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**University Examinations 2016/2017**

THIRD YEAR, FIRST SEMESTER EXAMINATION FOR THE DEGREE OF BACHELOR OF TECHNOLOGY IN MECHANICAL ENGINEERING.

**EMT 3301: ELECTRICAL MACHINES**

**DATE: DECEMBER, 2016 TIME: 2 HOURS**

**INSTRUCTIONS: -** *Answer question* ***one*** *and any other* ***two*** *questions*

**QUESTION ONE (30 MARKS)**

1. An ideal transformer with a turns ration of 2:7 is fed from a 240V supply. Determine its output voltage (3 marks)
2. A single-phere 500/100V, 50Ht transformer has a maximum core flux density of 1.5T and an effective core cross-sectional area of 50cm2. Determine the number of primary and secondary turns (4 marks)
3. Define the regulation of a transformer (3 marks)
4. A 400 kVA transformer has a primary winding resistance of 0.5Ω and a secondary winding resistance of 0.001Ω. The iron loss is 2.5kw and the primary and secondary voltages are 5kv and 320v respectively. If the power factor of the load is 0.85, determine the efficiency of the transformer on full load (5 marks)
5. Explain the work of current transformers and voltage transformers in power systems (4 marks)
6. A 10 kw shunt generator having an armature circuit resistance of 0.75Ω and a field resistance of 125Ω, generates a terminal voltage of 250v at full load. Determine the efficiency of the generator at full load, assuming the iron, friction and windage losses amount to600w (5 marks)
7. A stator winding supplied from three-phase 60Ht system is required to produce a magnetic flux relating at 900 rev/min. Determine the number of poles (3 marks)
8. State three advantages of squittel-cage induction motors over the wound rotor type (3 marks)

**QUESTION TWO (20 MARKS)**

1. An ideal transformer, connected to a 240v mains, supplies a 12v, 150w lamp. Calculate the transformer turns ratio and the current taken from the supply (4 marks)
2. Draw and clearly label the equivalent circuit of a transformer (6 marks)
3. Discuss commutator action in dc machines (5 marks)
4. A 4-pole generator has a lap-wound armature with 50 slots with 16 conductors per slot. The useful flux per pole is 30mWb. Determine the speed at which the machine must be driven to generate an e.m.f of 240v. (5 marks)

**QUESTION THREE (20 MARKS)**

1. A 5kVA single-phase transformer has a turns ratio of 10:1 and is fed from a 2.5 kV supply neglecting losses, determine: (6 marks)
2. The full-load secondary current
3. The minimum load resistance which can be connected across the secondary winding to give full load kVA
4. The primary current at full load kVA
5. The open circuit of a transformer is 240V. A tap changing device is set to operate when the percentage regulation drops below 2.5%. determine the load voltage at which the mechanism operates (4 marks)
6. The stator of a 3-phase, 4-pole induction motor is connected to a 50Ht supply. The rotor runs at 1455 rev/min at full load. Determine; (4 marks)
7. The synchronous speed
8. The ship at full load
9. Discuss three starting methods for squirrel-cage rotor induction motors (6 marks)

**QUESTION FOUR (20 MARKS)**

1. A transformer takes a current of 0.8 A when its primary is connected to a 240v, 50Ht supply the secondary being on open circuit. If the power absorbed is 72 watts. Determine; (6 marks)
2. The iron loss current
3. The power factor on no-load
4. The magnetizing current
5. A 100kVA, 4000/200V, 50Hz single-phase transformer has a 100 secondary turns. Determine; (6 marks)
6. The primary and secondary current
7. The number of primary turns
8. The maximum value of the flux
9. Discuss two broad sources of losses in a transformer (4 marks)
10. Differentiate between wave and lap windings types of armature windings (4 marks)