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P.E.S. College of Engineering, Mandya - 571 401
(An Autonomous Institution affiliated to VTU, Belgaum)
Fifth Semester, B.E. - Electrical and Electronics Engineering
Semester End Examination; Dec - 2016/Jan - 2017
Power Electronics

Time: 3 hrs   *Max. Marks: 100*

Note: i) Answer **FIVE** full questions, selecting **ONE** full question from each unit.
   ii) Assume missing data if any.

UNIT - I

1 a. List the major types of power electronic circuits and mention in each case, the type of input supply given and the output we get. — 8

   b. Mention two applications of each power electronic converter. — 6

   c. What are the peripheral effects of power electronic equipment? — 6

2 a. With neat wave forms, explain the switching characteristics of Power B.J.T. — 8

   b. List the merits, demerits and applications of MOSFETs. — 9

   c. Compare BJT and IGBT. — 3

UNIT - II

3 a. What is $\dfrac{di}{dt}$ and $\dfrac{dv}{dt}$? How power electronic devices are protected against $\dfrac{di}{dt}$ and $\dfrac{dv}{dt}$? — 8

   b. What is isolation? Why isolation is necessary in power electronic circuits? Explain in brief. — 5

   c. Explain the typical gate drive circuit for MOSFET. — 7

4 a. Using two transistor analogy explain the principle of switching on of an SCR. — 8

   b. A SCR is connected in series with a 0.5 H inductor and 20 Ω resistance. A 100 V DC voltage is applied to this circuit. If the latching current of the SCR is 4 mA, find the maximum width of the gate triggering pulse required to properly turn - ON the SCR. — 5

   c. Briefly explain the necessity of series and parallel connection of thyristors. — 7

UNIT - III

5 a. Distinguish between natural commutation and forced commutation for SCR with illustrative examples. — 10

   b. Explain with the help of a circuit and relevant wave forms, the commutation of SCR using an LC circuit. — 10

6 a. What is AC voltage controller? Explain two types of AC voltage control. — 5

   b. Derive an expression for R.M.S. and average value of output voltage for 1-φ half wave controller. — 10

   c. What are the advantages and disadvantages of ON-OFF control used in AC voltage controllers? — 5

UNIT - IV

7 a. Derive an expression for average and r.m.s. value of the load voltage for the step down chopper having inductive load.

10

b. A chopper circuit drives an inductive load from 200 V DC supply. Given the load resistance as 4 Ω, the average load current as 30 A and operating frequency is 400 Hz. Compute the ON period and OFF period of the chopper. Also determine the duty cycle of the chopper.

10

8 a. Explain the operation of a 1-ϕ full wave bridge inverter.

10

b. Explain 120º mode of 3-ϕ inverters with the help of wave forms.

10

UNIT - V

9 a. Derive an expression for average value of o/p voltage for 1-ϕ half wave controlled rectifier for RL load and freewheeling diode.

10

b. A 1-ϕ half wave converter is operated from a 120 V, 50 Hz supply and the load resistance R = 10 Ω. If the average output voltage is 25% of the maximum possible average o/p voltage, calculate:

i) Delay angle α

ii) Average of r.m.s. output currents

iii) Average and r.m.s. thyristor currents.

10

10 a. What is a dual converter? Draw the power circuit arrangement of a 1ϕ dual converter. What are the applications of dual converters?

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b. Derive the expression for average o/p voltage of 3ϕ half wave converter for highly inductive load.

6

c. What are the advantages of 3-ϕ rectifiers over single phase rectifier circuits?

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