

Basavarajeswari Group of Institutions  
**BALLARI INSTITUTE OF TECHNOLOGY & MANAGEMENT**  
 (Autonomous Institute under Visvesvaraya Technological University, Belagavi)

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Course Code 

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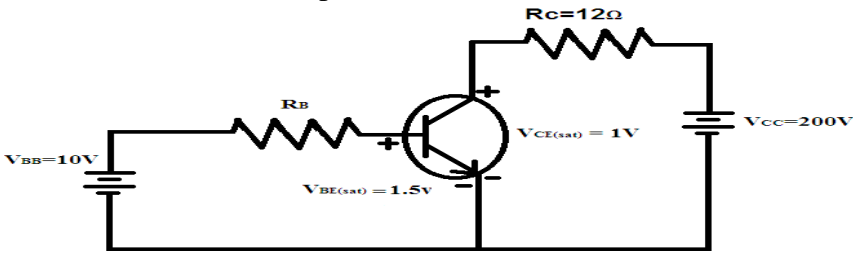
Fourth Semester B.E. Degree Examinations, September/October 2024

**POWER ELECTRONICS**

Duration: 3 hrs

Max. Marks: 100

**Note:** 1. Answer any FIVE full questions, choosing ONE full question from each module.  
 2. Missing data, if any, may be suitably assumed.

<u>Q. No</u>	<u>Question</u>	<u>Marks</u>	<u>(RBTL:CO:PI)</u>
<b>MODULE – 1</b>			
1.	a. Define Power Electronics. Mention and Explain different types of power electronic converter systems. Draw their input and output characteristics	12	(2 : 1 : 1.2.1)
	b. With neat block diagram, explain what are the peripheral effects of power converter system	08	(2 : 1 : 1.2.1)
<b>OR</b>			
2.	a. Define reverse recovery time of a diode and also derive an expression for reverse recovery diode.	08	(2 : 1 : 1.2.1)
	b. With neat Circuit Diagram and Waveforms, Explain the operation of Diodes Switched with R-L Load.	06	(2 : 1 : 1.2.1)
	c. A reverse recovery time of a diode is $t_{rr} = 3\mu\text{sec}$ & the rate of fall of the diode current is $di/dt = 30 \text{ A}/\mu\text{Sec}$ . Determine (i) The storage charge $Q_{RR}$ (b) The peak reverse Current $I_{RR}$ .	06	(2 : 1 : 1.2.1)
<b>MODULE – 2</b>			
3.	a. For the transistor switch as shown in the Fig.Q3 (a) below has $\beta$ in the range of 8 to 50. When $R_B = 0.75\Omega$ . Calculate (i)The forced $\beta_f$ of the transistor (ii) Obtain the power loss in the transistor	12	(2 : 2 : 1.2.1)
 <p style="text-align: center;">Fig. 3.Q.a</p>			
	b. Explain with neat circuit diagram, electric isolation using pulse transformer of BJT.	08	(2 : 2 : 1.2.1)
<b>OR</b>			
4.	a. Sketch the structure of n-channel enhancement type MOSFET and explain its working principle	12	(2 : 2 : 1.2.1)
	b. Sketch and explain the necessary characteristics of IGBT	08	(2 : 2 : 1.2.1)
<b>MODULE – 3</b>			
5.	a. Using Two Transistor model, Explain how a small gate Current can turn on the SCR when blocking forward voltage.	08	(2 : 3 : 1.2.1)
	b. Explain briefly different Turn On and Turn off methods of Thyristor.	06	(2 : 3 : 1.2.1)

- c. A SCR Circuit operate from 300V DC Supply has a Series Inductance of  $4\ \mu\text{H}$ . A resistance of  $4\ \Omega$  and a Capacitance of  $0.2\ \mu\text{F}$  is connected across the SCR. Calculate. the safe  $dv/dt$  and  $di/dt$  ratings of a SCR. **06** (2 :3 : 1.2.1)

**OR**

6. a. Distinguish between Holding Current and Latching Current of a Thyristor **04** (2 :3 : 1.2.1)  
 b. Explain with neat circuit diagram and waveforms explain UJT circuit. **08** (2 :3 : 1.2.1)  
 c. Ten Thyristors Are used in a String to withstand a DC voltage of  $V_s = 15\ \text{kV}$ . The maximum leakage Current, and. recovery charge differences are  $10\ \text{mA}$  &  $150\ \mu\text{C}$  respectively. Each Thyristor has a voltage sharing resistance of  $R = 56\ \text{K}\Omega$  & Capacitance  $C = 0.5\ \mu\text{F}$ . Determine (i) Maximum Steady State Voltage sharing (ii) Steady State Voltage derating factor (iii) Maximum transient voltage sharing (iv) Transient voltage derating factor. **08** (1 :3 : 1.2.1)

#### **MODULE – 4**

7. a. With neat circuit diagram and waveforms, explain the operation of 1-phase dual converters **06** (2 :4 : 1.2.1)  
 b. for a 1- $\phi$  full Converter having highly inductive Load, derive the following (i) Displacement Factor (ii) Harmonic Factor (iii) Power Factor **06** (2 :4 : 1.2.1)  
 c. A Single phase half wave converter is operated from a  $120\ \text{V}$ ,  $50\ \text{Hz}$ , Supply and the load resistance  $10\ \Omega$ . vs. if the average Output voltage is 25 % of the maximum possible average output voltage. Calculate (i) Delay angle (ii) The RMS & average Output-Current (iii) The RMS and average Thyristor Current (iv) the input- power factor. **08** (2 :4 : 1.2.1)

**OR**

8. a. What is the Difference between ON-OFF Controller and phase Angle Controller? **06** (2 :4 : 1.2.1)  
 b. Explain with neat circuit and waveforms a single phase Bidirectional regulator with R-load. **08** (2 :4 : 1.2.1)  
 c. An Ac Voltage controller have a resistive load of  $10\ \Omega$  and rms input voltage  $120\ \text{V}$ ,  $60\ \text{Hz}$ , The Thyristor Switch is on for 25 cycles and off for 75 cycles. Determine (i) RMS output voltage (ii) Input Power factor **06** (2 :4 : 1.2.1)

#### **MODULE – 5**

9. a. With a neat Circuit Diagram and waveforms, Explain the operation of Step up chopper **06** (2 :5 : 1.2.1)  
 b. Explain briefly the classification of Choppers. **06** (2 :5 : 1.2.1)  
 c. A DC Chopper has a resistive load of  $10\ \Omega$  and the input Voltage.  $V_s = 200\ \text{V}$ , when the converter switch remains. ON, its voltage Drop is  $V_{ch} = 2\ \text{V}$  and Chopping frequency is  $1\ \text{KHz}$ . of the Duty Cycle is 50%. Determine (i) Average output voltage (ii) RMS output voltage.(iii) The Chopper Efficiency (iv) Effective input Resistance of the Chopper **08** (2 :5 : 1.2.1)

**OR**

10. a. What are inverters? Explain the operation of single phase full bridge inverter for R-L load. **08** (2 :5 : 1.2.1)  
 b. Write a note on performance parameters for inverter. **06** (2 :5 : 1.2.1)  
 c. The single phase full bridge inverter has a resistive load of  $2.4\ \text{ohm}$  and a DC input voltage of  $48\ \text{V}$ . Determine (i) The RMS output voltage (ii) Output power (iii) The peak and average currents of each transistor. **06** (2 :5 : 1.2.1)

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