



(Following Paper ID and Roll No. to be filled in your Answer Books)

Paper ID : 131604

Roll No.

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B.TECH.

Theory Examination (Semester-VI) 2015-16

INTRODUCTION TO ELECTRIC DRIVES

Time : 3 Hours

Max. Marks : 100

Section-A

1. Attempt all parts of the following : (2×10=20)

- What are V_{DWM} and V_{DRM} ?
- Define latching and holding currents as applicable to SCR.
- A 3- ϕ induction motor having 4 poles is fed with 3- ϕ , 50Hz supply. Find the slip when the motor is running at 1600 rpm.
- Why chopper based DC drives give better performance than rectified controlled drives?
- Give two different of two quadrant and four quadrant drives.
- What is slip power recovery system?

(1)

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- (g) What is time ratio control in dc choppers?
- (h) A 3-pulse cycloconverter feeds a single - phase load at 200 V. Estimate the value of the supply voltage.
- (i) What is the need for controlling the voltage at the output terminals of the inverter?
- (j) Define the phase angle control.

Section-B

2. Attempt any five questions from this section. (5×10=50)

- (a) Describe the resistance firing circuit used for triggering SCRs. Is it possible to get a firing angle greater than 90° with resistance firing? Illustrate your answer with appropriate wave form.
- (b) Define di/dt and dv/dt protection of SCRs. What are the components used to protect SCR from dv/dt and di/dt in large values.
- (c) Describe the working of a single phase full converter in the rectifier mode with RLE load. Derive an expression for the average output voltage in terms of source voltage and firing angle.
- (d) Explain the concept of step down cycloconverter. Enumerate the advantages and applications of cycloconverter.



- (e) A dc chopper feeds power to an RLE load with $R=2\Omega$, $L = 10\text{mH}$ and $E = 6\text{V}$. If this chopper is operating at a chopping frequency of 1KHz and with duty cycle of 10% from a 220 V dc source, compute the maximum and minimum currents taken by the load.
- (f) Describe the working of single phase parallel inverter with relevant circuit and wave forms.
- (g) Describe stator voltage control technique for the speed control of a 3-phase induction motor.
- (h) In static rotor-resistance control of a 3-phase SRIM, each diode in the rotor circuit conducts for 120° . Assuming ripple free rotor currents derive expressions for rms value of rotor current referred to stator, fundamental component of rotor current and its value referred to stator.

Section-C

Note : Attempt any two questions from this section. ($2 \times 15 = 30$)

3. (a) Draw a suitable diagram & explain working of slip power recovery system using commutator-less kramer drive.
- (b) Explain with the associated wave form, how power factor can be improved with symmetrical angle control scheme.



4. (a) A 3- ϕ , 460V, 60Hz, 6 pole, star connected cylindrical rotor synchronous motor has synchronous reactance of $X_s = 2.5\Omega$ per pole and the armature resistance is negligible. The load torque which is proportional to the speed squared is $T_L = 400$ N-m to 1200 rpm. The power factor is maintained at unity by constant at the rated value. If the inverter frequency is 36 Hz. and the motor speed is 720 rpm determine the following :
- (i) The input voltage E_s .
 - (ii) The armature current I_a .
- (b) Enumerate the variable frequency control of an induction motor.
5. (a) Draw & explain the torque - speed characteristics of a separately excited dc motor at different firing angles for a full converter feeding.
- (b) The speed of a separately excited dc motor is controlled through 1 half wave controlled converter from 230V mains. The motor armature resistance is 0.5Ω and motor constant is $K = 0.4$ V-s/rad, for load torque of 20Nm at 1500 rpm and for constant armature current. Calculate.
- (i) r.m.s. value of thyristor current
 - (ii) firing angle of converters
 - (iii) I/P power factor of the motor