

JK LAKSHMIPAT UNIVERSITY, JAIPUR

INSTITUTE OF ENGINEERING AND TECHNOLOGY

End Term Examination (Regular), April-May 2015

M. Tech in Electronics & Communication Engineering, Semester II

Roll No.....

MTEC221: ADVANCED POWER
ELECTRONICS

Time: 3 hours

Max. Marks: 100

Instructions to students:

1. Do not write anything other than your roll number on question paper.
2. Assume suitable data wherever required and mention it clearly.
3. Writing appropriate units, nomenclature, and drawing neat sketches/schematics/ flow chart wherever, required are an integral part of the answer.

Q.1A Objective type multiple choice questions (10 questions @ 1 mark)

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- i. For a diode, reverse recovery time is defined as the time between the instant diode current becomes zero and instant reverse recovery current decays to
 - a) Zero
 - b) 10% of reverse peak current I_{RM}
 - c) 10% of I_{RM}
 - d) 25% of I_{RM}
- ii. As compared to power MOSFET, a BJT has:
 - a) Lower switching loss but higher conduction loss
 - b) higher switching loss but higher conduction loss
 - c) higher switching loss but Lower conduction loss
 - d) Lower switching loss but Lower conduction loss
- iii. An IGBT has three terminals called:
 - a) Collector, emitter, base
 - b) Drain, source, base
 - c) Drain, source, gate
 - d) Collector, emitter, gate
- iv. In dc choppers, if T_{on} is the on period and f is the chopping frequency, then output voltage in terms of input voltage V_s is given by:
 - a) $V_s.T_{on}/f$
 - b) $V_s.f/T_{on}$
 - c) $V_s/T_{on}.f$
 - d) $V_s.T_{on}.f$
- v. The selection a rectifier diode depends mostly on
 - a) Fault current
 - b) Average load current
 - c) Forward voltage
 - d) Reverse voltage
- vi. A chopper in which current remains positive but voltage may be positive or negative, is known as
 - a) Type-A
 - b) Type-B
 - c) Type-C
 - d) Type-D



- vii. In voltage source inverters:
- Load voltage waveform v_0 depends on load impedance Z , whereas load current waveform i_0 does not depend on Z
 - Both v_0 and i_0 depend on Z
 - v_0 does not depend on Z whereas i_0 depend on Z
 - Both v_0 and i_0 does not depend on Z
- viii. SMPS are superior to linear power supplies in respect of:
- Size and efficiency
 - Efficiency and regulation
 - Regulation and noise
 - Noise and cost
- ix. A freewheeling diode across inductive load will provide:
- Quick turn-on
 - Slow turn off
 - Reduced utilization factor
 - Improved power factor
- x. Consider the following statements:
The overlap angle of phase controlled converter will increase
- As the firing angle increases
 - As the frequency of supply increase
 - As the supply voltage decreases
- Of these statements:
- 1,2, 3 are correct
 - 2 and 3 are correct
 - 1 and 3 are correct
 - 1 and 2 are correct

Q.2 Short answer type questions (**Attempt any 4** questions @ 2.5 marks)

10

- State the advantages of IGBT over MOSFET?
- What is the function of snubber circuit?
- How SCR differs from Triac?
- What is meant by SMPS?
- What is current source inverter?
- What would happen of gate is made positive with respect to cathode during the reverse blocking of thyristor?

Attempt any THREE from Q.3-Q.6 (3*5M=15M)

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|-----|--|----|
| Q.3 | Compare the performance characteristics of MOSFET and BJT. | 05 |
| Q.4 | Explain the turn-off and turn-on characteristics of SCR with neat waveforms. | 05 |
| Q.5 | Describe gate triggering of thyristor. Does the Gate current has any effect on the forward break over voltage? | 05 |
| Q.6 | (a) What is the difference between power diode and signal diode?
(b) What is dv/dt triggering of SCR? | 05 |

Compulsory: Q.7-Q.8

- Q.7 For a type-A chopper, dc voltage source=230 V, load resistance=10 ohm. Take a voltage drop of 2 V across chopper when it is on. For a duty cycle of 0.4, calculate: 05
- (a) Average value of output voltage
 - (b) rms value of output voltage
 - (c) Chopper efficiency

OR

- Q.7 A step-up chopper has input dc voltage of 220 V and output voltage 660 V. If the conduction time of thyristor chopper is 0.12 ms, compute the pulse width of load voltage. 05

In case pulse width of load voltage is increased to three times its previous width, for constant frequency operation, calculate the new value of average output voltage.

- Q.8 Explain the structure, modes of operation and characteristics of SCR. 15

Attempt any THREE from Q.9-Q.12 (3*15M=45M)

- Q.9 With necessary circuits and waveforms, explain the principle of operation of step down dc-to-dc converter with RL load. 15
- Q.10 Describe the working of Boost converter with necessary circuit and waveforms. 15
- Q.11 A single phase half wave SCR rectifier circuits feed power to a resistive load. Draw waveforms for source voltage, load voltage, load current and voltage across the SCR for a given firing angle α . obtain expression for average and rms load voltages in terms of source voltage and firing angle. 15
- Q.12 Write short note on Any three: 15
- (a) Uninterrupted power supply
 - (b) Flyback converter
 - (c) Single phase voltage source inverter
 - (d) Methods of Gate triggering in SCR

