

**R22**

**Code No: 185DY**

**JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD**

**B. Tech III Year I Semester Examinations, January - 2025**

**POWER ELECTRONICS**  
**(Electrical and Electronics Engineering)**

**Time: 3 Hours**

**Max. Marks: 60**

**Note:** This question paper contains two parts A and B.

i) Part- A for 10 marks, ii) Part - B for 50 marks.

- Part-A is a compulsory question which consists of ten sub-questions from all units carrying equal marks.
- Part-B consists of ten questions (numbered from 2 to 11) carrying 10 marks each. From each unit, there are two questions and the student should answer one of them. Hence, the student should answer five questions from Part-B.

**PART- A**

**(10 Marks)**

- 1.a) What is latching current in SCR? [1]
- b) Abbreviate IGBT. [1]
- c) What is source inductance effect on phase controlled converters? [1]
- d) What is a dual converter? [1]
- e) What is duty ratio of chopper? [1]
- f) State the applications of the chopper. [1]
- g) What is an inverter? [1]
- h) What is sinusoidal pulse width modulation? [1]
- i) What is a cyclo converter? [1]
- j) State the applications of A.C. voltage controllers. [1]

**PART - B**

**(50 Marks)**

- 2.a) Draw the V-I characteristics of power diode and explain.
  - b) How UJT is used as a trigger source? Explain. [5+5]
- OR**
- 3.a) What are the ratings of thyristor? Explain in detail.
  - b) Draw a gate drive circuit for MOSFET and explain. [5+5]

- 4.a) Draw the circuit diagram of single phase fully controlled converter with R load and explain.
- b) A 3-phase full converter delivers a ripple free load current of 5 A with a firing angle delay of  $60^\circ$ . The input voltage is 3-phase, 230 V, 50 Hz. Calculate the active and reactive input powers [5+5]

**OR**

- 5.a) With the help of circuit diagram, explain the operation of three phase dual converter.
- b) A three phase half controlled SCR converter delivers constant load current of 5 A over the firing angle range of  $0^\circ$  to  $60^\circ$ . At these two firing angles, compute the power delivered to load for an ac input voltage of 300V from a delta star transformer. [5+5]

- QA QA QA QA QA QA QA QA QA
- 6.a) Derive the expression of output voltage in Buck converter in terms of duty ratio.  
b) A Buck-Boost converter is fed from 60V DC and its duty cycle is 0.7 with a load resistance of  $5 \Omega$ . Calculate the output voltage and output current. [5+5]

**OR**

- QA QA QA QA QA QA QA QA QA
- 7.a) Derive the expression of output voltage in Buck-Boost converter in terms of duty ratio.  
b) A buck converter, fed from 100 V DC, is connected to RL load with  $R = 10 \Omega$  and  $L = 100$  mH. Chopper frequency is 2000 Hz and duty cycle is 0.5. Calculate (i) minimum and maximum values of load current (ii) maximum value of ripple current. [5+5]

- QA QA QA QA QA QA QA QA QA
- 8.a) Explain the operation of 180 degree mode of three phase bridge inverter.  
b) Discuss in detail about voltage control of single phase inverters. [5+5]

**OR**

- QA QA QA QA QA QA QA QA QA
- 9.a) Discuss in detail about multiple pulse width modulation.  
b) Draw the circuit diagram of single phase bridge inverter with RL load and explain the working. [5+5]

- QA QA QA QA QA QA QA QA QA
- 10.a) Draw the circuit diagram of single phase voltage controller with R load and explain the operation.

- QA QA QA QA QA QA QA QA QA
- b) A single-phase full-wave ac voltage controller feeds a load of  $R = 20 \Omega$  with an input voltage of 230 V, 50 Hz. Firing angle of thyristor is  $30^\circ$ . Determine (i) input power factor and (ii) average input current. [5+5]

**OR**

- QA QA QA QA QA QA QA QA QA
- 11.a) Explain in detail about the circulating current mode of operation of a cyclo-converter.  
b) A single-phase full-wave ac voltage controller feeds a load of  $R = 20 \Omega$  with an input voltage of 100 V, 50 Hz. Firing angle of thyristor is  $30^\circ$ . Determine (i) rms value of output voltage and (ii) power delivered to load. [5+5]

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