FACULTY OF ENGINEERING

BE 3/4 (EE/Inst.) I-Sem (New) Examinations, November / December 2012

Subject: Power Electronics

Time: 3 Hours   **Max. Marks:75**

Note: Answer all questions from Part-A and any Five questions From Part-B

Part-A (25 Marks)

1. Why it is necessary to use fast recovery diodes for high speed applications?   (2)
2. What are the differences between enhancement type MOSFETs and depletion type MOSFETs?   .   (3)
3. Explain the R triggering circuit of a SCR.   (3)
4. Explain the principle of operation of a GTO. State the limitations of GTO.   (2)
5. A 230V, 50 Hz, single pulse SCR is triggered at a firing angle of 40^0 and the load current extinguishes at an angle of 210^0. Find the circuit turn –off time.   (3)
6. Derive the equation for average output voltage of a single phase half wave converter for R load.   (3)
7. Explain the principle of pulse width modulation control of choppers.   (2)
8. Explain the operation of a Buck regulator.   (3)
9. Compare the Voltage source inverter with a Current source inverter.   (2)
10. Define amplitude modulation index and frequency modulation index in sinusoidal pulse width modulation.   (2)

Part-B (50 Marks)

11. a) Describe different methods of triggering a thyristor.   (5)
    b) Explain the switching characteristics of an IGBT with necessary diagrams.   (5)

12. a) Explain the working of Class-C commutation circuit with necessary diagrams.   (5)
    b) Explain the characteristics and applications of GTOs.   (5)

13. A three phase fully controlled bridge rectifier is supplied at 230 V/phase and at a frequency of 50Hz. The Source inductance L_s=5 mH and the load current on the DC side is constant at 12 A. If the load consists of a DC source voltage of 230 V having an internal resistance of $0.9\,\Omega$, find a) firing angle b) overlap angle.   (10)

14. A simple chopper is operating at a frequency of 2 kHz from a 96 V DC source to supply a load resistance of $8\,\Omega$. The load time constant is 6 ms. If the average load voltage is 57.6 V. Find the T_{on} period of the chopper, the average load current, the magnitude of the ripple current and its RMS value.   (10)

15. a) Explain the working of a Cuk regulator   (5)
    b) Write the applications of AC voltage regulators and cycloconverters   (5)

16. For a single pulse modulation, show that output voltage can be expressed as

$$V_L = \sum_{n=1,3,5\ldots}^{\infty} \frac{4V_{DC}}{n\pi}\, \sin\left(\frac{np}{2}\right) \sin (n\,\omega\, t), \text{ where p is the pulse width.}$$ (10)

17. Write a short notes on   (10)
    (i) Noncirculating Dual converter
    (ii) Current source inverter

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