



## P.E.S. College of Engineering, Mandya - 571 401

(An Autonomous Institution affiliated to VTU, Belagavi)

**Fifth Semester, B.E. - Electrical and Electronics Engineering**

**Semester End Examination; Dec. - 2019**

### Power Electronics

*Time: 3 hrs*

*Max. Marks: 100*

*Note: Answer FIVE full questions, selecting ONE full question from each unit.*

#### UNIT - I

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|------|--|----|
| 1 a. | Explain the different types of power electronics circuits.           | 8  |
|      | b. Sketch and explain the switching characteristics of power MOSFET. | 8  |
|      | c. List the differences between power BJT and SCR.                   | 4  |
| 2 a. | Explain steady state characteristics of BJT with neat diagram.       | 10 |
|      | b. Describe briefly the cross section and efficient circuit of IGBT. | 10 |

#### UNIT - II

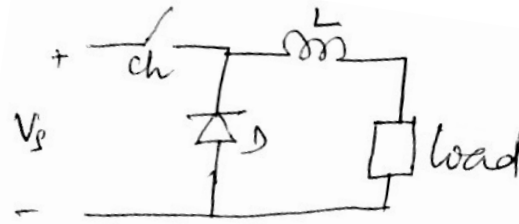
- |      |   |    |
|------|---|----|
| 3 a. | Explain propositional base control of BJT.  | 8  |
|      | b. With neat circuit diagram and relevant expressions, explain how power electronic devices protected from $\frac{di}{dt}$ and $\frac{dv}{dt}$ effects. | 12 |
| 4 a. | Explain isolation of gate and base devisees.  | 6  |
|      | b. With the help of two transistor analogy, explain the principle of switching on of an SCR.  | 8  |
|      | c. Explain the series and parallel operation of thyristors.   | 6  |

#### UNIT - III

- |      |  |    |
|------|--|----|
| 5 a. | What is communication of SCR? Explain the different types of SCR commutation techniques.   | 10 |
|      | b. With the help neat circuit diagram and wave forms, explain bidirectional controller with R-load and derive an expression for output voltage.  | 10 |
| 6 a. | Explain impulse commutation with neat circuit and wave forms.  | 10 |
|      | b. Explain the principle of ON-OFF control with neat circuit diagram and waveforms.  | 5  |
|      | c. A single phase bidirectional regulator is feeding resistive load of 10 $\Omega$ . The supply voltage is 230 V, 50 Hz. If the firing angle is 45°. Calculate the power absorbed by the load. | 5  |

#### UNIT - IV

- |      |   |   |
|------|---|---|
| 7 a. | Describe the operations of step down chopper with R-L load, and derive relative expression.   | 8 |
|      | b. For a chopper shown below, DC source voltage is 230 V, load resistance is 10 $\Omega$ , consider the voltage drop of 2 V across chopper when it is on. For a duty cycle of 0.4, calculate; | 6 |
|      | i) Average and rms values of output voltage   |   |
|      | ii) Chopper efficiency  |   |



- c. Explain the performance parameter of inverters. 6
- 8 a. Write brief description on classification of choppers with circuit diagrams. 10
- b. With relevant circuit and waveforms, explain the operation of three phase bridge inverter for  $180^\circ$  mode of operation. 10

### UNIT - V

- 9 a. With the neat circuit and waveforms, explain the operation of single phase half wave controlled rectifier and also derive an expression for output voltage. 10
- b. A three phase full wave converter is operated from a three phase star connected 208 V, 60 Hz supply and the load resistance is  $R = 10 \Omega$ . If it is required to obtain an average output voltage of 50% of the maximum possible output voltage, calculate : 10
- The delay angle  $\alpha$
  - The rms and average output currents
  - The average and rms
  - The average and rms thyristor currents
  - The rectification efficiency
- 10 a. With a neat circuit and waveforms, explain the operation of single phase fully controlled bridge rectifier with R-load for firing angle of  $\alpha = 30^\circ$ . 10
- b. Explain the operation of 3 phase full converter with relative expression and waveforms for highly inductive load. 10

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