



SF-7753

B. E. - IV (Sem. - VIII) (Electrical) Examination
May/June - 2011
Electrical Machine Design

Time : 3 Hours]

[Total Marks : 100

Instructions :

(1)

नीचे दर्शाविएव निशानीवाणी विगतो उत्तरवही पर अवश्य लपनी. Fillup strictly the details of signs on your answer book.	Seat No.:
Name of the Examination :	<input type="text"/>
<input type="text" value="B. E. - 4 (SEM. - 8) (ELECTRICAL)"/>	<input type="text"/>
Name of the Subject :	<input type="text"/>
<input type="text" value="ELECTRICAL MACHINE DESIGN"/>	<input type="text"/>
Subject Code No. : <input type="text" value="7"/> <input type="text" value="7"/> <input type="text" value="5"/> <input type="text" value="3"/>	Section No. (1, 2,.....): <input type="text" value="1&2"/>
	<input type="text" value="Student's Signature"/>

- (2) All questions are **compulsory**.
- (3) Write both Sections in **separate** answer book.
- (4) Draw figure wherever necessary and make necessary assumptions wherever required.
- (5) Figures to **Right** indicates full marks.
- (6) Please write the answer in **point-wise** and try to avoid essay type answer.

SECTION - I

- 1 (a) Answer in short : (**two-three lines**) **10**
 - (i) How to reduce the effect of armature reaction in a dc generator ?
 - (ii) What is square pole criteria in dc machine ?
 - (iii) What are the guiding factor for choice of number of poles ?
 - (iv) What is straight line commutation ?
 - (v) For which type of DC machine lap winding is use.
- (b) Fill in the blanks : **5**
 - (i) In a dc machine, for the same no. of slots and same current in an armature conductor, _____ winding will induce higher emf ?

- (ii) The _____ loss in a dc machine does not vary with load as well as flux density.
- (iii) In DC machine by increasing the number of poles overall size of Machine _____ .
- (iv) In a dc machine _____ connection have to be used for lap wound machine.
- (v) In a dc machine, the lap winding is suitable for _____ voltage and _____ current.
- (c) With the help of neat sketch explain the effect of armature reaction on the flux in a dc machine. 5
- 2** (a) What the function of inter-pole in dc machine ? 7
How they wound (i) in case of motor (ii) in case of generator.
- (b) For a certain dc generator the core loss is 1000w, and the armature resistance is 0.025 ohm. The core and winding form a cylinder 0.25m long and 0.25m in diameter. Specific loss dissipation is 230w/m²-°C. Calculate the specific electric loading which would result in winding and core having a temperature rise of 40°C. The machine is wave wound with 270 armature conductors. 8
- OR**
- (b) The diameter and length of a dc machine 500V, 300rpm dc generator is 1.40m and 0.35m respectively. Calculate the mean emf per conductor, total flux and the number of conductors in series. Armature drop is 6.6 V at full load and flux density in the airgap is 1 wb/m². Assume form factor $K_f=0.7$. 8
- 3** Short notes : (any three) 15
- (a) What are the main factors affecting choice of specific electric loading in case of DC machine.
- (b) Discuss the main factors for selecting the numbers of armature slots.
- (c) What are the governing factors for the size of rotating machine.
- (d) Find the main dimension and number of poles of a 50 Hp, 230 V, 1400 rpm shunt motor, so that a square pole face is obtained, B_{av} in the air-gap is 0.5wb/m² and the amp. Conductor per meter are 22000. The ratio of pole arc to pole pitch is 0.7. Assume the efficiency of the machine as 90%.

- (e) Calculate the amp.-turns for each compensating pole of an 8 pole generator with 107 slots, each containing 1000 amperes conductors. The inter pole air gap is 1.2 cm. the flux density in the air-gap is 0.32 wb/m^2 . Neglect the iron parts of machine and leakage.

SECTION - II

- 4 (a) Answer in two-three lines : 10
- (i) Why closed type slots often used for small induction motor ?
 - (ii) What type of slot give quite operation of induction motor ?
 - (iii) Why air-gap between stator core and rotor core of an induction motor is made very small ?
 - (iv) Why SCR is one of the most important parameter in Synchronous machine design ?
 - (v) Why higher voltages are possible to be generated in an alternator compare to dc generator ?
- (b) Fill the blanks : 5
- (i) Larger values of air-gap flux density is taken while designing induction motor of _____ output.
 - (ii) The speed of synchronous machine is always remains _____ .
 - (iii) In an induction motor _____ magnetizing current will lead to poor power factor.
 - (iv) A slow speed induction motor has inherently _____ power factor.
 - (v) Larger air-gap length in an induction motor yields _____ power factor and _____ noise level.
- (c) State important features of much winding. 5
- 5 (a) State main factor to be considered for design of slip-ring induction motor. 7

OR

- (a) Define short circuit ratio and explain the method of estimating air-gap length of an alternator. 7
- (b) A 6 pole, 3-phase squirrel cage induction motor has 72 stator slots with 15 conductors in each slot. There are 55 rotor slots. The coil span is 11 slots and the phase spread is 60° . Determine the current in rotor bars and end-rings if the stator current is 24.1 A. and the power factor is 0.83. 8

OR

- (b) State the methods used to reduce harmonic torque in induction motor. 8

6 Attempt any **three** : 15

- (a) Derive expression for the rotor bar and end-ring current of squirrel induction motor.
- (b) Define dispersion coefficient and derive the expression for it.
- (c) Discuss the factors which influence the selection of the specific loading in the design of synchronous machine.
- (d) Find the main dimensions of 15 kW, 3-phase, 400 V 50 Hz, 2810 rpm squirrel cage induction motor having an efficiency of 0.88 and full load power factors of 0.9. Assume specific magnetic loading = 0.5 wb/m^2 , specific electric loading = 25000 A/m . Take the rotor peripheral speed as approximately 20m/s at synchronous speed.
- (e) A 15 Hp, 400 V, 1430 rpm, 3-phase induction motor with an efficiency of 80% and power factor 0.81 has inner diameter of stator 30cm, and length 12cm. Estimate the diameter and length for 50Hp, 400V, 4 pole, 50Hz induction motor to be designed for 84% efficiency and 0.85 power factor assuming same specific loading as the previous motor.