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

PAPER ID : 2028 Roll No. | | | | | | | | | | |

B.Tech.

SIXTH SEMESTER EXAMINATION, 2004-2005

FUNDAMENTALS OF POWER ELECTRONICS

Time : 3 Hours *Total Marks : 100*

Note : *(i) Attempt **ALL** questions.*

(ii) All questions carry equal marks.

1. Attempt ***any four*** parts of the following : **(5x4=20)**

(a) Based on degree of controllability, classify power semi condctor devices. Write down the maximum voltage, maximum current ratings and typical maximum operating frequency of atleast one presently available devices.

(b) A thyristor of 100 A is to be used with a thyristor of 150A in parallel to share the total load current of 250 A in proportions of their ratings, the on-state voltage drops of the two thyristors are 2.1 V and 1.75 V respectively. Calculate the series resistance that should be connected with each thyristor for proportional sharing of load current.

(c) Discuss various types of firing circuits design used for turn on of thyristor. Also discuss their comparative features.

(d) A dc source of 100 V supplied a purely inductive load of 0.1 H. The controller device is a thyristor in series with the source and load. The forward gate characteristic is a straight line passing through the origin with a gradient of 4×10^3. The latching current of power device is 5 mA and allowable maximum gate power dissipation is 12 mW. The gate is connected to a positive source of 10 V through a series resistance of 1kΩ. Calculate:

(i) The minimum width of gating pulse to ensure thyristor turn on.

(ii) Whether the device will turn on safely.

(iii) What should be the value of gate source resistance to keep the gate power dissipation within specified limit.

(e) Explain basic Darlington connections of two transistors. Also discuss their advantages and disadvantages.

(f) Give comparative properties of MOSFETs and IGBT.

2. Attempt *any four* parts of the following : **(5x4=20)**

(a) What is a cycloconverter ? Mention their advantages and disadvantages. Also explain the operation of a single phase/single phase cycloconverter.

(b) Explain the operation of ac voltage controllers in phase control and integral cycle control mode. Mention the advantages and disadvantages of each.

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(c) Explain the meaning of phase controlled converters. Give different ways of classifying them.

(d) Define transformer utilization factor and mention its significance.

A single phase full wave bridge diode rectifier is used to deliver 500 W d.c. power to a load. The transformer utilisation factor is 0.812. Calculate the rating of transformer.

(e) Discuss the effects of source inductance on the voltage regulation of 2-pulse converters.

(f) Explain regulated d.c. power supplies. Also mention desirable specifications.

3. Attempt *any two* parts of the following : **(10x2=20)**

(a) State and explain quality of an inverter. Also mention the categories of voltage fed inverters based on the voltage wave forms.

(b) A three phase bridge converter operating in 120° conduction mode is fed from a d.c. source of 200 V. Pure resistance of 10Ω is connected in each phase of star connected load. Determine :

(i) rms load current,

(ii) the required rms current rating of the switches and the load power.

(c) What is pulse width modulation ? List the various PWM techniques. How do these differ from each other.

4. Attempt *any two* parts of the following : (10x2=20)

(a) Explain the principle of chopper. Also describe chopper control methods and compare them.

(b) A stepdown chopper is supplying a resistive load of 10Ω from an ideal d.c. source of 220V. When the chopper switch remains on its voltage drop is 2V and the chopper frequency is 1 KHz. If the chopper duty cycle is maintained at 0.5 calculate :

(i) the average and rms value of load voltage and

(ii) the chopper efficiency and the effective input resistance seen by the source.

(c) With circuit connection, explain the working of a fourquadrant chopper. Also mention its applications.

5. Attempt *any two* parts of the following : (10x2=20)

(a) State and explain advantages, disadvantages and application considerations of solid state control of motors. Also describe the circuit connection and operation of fan motors with electronic regulator presently available in the market.

(b) State and explain supply and motor performance parameters of phase controlled d.c. drives.

(c) State and explain different methods of speed control of 3 - phase induction motors using solid state controllers. Also discuss merits and demerits of each.

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