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EE - 8301

B.E. VIII Semester

Examination, June 2016

Advanced Electrical Drives

(ELective - III)

Time : Three Hours

Maximum Marks : 70

- Note:** i) Answer five questions. In each question part A, B, C is compulsory and D part has internal choice.
 ii) All parts of each question are to be attempted at one place.
 iii) All questions carry equal marks, out of which part A and B (Max. 50 words) carry 2 marks, part C (Max. 100 words) carry 3 marks, part D (Max. 400 words) carry 7 marks.
 iv) Except numericals, Derivation, Design and Drawing etc

1. a) What are the various parameters that control the speed of dc motors?
- b) What are the various conventional speed control methods used in induction motors?
- c) Describe the effects of power electronic equipments on load side. www.rgpvonline.com
- d) A 3-phase, **delta connected**, 6-pole, 50 Hz, 400 V, 925 rpm, **squirrel cage induction motor** has the following parameters:

$$R_s = 0.2 \Omega, R_r = 0.3 \Omega, X_s = 0.5 \Omega, X_r = 1 \Omega.$$

The motor is fed from a voltage source inverter with a constant V/f ratio from 0 to 50 Hz and constant voltage of 400 V above 50 Hz frequency.

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- i) Determine the breakdown torque for a frequency of 100 Hz as a ratio of its value at 50 Hz.
- ii) Calculate the motor torque at 30 Hz and a slip-speed of 60 rpm.

OR

A 1000 kW, 3-phase, 6.6 kV, 50 Hz, 6 pole, unity power factor, star connected synchronous motor has following parameters $X_s = 30 \Omega$, $R_s = 0$. Motor is controlled by line commutated and load commutated converter in self control mode. The load side converter operates at a fixed firing angle of 0° when working as a rectifier and fixed firing angle of 150° when working as an inverter. Calculate the source side converter firing angle for following cases:

- i) Motor is operating at rated torque and 750 rpm.
- ii) Motor is regenerating at torque equal to rated torque and 750 rpm.

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- a) State the important features of various braking methods of dc motors.
- b) Why current sensing is required in electric drives? What are the common methods of current sensing?
- c) Explain the operation of a closed-loop speed control scheme with inner current control loop.
- d) A 230 V, separately excited dc motor takes 50 A at a speed of 800 rpm. It has armature resistance of 0.4Ω . This motor is controlled by a chopper with an input voltage of 230V and frequency of 500 Hz. Assuming continuous conduction throughout, calculate the plot speed-torque characteristic for www.rgpvonline.com
 - i) Motoring operation at duty ratios of 0.3 and 0.6.
 - ii) Regenerative braking operation at duty ratios of 0.7 and 0.4.

OR

A 220V, 750 rpm, 200A separately excited motor has an armature resistance of 0.05Ω . Armature is fed from three-phase non-circulating current dual converter of fully-controlled rectifier A and B. Rectifier A provides motoring operation in forward direction and rectifier B in reverse direction. Line voltage of ac source is 400 V. Calculate firing angles of rectifiers for the following assuming continuous conduction.

- Motoring operation at rated torque and 600 rpm.
- Regenerative braking operation at rated torque and 600 rpm.

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- Discuss the merits of sensorless speed control over the speed sensed vector control of induction motor.
 - Explain the concept of vector flux oriented speed control.
 - Discuss the vector control strategies for synchronous motor.
 - Describe self controlled and load commutated inverter controlled synchronous motor drives and compare them.

OR

Explain the concept and control strategy for linear induction motor.

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- How does a BLDC motor works?
- Draw the inductance profile of switched reluctance motor.
- What are the advantages of SRM drive over other ac motor drives?

- Describe the characteristics and control strategy of PLC based drives.

OR

Describe the operation of low cost brushless dc motor drive with circuit diagram and output quantities wave-forms.

- What are the main features of stepper motors?
 - What is microstepping? www.rgpvonline.com
 - Explain the torque versus stepping rate characteristics of a stepper motor.
 - Explain the various control strategies for stepper motor.

OR

Describe the operation of AC and DC servo motor with appropriate circuit diagrams and compare them.

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