USN | | | | | | | | | | 　　　　　　　　　　　　　　15EC73

Seventh Semester B.E. Degree Examination, Aug./Sept.2020
Power Electronics

Time: 3 hrs. 　　　　　　　　　　　　　　　　　　　　　　Max. Marks: 80

Note: *Answer any FIVE full questions, choosing ONE full question from each module.*

Module-1

1　a.　Give symbol, characteristic features of the following devices :
　　　　i) GTO　　ii) TRIAC　　iii) MOSFET. 　　　　　　　　　　(06 Marks)
　　b.　Explain different types of power electronic circuits with their input and output waveforms.
　　　　　　　　　　　　　　　　　　　　　　　　　　　　　　　　(06 Marks)
　　c.　Explain peripheral effects of power converter system. 　　　　(04 Marks)

OR

2　a.　Compare power MOSFET and bipolar junction transistor. 　　　(04 Marks)
　　b.　Draw the switching model of MOSFET and explain its switching characteristics with neat figure. 　　　　　　　　　　　　　　　　　　　　　　　　(06 Marks)
　　c.　Explain output and transfer characteristics of IGBT. 　　　　(06 Marks)

Module-2

3　a　Explain the static anode – cathode characteristics of SCR. 　　(06 Marks)
　　b.　Explain the two transistor model of SCR and derive an expression for anode current in terms of current amplification factor and leakage current. 　　　　　(06 Marks)
　　c.　The latching current of a thyristor circuit in fig.Q3(c) is 50mA. The duration of the firing pulse is 50μs. Will the thyristor get fired? 　　　　　　　　(04 Marks)

Fig. Q3(c)
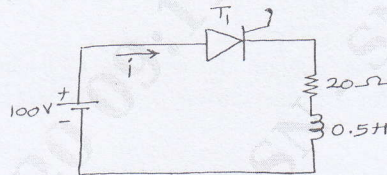
OR

4　a.　Distinguish between natural and forced commutation with examples. 　(04 Marks)
　　b.　With a neat sketch, explain turn – off mechanism of SCR. 　　(06 Marks)
　　c.　With the help of neat circuit diagram and waveforms, explain the UJT firing circuit.
　　　　　　　　　　　　　　　　　　　　　　　　　　　　　　　　(06 Marks)

Module-3

5　a.　With a circuit diagram and waveforms, explain the working of a single phase full converter with a highly inductive load. Derive an expression for the average output voltage and rms output voltage. 　　　　　　　　　　　　　　　　　　　　(08 Marks)
　　b.　With a neat diagram and waveforms, explain the principle of single phase dual converter.
　　　　　　　　　　　　　　　　　　　　　　　　　　　　　　　　(06 Marks)
　　c.　Explain the role played by the free – wheeling diode in converters with R – L load.
　　　　　　　　　　　　　　　　　　　　　　　　　　　　　　　　(02 Marks)

OR

6 a. Explain the principle of ON – OFF control, with the help of waveforms and derive an expression for rms output voltage. (06 Marks)
   b. An AC voltage controller has a resistive load of R = 10 and the rms input voltage is 120V, 60Hz. The thyristor switch is ON for n = 25 cycles and is OFF for m = 75 cycles. Determine
      i) rms output voltage   ii) the input power factor   iii) the average and rms current of thyristor. (04 Marks)
   c. Explain the operation of a single phase bidirectional controller with resistive load. Derive an expression for rms output voltage. (06 Marks)

Module-4

7 a. Explain the operation of step – down converter with RL load. Also derive an expression for peak – to – peak load ripple current. (08 Marks)
   b. Explain with suitable circuit and waveforms, the principle of operation of step – up converter. Derive an expression for average output voltage of step-up converter. (08 Marks)

OR

8 a. Briefly explain the classification of the converter depending upon the directions of the current and voltage flows. (05 Marks)
   b. With the help of circuit diagram and waveforms, explain the working of a Buck regulator. Derive the expression for peak – to – peak ripple current of the inductor. (11 Marks)

Module-5

9 a. Explain the operation of single phase half bridge inverter with R - load. Derive the expression for rms output voltage. (08 Marks)
   b. Explain the performance parameters of inverters. (08 Marks)

OR

10 a. Explain the working of variable dc – link inverter. (08 Marks)
   b. With a circuit diagram and waveforms, explain the working of a single phase full wave switch. Also derive an expression for average current and rms current of each thyristor. (08 Marks)

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