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BIEEE-018

B.Tech. – VIEP – ELECTRICAL ENGINEERING (BTELVI)

Term-End Examination

00884

June, 2017

BIEEE-018 : ADVANCED POWER ELECTRONICS

Time : 3 hours *Maximum Marks : 70*

Note : *Attempt any **five** questions. All questions carry equal marks. Missing data, if any, may be suitably assumed. Use of scientific calculator is permitted.*

1. (a) What is a power MOSFET ? Explain its principle of operation and draw the drain characteristic of an enhancement type power MOSFET. 7

(b) In a thyristor, the ON-state voltage drop V_T and current I_T are related as $V_T = 0{\cdot}9 + 0{\cdot}02\ I_T$ volts. Find the mean power dissipation of the thyristor if the

(i) current is constant at 20 A, and

(ii) current wave is half sine wave of average value of 20 A. 7

2. (a) Explain what is meant by commutation of SCR. How are commutation methods classified ? Draw the circuit and explain any one method of forced commutation. *10*

(b) Briefly discuss resistance triggering circuit of an SCR. *4*

3. (a) Draw the circuit of a single-phase fully controlled converter. Derive necessary expressions and explain its working taking R-L load. *8*

(b) A single-phase half wave rectifier feeds a 15 ohms resistance. The supply voltage is 230 V (rms). The firing angle is $\frac{\pi}{2}$. Find the rectification efficiency and form factor. *6*

4. (a) What is a semi-converter ? In what respect is the operation of single-phase semi-converter different from that of full converter ? *7*

(b) Explain the difference between circulating current mode and non-circulating current mode of operation of a dual converter. *7*

5. (a) Differentiate between the working of voltage source and current source inverters. *7*

(b) A three-phase bridge voltage source inverter feeds a three-phase star connected resistive load. Obtain the output phase and line voltage if two SCRs conduct at a time. 7

6. (a) Describe the working of thyristor controlled reactors (TCRs). Draw necessary voltage and current waveforms. 7

(b) Discuss the characteristics of shunt compensators. 7

7. (a) Describe the working of pulse-width modulated (PWM) inverters. List the most commonly used PWM techniques. 7

(b) With suitable circuit diagram and waveform, explain the principle of operation of a 3-phase dual converter with circulating mode, firing angle $\alpha = 60°$. 7

8. (a) Explain the protection of SCR against overvoltages and overcurrents. 7

(b) In an inverter's operation, harmonic control is an important step. Mention the different methods available for harmonic reduction and explain one method in detail. 7
