

M.TECH
(SEM 2nd) THEORY EXAMINATION 2017-18
POWER CONVERTER-II

Time: 3 Hours**Total Marks: 70**

Note: 1. Attempt all Sections. If require any missing data; then choose suitably.
 2. Any special paper specific instruction.

SECTION A

- 1. Attempt all questions in brief. 2 x 7 = 14**
- Enumerate basic differences between BJT and MOSFET.
 - When chopper is feeding an RLE load, why the current is not constant?
 - Why multiphase chopper preferable in high power circuit?
 - What are the drawbacks of series inverter?
 - How can input DC voltage to an inverter be controlled?
 - What is the role of resistance connected in series with capacitor in snubber circuit?
 - What do understand by secondary breakdown in BJT?

SECTION B

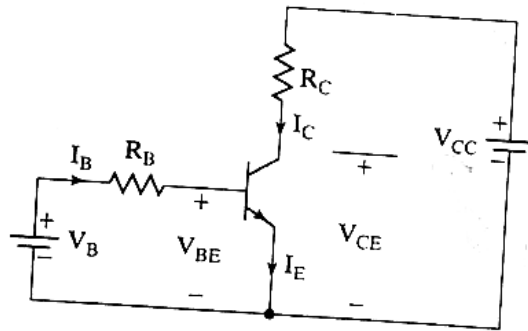
- 2. Attempt any three of the following: 7 x 3 = 21**
- Explain the working principle of IGBT with their switching characteristic.
 - Discuss the advantage of high frequency operation of dc chopper.
In a DC chopper circuit an ideal battery of 100 V feeds a series load of resistance 0.5Ω and inductance of 1 mH. The device is switch on for 1 ms in an over all period of 3 ms. Find maximum , minimum and average load current , and average load voltage.
 - What is necessity of commutation in a thyristorised dc chopper circuit? Describe with neat circuit diagram and relevant waveforms the working of load commutated DC chopper circuit.
 - Describe with neat circuit diagram second quadrant DC chopper circuit and also draw its the relevant waveforms.
 - Explain the working principle of MOS- controlled thyristor with clear diagram.

SECTION C

- 3. Attempt any one part of the following: 7 x 1 = 7**
- Describe with neat diagram P-channel depletion-type MOSFET. Also draw its transfer characteristics
 - A buck-boost regulator has an input voltage of $V_s = 12 \text{ V}$. The duty cycle $k = 0.6$, and the switching frequency is 25 kHz. For the inductance $L = 250 \mu\text{H}$, the filter capacitance $C = 220 \mu\text{F}$ and for average load current $I = 1.5 \text{ A}$, determine (i) the average output voltage, (ii) the capacitor ripple voltage ΔV_c , and (iii) peak to ripple current of inductor ΔI .

- 4. Attempt any one part of the following: 7 x 1 = 7**

- (a) The beta (β) of a bipolar transistor as shown in figure (1) varies from 10 to 60. The load resistance is $R_C = 5 \Omega$. The dc supply voltage is $V_{CC} = 100 \text{ V}$ and the input voltage to the base circuit is $V_B = 8 \text{ V}$. If $V_{CE}(\text{sat}) = 2.5 \text{ V}$ and $V_{BE}(\text{sat}) = 1.75 \text{ V}$, find (i) the value of R_B that will result in saturation with an over drive factor of 20, and (ii) the power loss in transistor.



- (b) A single phase half bridge inverter has a resistive load of 3Ω . The dc input voltage is 30 V . Find: (i) the rms value of fundamental component of output voltage, (ii) output power, (iii) the average current of each thyristor, and (iv) peak current of each thyristor

5. Attempt any *one* part of the following:

7 x 1 = 7

- (a) Discuss three phase inverter with 120° conduction of a thyristor for star connected resistive load. Also draw the output phase voltage waveform for any one phase and discuss its merits & demerits.
- (b) Explain the necessity of harmonics reduction in a inverter circuit. Describe harmonics reduction technique by transformer connections. Also enumerate the drawbacks of this method.

6. Attempt any *one* part of the following:

7 x 1 = 7

- (a) Explain principle of step up chopper and obtain output voltage expression in terms of duty cycle with suitable circuit diagram and waveform.
- (b) With relevant diagram explain the role of snubber circuit.

7. Attempt any *one* part of the following:

7 x 1 = 7

- (a) Discuss with circuit diagram and relevant waveforms basic series resonant inverter and also derive the mathematical expressions for capacitor voltage.
- (b) What are advantages of ZCS in a converter circuit. Discuss L-type ZCS resonant converter. Also derive the expression capacitor voltages during each mode of operations.