

USN

--	--	--	--	--	--	--	--	--	--

Course Code

2	1	E	E	4	3
---	---	---	---	---	---

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>
--------------	-----------------	--------------	---------------------

MODULE – 1

- | | | | |
|----|---|----|-----------------|
| 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) |

OR

- | | | | |
|----|--|----|-----------------|
| 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) |

MODULE – 2

- | | | | |
|----|---|----|-----------------|
| 3. | a. For the transistor switch as shown in the Fig.Q3 (a) below has β in the range of 8 to 50. When $R_B = 0.75\Omega$. Calculate (i)The forced β_f of the transistor (ii) Obtain the power loss in the transistor | 12 | (2 : 2 : 1.2.1) |
|----|---|----|-----------------|

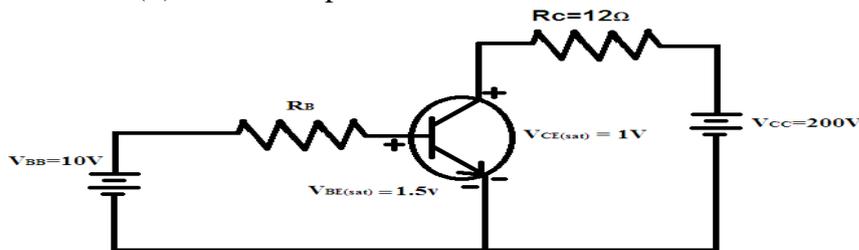


Fig. 3.Q.a

- | | | | |
|----|---|----|-----------------|
| b. | Explain with neat circuit diagram, electric isolation using pulse transformer of BJT. | 08 | (2 : 2 : 1.2.1) |
|----|---|----|-----------------|

OR

- | | | | |
|----|--|----|-----------------|
| 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) |

MODULE – 3

- | | | | |
|----|--|----|-----------------|
| 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 4Ω 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 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 V , 50 Hz , Supply and the load resistance 10Ω . 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 10Ω and rms input voltage 120 V , 60 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 10Ω 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 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 ohm and a DC input voltage of 48 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)

** ** *