EEL 102 - Principles of Electrical Engineering

Major Test

May 1, 2009

PART 1

Answers to part 1 should be marked CLEARLY in the answer book. Each question carries 2.5 marks and there is only one correct option. Wrong answers will carry a penalty of 1 mark. Part 1 must be attempted before attempting Part 2

1. The number of parallel paths in a lap wound armature is equal to
   - (a) Two
   - (b) the number of poles
   - (c) twice the number of poles
   - (d) none of these

2. Interpoles are added in a DC machine in order to counter —— effect of the armature reaction.
   - (a) self magnetising
   - (b) demagnetising
   - (c) cross magnetising
   - (d) remagnetising

3. A two winding transducer essentially produces a torque proportional to the product of
   - (a) two currents
   - (b) two voltages
   - (c) a current and a voltage
   - (d) none of these

4. Which of the following is not required for the operation of a self-excited DC generator
   - (a) Residual magnetism in the field winding
   - (b) Polarity of armature winding should aid field build-up in shunt winding
   - (c) a separate field excitation
   - (d) All three conditions are required

5. Of the following the reason for a DC generator producing a DC voltage at the output terminals rather than an AC voltage is
   - (a) armature reaction
   - (b) commutation
   - (c) saturation of magnetic field
   - (d) cumulative coupling

6. A transformer is so designed that primary and secondary coils have
   - (a) high leakage reactance
   - (b) large resistance
   - (c) coupling coefficient close to unity
   - (d) good electrical coupling

PART 2

1. Draw the equivalent circuit of a two winding non-ideal transformer and indicate the significance by each parameter in the circuit. ... (7)

2. A 1200/240 V rms transformer has an impedance $60\angle30°$ Ω connected in series on the high voltage side. If the transformer is connected to a load of $0.8\angle10°$ Ω on the low voltage side, determine the primary and secondary currents and the average power consumed by the load when the transformer is connected to 1200 V rms supply. ...(6)

3. Three equal impedances, $60 + j30$ Ω each are delta connected to a 230 V rms, three phase circuit. Another three equal impedances, $40 + j10$ Ω each, are wye connected across the same circuit at the same points. Determine :

   (a) the line current ... (2)

   (b) the total complex power supplied to the two loads ... (2)

   (c) the power factor of the two loads combined ... (1)

4. A non-ideal opamp has an open loop gain of 10^5. It is connected in a voltage follower configuration. Assume an input resistance of $10k$ Ω and an output resistance of 100 Ω.

   (a) Draw the equivalent circuit for a non-ideal opamp. ...(2)

   (b) Find the voltage gain achieved the circuit described above using this model. ...(5)