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B.TECH.
(SEM-VI) THEORY EXAMINATION 2018-19
INDUSTRIAL ELECTRONICS

Time: 3 Hours ***Total Marks: 70***

Note: 1. Attempt all Sections. If require any missing data; then choose suitably.
2. Any special paper specific instruction.

SECTION A

1. Attempt *all* questions in brief. **2 x 7 = 14**

a. Define latching and holding currents as applicable to SCR.
b. What is slip power recovery system?
c. Why chopper based DC drives gives better performance than rectifies controlled drives?
d. Give two difference between two quadrant and four quadrant Drives.
e. 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.
f. What is the need for controlling the voltage at the output terminals of the inverter?
g. What is need of series and parallel operation of thyristors?

SECTION B

2. Attempt any *three* of the following: **7 x 3 = 21**

a. Describe the resistance firing circuit used for triggering SCRs. Is it possible to get a firing angle greater than 90º with resistance firing? Illustrate your answer with appropriate wave form.
b. 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.
c. Write the short note on cooling and heatsinks.
d. A dc chopper feeds power to an RLE load with R=2Ω, L = 10mH and E = 6V. 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.
e. In static rotor-resistance control of a 3-phase SRIM, each diode in the rotor circuit conducts for 120º. 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

3. Attempt any *one* part of the following: **7 x 1 = 7**

(a) Draw and explain steady state characteristic of Power MOSFET and IGBT.
(b) Explain methods of turn on operation of GTO and TRIAC.

4. Attempt any *one* part of the following: 7 x 1 = 7

(a) 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.

(b) Briefly describe voltage protection and current protection.

5. Attempt any *one* part of the following: 7 x 1 = 7

(a) A 500kw, 3-phase, 3.3kV, 50Hz, 0.8(lagging) power factor ,4 pole, star connected synchronous motor has following parameters: X_s=15Ω, R_s=0. Rated field current is 10A. Calculate (i) Armature current and power factor at half the rated torque and rated field current (ii) Field current to get unity power factor at the rated torque.

(b) Enumerate the variable frequency control of an induction motor.

6. Attempt any *one* part of the following: 7 x 1 = 7

(a) A single phase full wave ac controller operates from 230V, 50 Hz mains and feeds a resistive load whose value varies between 1.15 ohms and 2.30 ohms. Calculate:

(i) RMS current rating of each SCR
(ii) Average current rating of each SCR
(iii) The maximum load power for $\alpha = \pi/4$

(b) Explain with the associated waveform, how power factor can be improved with symmetrical angle control scheme.

7. Attempt any *one* part of the following: 7 x 1 = 7

(a) Explain the concept of step down cycloconverter. Enumerate the advantages and applications of cycloconverter.

(b) A 220 volts, 1500 rpm, 10 Amps separately excited dc motor has an armature resistance of 10 Ω. It is fed from a single phase fully controlled bridge rectifier with an ac source voltage of 230 volts, at 50 Hz. Assuming continuous load current, compute

i. The motor speed at firing angle of 30 degrees and torque of 5 Nm

ii. Developed torque at the firing angle of 45 degrees and speed of 1000 RPM