 4% slip,
   iii. The phase difference between the rotor emf and rotor current at 4% slip. [3+3+3]

6. (a) Derive the expression for torque in an induction motor.

   (b) Derive the condition for maximum torque. [8+8]

7. (a) Draw the approximate equivalent circuit of an induction motor. Also explain the significance of each component.

   (b) A 7.5Kw, 440V, 3-phase star connected, 50Hz, 4 pole squirrel cage induction motor develops full load torque at a slip of 5% when operated at rated voltage and frequency. Rotational losses are to be neglected. Motor impedance data is as follows:
   r1=1.32 Ω
   $x_1 = x_2$ =1.46 Ω
   x_m = 22.7 Ω
   Determine the maximum motor torque at rated voltage and the slip at which it will occur. Also calculate the starting torque. [8+8]

8. (a) Describe static slip power recovery scheme of speed control with neat sketch.

   (b) What are the merits of this method over classical methods? [9+7]

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