CBCS SCHEME

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BEE503

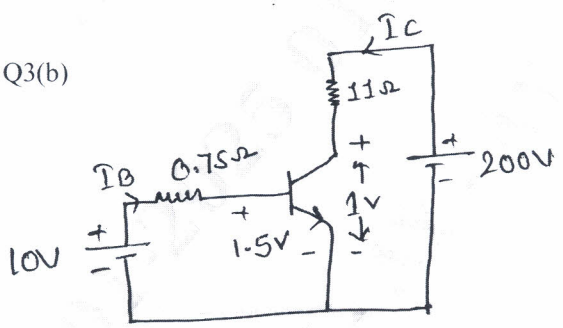
Fifth Semester B.E./B.Tech. Degree Examination, Dec.2024/Jan.2025
Power Electronics

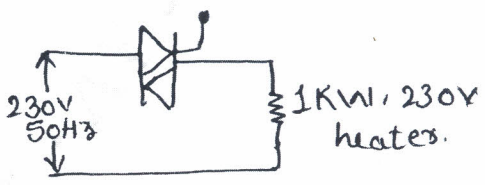
Time: 3 hrs. Max. Marks: 100

Note: 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 control characteristics of power devices with neat circuit and wave form.	8	L1	CO1
	b.	With neat diagram, explain different types of power electronic converters.	8	L1	CO1
	c.	The forward voltage drop of power diode is $V_D = 1.2V$ at $I_D = 300A$, $n = 2$ and $V_T = 25.7mV$, find the reverse saturation current I_S.	4	L3	CO1
		OR			
Q.2	a.	Explain Full wave Rectifier with central tapped transformer with R load. Derive the expression for $V_{o(rms)}$, $V_{o(av)}$, RF , FF, TUF.	10	L2	CO1
	b.	With neat waveform and equation, explain Reverse Recovery characteristics.	10	L2	CO1
		Module – 2			
Q.3	a.	Explain Steady State characteristics and switching characteristics of BJT with neat circuit and waveforms.	10	L2	CO2
	b.	For the transistor switch of Fig. Q3(b), calculate forced beta, β_f of transistor, ODF and power loss P_T of transistor.	10	L3	CO2
		OR			
Q.4	a.	Explain different methods of providing gate and base drive isolation.	10	L1	CO2
	b.	The collector clamping of Antisaturation control has $V_{CC} = 100V$, $R_C = 1.5\Omega$, $Vd_1 = 2.1V$, $Vd_2 = 0.9V$, $V_{BE} = 0.7V$, $V_B = 15V$ and $R_B = 2.5\Omega$ and B = 16. Calculate i) The Collector current without clamping ii) The Collector – Emitter clamping voltage and iii) The Collector current with clamping.	10	L3	CO2

Fig. Q3(b)



		Module – 3			
Q.5	**a.**	Derive an expression for the anode current of thyristor with the help of two transistor analogy.	**10**	**L2**	**CO3**
	b.	The latching current for SCR inserted in between adc voltage source of 200V and load is 100 mA. Calculate the minimum width gate pulse current required to turn on SCR in case load consist of i) L = 0.2H ii) R = 20Ω in series with L = 0.2H.	**10**	**L3**	**CO3**
		OR			
Q.6	**a.**	With the help of neat diagram and waveform , explain RC firing circuit used with half controlled rectifier.	**10**	**L2**	**CO3**
	b.	Design the UJT triggering circuit for SCR. Given V_{BB} = 20V , η = 0.6 , I_P = 10μA, V_V = 2V , I_V = 10mA. The frequency of oscillation is 100Hz. The triggering pulse width should be 50μS.	**10**	**L3**	**CO3**
		Module – 4			
Q.7	**a.**	With neat diagram and waveform explain single phase dual converter.	**10**	**L2**	**CO4**
	b.	A single phase half wave converter is operated from a 120V , 50Hz supply and the load resistance of 10Ω. If average output is 25% of the maximum possible average output voltage calculate : i) Delay angle ii) The rms and average output current iii) The rms and average thyristor current. iv) The Input power factor.	**10**	**L3**	**C)4**
		OR			
Q.8	**a.**	With neat circuit and waveform, explain the operation of single phase bidirectional AC voltage controller with resistive load. Obtain the equation for output voltage.	**10**	**L2**	**CO4**
	b.	The single phase full wave AC voltage controller operates on single phase supply voltage of 230V rms at 50Hz. If the triac is triggered at a delay angle of 45°, during each half cycle of Input supply. Calculate i) RMS value of output voltage. ii) RMS value of current through heater. iii) Average value of triac current and RMS. iv) Input power factor.  Fig. Q8(b)	**10**	**L3**	**CO4**
		Module – 5			
Q.9	**a.**	Explain the principle of operation of a step – up chopper with suitable circuit diagram and waveform. Derive the expression for average output voltage.	**10**	**L1**	**CO5**

	b.	A step up input chopper is 200 V. The output required is 600 V. If the conducting time of thyristor is 200 μs, compute i) Chopping frequency ii) If pulse width is halved for constant frequency of operation, find the new output voltage.	**10**	**L3**	**CO5**
		OR			
Q.10	**a.**	With circuit diagram, explain the operation of 1 ϕ full bridge inverter with R load.	**10**	**L1**	**CO5**
	b.	The single phase full bridge inverter has a resistive load of 24Ω and DC input voltage of 48 V. Determine i) rms output voltage at fundamental frequency. ii) The output supply. iii) The peak and average currents of each transistor.	**10**	**L3**	**CO5**

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