Code No: 125AF

R15

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD
B. Tech III Year I Semester Examinations, January/February - 2023
POWER ELECTRONICS
(Electrical and Electronics Engineering)

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

Note: i) Question paper consists of Part A, Part B.
　　　 ii) Part A is compulsory, which carries 25 marks. In Part A, Answer all questions.
　　　 iii) In Part B, Answer any one question from each unit. Each question carries 10 marks
　　　　　 and may have a, b as sub questions.

PART - A

(25 Marks)

1.a)　What is commutation? What are the two main types of commutation?　　　　　　[2]
　b)　What are the conditions which must be satisfied for turning on time SCR with a gate
　　　signal?　　　　　　　　　　　　　　　　　　　　　　　　　　　　　　　　　[3]
　c)　What are the performance factors of line commutated converters?　　　　　　[2]
　d)　What are the differences between half controlled bridge and fully controlled bridge
　　　rectifier?　　　　　　　　　　　　　　　　　　　　　　　　　　　　　　　　[3]
　e)　List out the applications of DC chopper.　　　　　　　　　　　　　　　　　[2]
　f)　What is meant by step down and step up chopper?　　　　　　　　　　　　　[3]
　g)　What are the different types of AC voltage controller?　　　　　　　　　　　[2]
　h)　What are the merits and demerits of three phase bridge cycloconverter?　　　[3]
　i)　What is space vector PWM?　　　　　　　　　　　　　　　　　　　　　　　[2]
　j)　What is the need for voltage control in an inverter?　　　　　　　　　　　　[3]

PART - B

(50 Marks)

2.a)　Describe the different modes of operation of a thyristor with the help of its static V-I
　　　characteristics.
　b)　The gate circuit of an SCR has a source voltage of 15 V and the load line has a slope of
　　　-120 V per ampere. The minimum gate current to turn on the SCR is 25 mA. Calculate
　　　(i) Gate source resistance and (ii) the gate voltage and gate current for an average gate
　　　power dissipation of 0.4 watts.　　　　　　　　　　　　　　　　　　　　　[5+5]

OR

3.a)　What is the necessity of connecting SCRs in series and what are the problems
　　　associated with series connection of SCRs? How are they eliminated?
　b)　Draw and explain the switching behavior of power MOSFET.　　　　　　　　[5+5]

4.a) Explain the effect of freewheeling diode in details. Also, justifies the statement "freewheeling diode improved the power factor of the system".

 b) A single phase semi converter is operated from 120 V, 50 Hz AC supply. The load current with an average value I $_{dc}$ is continuous and ripple free firing angle $\alpha = \Pi/6$. Determine (i) displacement factor, (ii) harmonic factor of input current and (iii) input power factor. [5+5]

OR

5.a) Describe the operation of a three phase, half controlled bridge converter with associated waveforms.

 b) For a 3-phase full converter operating from a 3-phase, 415 V, 50 Hz supply, derive an equation for the average output voltage in terms of the overlap angle 'μ'. Also find out the reduction in output voltage. [5+5]

6.a) With the circuit diagram and output voltage waveforms, explain the principle of operation of a chopper.

 b) With the help of voltage and current waveforms, explain the working of first quadrant chopper. Give the complete time domain analysis of class A chopper. [5+5]

OR

7.a) Draw a schematic diagram of a single phase AC chopper and discuss in brief with output voltage and current waveforms.

 b) A Dc On-OFF chopper operating at 1 kHz and duty cycle of 10 % is supplied from a 200 V source. If the load inductance is 10 mH and resistance 10 ohms, compute the maximum and minimum current in the load. [5+5]

8.a) Describe the operation of single phase half wave AC voltage regulator with the help of voltage and current wave forms. Also derive the expression for average value of output voltage.

 b) A single phase voltage controller has input voltage of 230 V, 50 Hz and a load of R = 15 Ω. For 6 cycles on and 4 cycles off, determine (i) rms output voltage, (ii) inut p.f. (iii) average and rms thyristor currents. [5+5]

OR

9.a) Explain the basic principle of working of a single phase to single phase cycloconverter for both continues and discontinues conductions for a bridge type cyclo converter.

 b) A three phase to six pulse, 50 kVA, 415 V cycloconverter is operating at a firing angle of 45^0. And supplying load of 0.8 p.f. Determine input current to the converters. [5+5]

10.a) Explain the operation of single phase bridge inverter with the help of voltage waveforms.

 b) Design a series inverter to meet the following specifications:
 Max. Output frequency = 4 kHz
 Load resistance varies from 400 to 100 ohms
 Supply voltage = 120 V. [5+5]

OR

11.a) What is the need for controlling the output at the output terminals of an inverter? Discuss briefly and compare the various methods employed for the control of output voltage of inverters.

 b) Define pulse width modulation. List the various PWM techniques. How do these differ from each other? [5+5]

---ooOoo---