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Reg. No:

Name:

M.TECH. DEGREE EXAMINATION

Model Question Paper - I

First Semester

Branch: Electrical and Electronics Engineering

Specialization: Energy Systems

MEEES 104 POWER ELECTRONIC DEVICES AND CIRCUITS

[Regular/Supplementary – 2013 Admission Onwards]

Time: Three Hours

Maximum: 100 Marks

1. (a) Compare the switching characteristics of power MOSFETs and power transistors bringing out the advantages of one over the other. (15 marks)
- (b) For an SCR, the gate cathode characteristics are given by a straight line passing through the origin with a gradient of 16V/A. the turn-on time is $4\mu\text{s}$ and the gate current required is 500mA. For the gate-source voltage of 15V, calculate; (i) gate power dissipation; (ii) the resistance to be connected in series with the gate. (10 marks)

OR

2. (a) Explain the Static and dynamic characteristics of IGBT? (10 marks)
- (b) Discuss the overvoltage, over current, di/dt and dv/dt protection of power semiconductor device. (10 marks)
- (c) Compare the power diode with signal diode? (5 marks)
3. (a).With neat diagram and waveform, explain the operation of a single phase rectifier (uncontrolled) with RL load and capacitive filter. Derive the expression for the performance parameters of the rectifier. (15 marks)
- (b). Discuss the effect of source inductance on the performance of the rectifier. (10 marks)

OR

4. (a). What are dual converters? Mention their advantages and applications. (7 marks)
- (b) Explain the inversion mode of operation of converter. (8 marks)
- (c). A 3-phase full converter is fed by a 400V, 3-phase 50Hz supply. The average load current is 100A. Assuming highly inductive load, for a firing angle of 60° , determine.
 - i. Output voltage and power.
 - ii. Average r.m.s. and peak currents through the SCR.
 - iii. PIV of the SCR. (10 marks)

5. (a) Draw the circuit of a buck-boost converter and explain its working principle. (5 marks)

(b). Discuss the discontinuous conduction mode of Buck Converter? Also derive expression for voltage conversion ratio (10 marks)

(c) What is a multiphase boost converter? Explain the operation. List the merits and demerits of multiphase choppers (10 marks)

OR

6. (a) Explain the operation of the basic Cuk converter. What are its main advantages? (10 marks)

(b) Describe the state-space modeling of buck and buck boost DC-DC converters (5 marks)

(c) In a step-up converter, the duty ratio is adjusted to regulate the output voltage V_o at 48V. The input voltage varies in a wide range from 12V to 36V. The maximum power output is 120W. For stability reasons, it is required that the converter always operate in discontinuous – current-conduction mode. The switching frequency is 50 kHz. Assuming ideal components and C as very large, calculate the maximum value of L that can be used (10 marks)

7. (a). With necessary waveforms explain the working of a single-phase bridge inverter. (10 marks)

(b) Explain the PWM method of voltage control in inverters. What are its advantages? (10 marks)

(c) Compare voltage source and current source inverters. (5 marks)

OR

8. (a). Explain the working of a 3-phase current source inverter with necessary waveforms. (10 marks)

(b).What is the need for controlling the output of an inverter? Discuss briefly and compare the various methods employed for the control of output voltage of inverters. (10 marks)

(c) Explain the significance of multi level inverter. (5 marks)

[4 x 25 = 100 marks]