USN | | | | | | | | | | **Course Code** | 2 | 1 | E | E | 4 | 3 |

Fourth Semester B.E. Degree Examinations, Sept/ Oct 2023
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*

Q. No		Question	Marks	(RBTL:CO: PI)
		MODULE – 1		
1.	a.	With a neat circuit diagram, input and output waveforms, explain the different types power electronics converters?	10	(2 :1: 1.3.1)
	b.	With a neat block diagram, explain the peripheral effects of power electronics equipments and list the major applications of power	10	(2 :1: 1.3.1)
		OR		
2.	a.	Explain the reverse recovery characteristics of power diode, with neat waveform. And also obtain an expression for peak reverse current?	10	(2 :1: 1.3.1)
	b.	Explain the working operation of single phase full wave bridge rectifier circuit with 'R' load, with necessary waveforms.	10	(2 :1: 1.3.1)
		MODULE – 2		
3.	a.	A transistor switch of fig. 3.Q.a has β in the range of 8 to 50. Calculate i. The value of R_B that results in saturation with an ODF of 5 ii. The forced β_f and iii. The power loss in the transistor	10	(3 :2: 2.1.2)

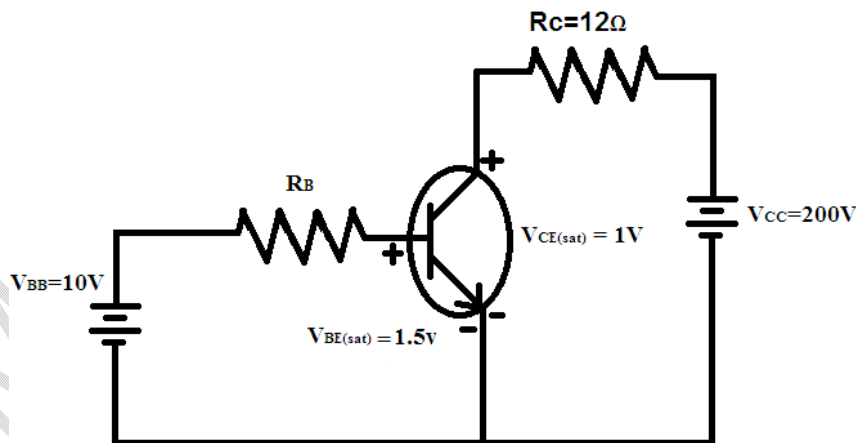$Rc=12\Omega$

Fig. 3.Q.a

	b.	What is the necessity of base drive control in a power transistor? List and explain the base drive control methods.	10	(2:2: 1.3.1)
		OR		
4.	a.	In the circuit shown, the BJT is acting as chopper switch at a frequency of 16KHz, E_{DC}=220V, and load current is 100A. The switching times are $t_d = 0$, $t_r = 1.5\mu s$, and $t_f = 0.7\mu s$. Calculate the values of	10	(3 :2: 2.1.2)

Note: (**RBTL - Revised Bloom's Taxonomy Level: CO - Course Outcome: PI - Performance Indicator**)

i. L_s and C_s
ii. R_s for critically damped conditions
iii. R_s if the discharge current is limited to 5% of load current
iv. Power loss due to snubber, neglecting effect of inductor L_s on voltage of C_s. Assume that $V_{CE(sat)} = 0$.
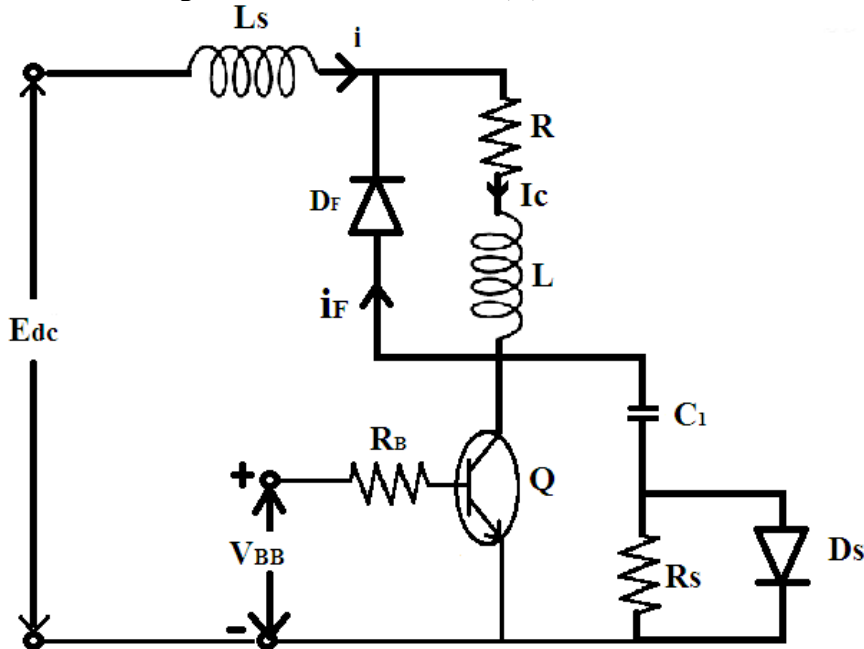

Fig. Q.4.a

b.	Sketch the structure of n-channel enhancement type MOSFET and explain its working principle.	10	(2 :2: 1.3.1)

MODULE – 3

5.	**a.** Explain V-I characteristics of SCR. Also define holding current and latching current.	10	(2 :3: 1.3.1)
	b. The capacitance of the reverse biased junction J2 in a Thyristor is 30pF and can be assumed to be independent of the off state voltage. The limiting value of the charging to turn on the Thyristor is 15mA. Determine the critical value of dv/dt.	14	(3 :3: 2.1.2)

OR

6.	**a.** With a neat circuit diagram and waveforms, explain the UJT triggering for SCR.	10	(2 :3: 1.3.1)
	b. Design the UJT triggering circuit for SCR, given V_{BB}=18V, η=0.5, I_p = 10μA, V_V=2V, I_v = 10mA. The frequency of oscillation is 100 Hz. The triggering pulse width should be 50μs.	10	(3 :3: 2.1.2)

MODULE – 4

7.	**a.** With necessary waveforms, explain the operation of 1-phase AC voltage controller with R load. Derive the expression for RMS output voltage	10	(3 :4: 1.3.1)
	b. With circuit diagram and waveforms, explain the operation of 1-phase dual converters and give the comparison between circulating and non circulating current modes	10	(2 :4: 1.3.1)

OR

8.	**a.** Derive an expression for the RMS value of output voltage of a bidirectional AC voltage controller employing ON-OFF control	10	(3 :4: 2.1.2)

Note: (**RBTL - Revised Bloom's Taxonomy Level: CO - Course Outcome: PI - Performance Indicator**)

	b.	With necessary waveforms, derive the expression for RMS output voltage of 1-phase full wave controller with inductive load for discontinuous load current	**10**	(2 :4: 1.3.1)

MODULE – 5

9.	**a.**	Explain the principle of operation of a step up chopper	**08**	(2 :5: 1.3.1)
	b.	Classify the different types of chopper circuit	**04**	(2 :5: 1.3.1)
	c.	A dc chopper has an input voltage of 200v and a load resistance of 7Ω. The voltage drop across thyristor is 3v and the chopper frequency is 800HZ. The duty cycle α=0.4. find i) average output voltage ii) RMS output voltage iii)chopper efficiency	**08**	(3 :5: 2.1.2)

OR

10.	**a.**	With a circuit diagram explain the operation of 1-phase full bridge inverter	**08**	(2 :5: 1.3.1)
	b.	Write a note on performance parameters for inverter	**04**	(2 :5: 1.3.1)
	c.	A 1-phase full bridge inverter has a resistance load of R=12Ω and the dc input voltage is Vs=220v, calculate (i)the RMS output voltage at fundamental frequency V_1 (ii) the average RMS and peak currents of each transistor switch (iii) the output power P_0 and (iv) the peak off-state voltage of each transistor, V_{BR}.	**08**	(3 :5: 2.1.2)

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