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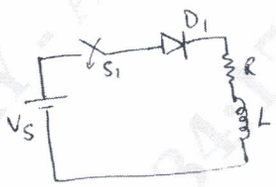
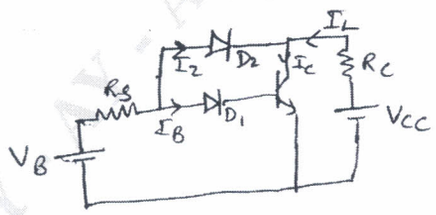
BEE503

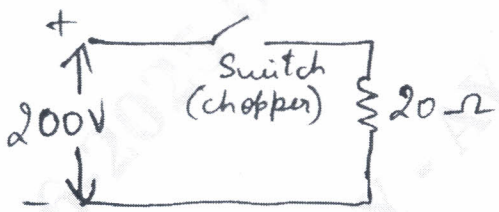
Fifth Semester B.E./B.Tech. Degree Examination, June/July 2025
Power Electronics

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.	Determine the reverse recovery time and reverse recovery current with its characteristics.	8	L2	CO1
	b.	Explain the characteristics of practical diode with its relevant equation.	7	L1	CO1
	c.	Explain with the block diagram of power electronic system.	5	L2	CO2
		OR			
Q.2	a.	Determine the equation for switched RL load with free wheeling diode.	8	L2	CO2
	b.	A diode RL circuit shown in Fig. Q2 (b) below with $V_S = 220$ V, R = 4 Ω, L = 5 mH. The inductor has no initial current. If switch S_1 is closed at t = 0. Determine (i) Steady state diode current. (ii) Energy stored in inductor. (iii) Initial $\frac{di}{dt}$.  Fig. Q2(b)	7	L3	CO2
	c.	Explain the Peripheral effects with a neat block diagram.	5	L1	CO2
		Module – 2			
Q.3	a.	Explain the Base Drive control of BJT turn on method.	7	L1	CO2
	b.	The collector clamping circuit shown in Fig. Q3 (b) below has $V_{CC} = 100$ V, $R_C = 1.5$ Ω, $V_{d_1} = 2.1$ V, $V_{d_2} = 0.9$ V, $V_{BE} = 0.7$ V, $V_B = 15$ V, $R_B = 2.5$ Ω, $\beta = 16$. Calculate : (i) Collector current without clamping. (ii) Collector-emitter clamping voltage V_{CE}. (iii) Collector current with clamping  Fig. Q3 (b)	7	L3	CO2
	c.	Describe the switching limits of the power transistors.	6	L2	CO2

		OR			
Q.4	**a.**	Explain gate drive of MOSFET with a neat circuit diagram.	**6**	**L1**	**CO3**
	b.	Explain the structure of IGBT and its working.	**7**	**L3**	**CO3**
	c.	A simple transistor switch is used to connect a 24 V. DC supply across a relay coil, which has a DC resistance of 200 Ω. An input pulse of 0 to 5 V amplitude is applied through a series base resistor R_B at the base so as to turn on transistor switch. Calculate (i) I_{CS} (ii) Value of R_B required to obtain ODF = 2. (iii) Total power dissipation in transistor that occurs during the saturation state.	**7**	**L3**	**CO3**
		Module – 3			
Q.5	**a.**	Derive an expression of anode current on two transistor Analogy model of thyristor.	**7**	**L3**	**CO3**
	b.	Explain the forced commutation with its neat waveform.	**6**	**L1**	**CO3**
	c.	Describe thyristor RC Firing circuit with its waveform.	**7**	**L3**	**CO3**
		OR			
Q.6	**a.**	Derive an equation of series connection of thyristors with a neat circuit diagram.	**7**	**L2**	**CO3**
	b.	Explain the modes of operation on an thyristor.	**6**	**L1**	**CO4**
	c.	Describe an operation of unijunction transistor with its V-I characteristics.	**7**	**L2**	**CO4**
		Module – 4			
Q.7	**a.**	Describe the operation of single phase half wave circuit with R-L load.	**6**	**L2**	**CO4**
	b.	Describe the principle of operation on single phase dual converters and determine the circulating current.	**7**	**L2**	**CO4**
	c.	A single phase half wave controlled rectifier is used to supply power to 10 Ω load from 230 V, 50 Hz supply at a firing angle of 30°, calculate (i) Average output voltage. (ii) Effective output voltage. (iii) Average load current.	**7**	**L3**	**CO5**
		OR			
Q.8	**a.**	Explain the operation of single phase full wave AC voltage controller with R load.	**6**	**L1**	**CO5**
	b.	Describe the principle of phase control of single phase half wave AC voltage controller.	**7**	**L2**	**CO5**
	c.	An AC voltage controller has a resistive load of 10 Ω and RMS input voltage 120 V, 60 Hz. The thyristor switch is on for n = 25 cycles and off form = 75 cycles. Determine : (i) RMS output voltage V_0 (ii) Input power factor (iii) Average and RMS current of thyristors.	**7**	**L3**	**CO5**
		Module – 5			
Q.9	**a.**	Describe the classification of DC-DC converters. With its circuit diagram and waveforms (any 2).	**10**	**L2**	**CO6**
	b.	Discuss on the performance parameter of a chopper.	**5**	**L2**	**CO6**
	c.	Discuss on the chopper control techniques.	**5**	**L2**	**CO6**

		OR			
Q.10	a.	Explain the operation of 180° conduction type three phase inverter. With circuit diagram and waveforms.	10	L1	CO6
	b.	A chopper circuit is operating on TRC at a frequency of 2 kHz on a 460 V supply of the load voltage of 350 V. Calculate the conduction period of the thyristor in each cycle.	5	L3	CO6
	c.	Considering the switch to be ideal in the circuit of Fig. Q10 (c). Determine (i) The duty cycle, for which the output average dc voltage and rms voltage are equal. (ii) The chopper efficiency.  Fig. Q10 (c)	5	L3	CO6

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