

CBCS SCHEME

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BEE503

Fifth Semester B.E./B.Tech. Degree Examination, June/July 2026

Power Electronics

Time: 3 hrs.

Max. Marks: 100



*Notes: 1. Answer any FIVE full questions, choosing ONE full question from each module.
2. M : Marks , L: Bloom's level , C: Course outcomes.*

Module – 1			M	L	C
Q.1	a.	Explain different types of power electronic converters and mention applications for each type of power electronic converters.	10	L2	CO1
	b.	Analyze the reverse recovery characteristics of a power diode and derive equations for reverse recovery time t_{rr} and reverse recovery current I_{RR} .	10	L3	CO1
OR					
Q.2	a.	With circuit diagram and waveforms, explain the operation of single phase full wave bridge diode rectifier with purely resistive load. Derive the expression for average and RMS value of output voltage.	10	L3	CO2
	b.	With circuit diagram and waveforms of control signal and output voltage, explain the control characteristics of B.J.T and S.C.R.	6	L2	CO1
	c.	The reverse recovery time of a diode is $t_{rr} = 5 \mu s$ and the rate of fall of the diode current is $di/dt = 50 A/\mu s$. Determine : i) The storage charge Q_{RR} ii) The peak reverse current I_{RR}	4	L3	CO1
Module – 2					
Q.3	a.	What is the necessity of base drive control in a power transistor? Explain proportional base control.	8	L2	CO3
	b.	With the help of necessary waveform, explain the switching characteristics of power MOSFET.	8	L2	CO3
	c.	Compare power BJT and power MOSFET.	4	L2	CO3

OR

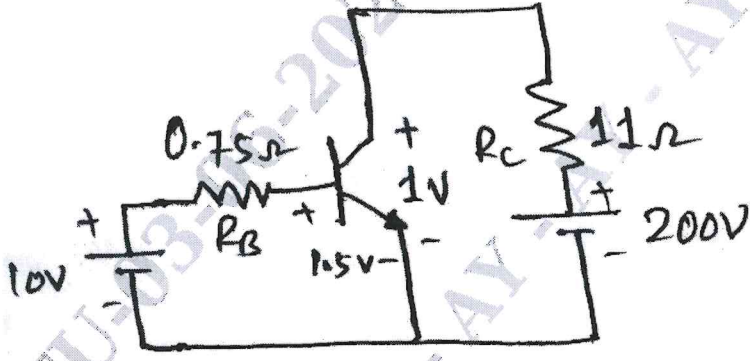
Q.4	a.	Discuss the need for providing isolation of gate drive from power circuit and explain electric isolation using pulse transformer.	8	L2	CO3
	b.	For the transistor switch of Fig.Q.4(b) i) Calculate forced beta, 'β_f' of transistor ii) If the manufacturer's specified 'β' is in the range 8 to 40, calculate the minimum overdrive factor. iii) Obtain the power loss 'P_T' of the transistor.	8	L4	CO3
					
	c.	Explain forward biased Safe Operating Area (SOA) of transistor with respect to switching limit.	4	L2	CO3

Fig.Q.4(b)

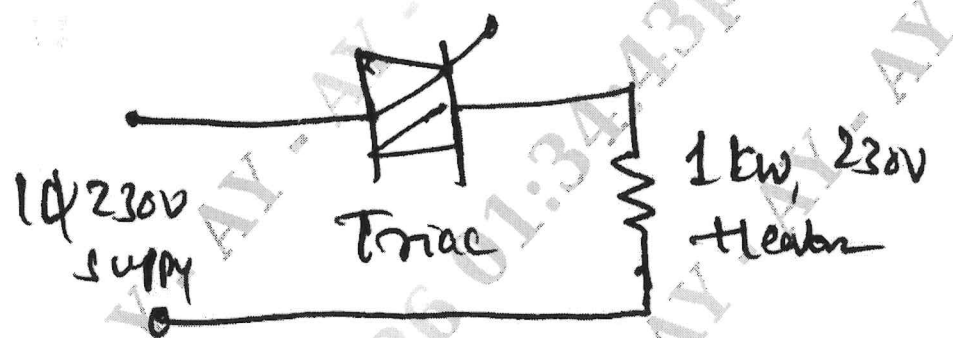
Module – 3

Q.5	a.	Explain the V-I characteristics of SCR. Also define latching and holding current.	10	L2	CO4
	b.	Derive an expression for the anode current of thyristor with the help of a two transistor analogy.	10	L3	CO4

OR

Q.6	a.	What is the need for protection of thyristors? Explain how thyristors are protected against high $\frac{di}{dt}$ and $\frac{dv}{dt}$	10	L3	CO4
	b.	Explain synchronized UJT triggering circuit with the help of relevant waveforms.	6	L2	CO4
	c.	A SCR is connected in series with 0.5H inductor and 20 Ω resistance. A 100V DC voltage is applied to this circuit. If the latching current of the SCR is 4 mA. Determine the minimum width of the gate trigger pulse required to properly turn-on the SCR.	4	L4	CO4

Module – 4

Q.7	a.	Draw the circuit diagram of single phase half-wave controlled rectifier circuit with RL load sketch the input voltage, output voltage and output current waveforms. Also derive an expression for average value of output voltage.	10	L3	CO5
	b.	A single phase fullwave A.C voltage controller operates on a single phase supply voltage of 230 V rms at 50 Hz. If the triac is triggered at a delay angle of 45°, during each half cycle of input supply (Refer Fig.Q.7(b)). Calculate : i) RMS value of output voltage ii) RMS value of output current iii) RMS value of TRIAC current iv) Input power factor  Fig.Q.7(b)	10	L4	CO5

OR

Q.8	a.	Explain the working of a bidirectional single phase A.C. voltage controller with 'R' load, with neat circuit diagram and relevant waveforms. Derive the equation for $V_0(\text{rms})$.	10	L3	CO5
	b.	With the help of a neat circuit diagram and waveform explain single phase dual converter operating in circulating current mode.	10	L2	CO5

Module – 5

Q.9	a.	Explain the principle of operation of step up chopper with suitable circuit diagram. Derive the expression for average output voltage.	10	L3	CO5
	b.	A dc chopper has an input voltage of 200 V and a load resistance of $8\ \Omega$. The voltage drop across thyristor is 2V and the chopper frequency is 800 Hz. The duty cycle $\alpha = 0.4$. Determine : i) Average output voltage ii) R.M.S. output voltage iii) Chopper efficiency	6	L4	CO6
	c.	Write note on Chopper Control Techniques.	4	L2	CO6
OR					
Q.10	a.	With circuit diagram and waveform, explain the operation of single phase full bridge inverter supplying resistive load.	10	L2	CO6
	b.	Explain single phase transistorized current source inverter with the help of necessary circuit and waveforms. Also write its advantages and disadvantages.	10	L2	CO6
