

**BIRLA INSTITUTE OF TECHNOLOGY, MESRA, RANCHI  
(MID SEMESTER EXAMINATION)**

**CLASS: BE  
BRANCH: EEE**

**SEMESTER: VII  
SESSION : MO/2019**

**SUBJECT : MEE1151 ADVANCED POWER ELECTRONICS**

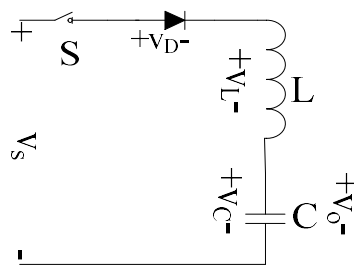
**TIME: 1.5 HOURS**

**FULL MARKS: 25**

**INSTRUCTIONS:**

1. The total marks of the questions are 30.
  2. Candidates may attempt for all 30 marks.
  3. In those cases where the marks obtained exceed 25 marks, the excess will be ignored.
  4. Before attempting the question paper, be sure that you have got the correct question paper.
  5. The missing data, if any, may be assumed suitably.
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- Q1 State whether following statements are true or false. [5]
- (a) The capacitance between Gate to Drain of a Power MOSFET has smaller value in Ohmic region as compared to the capacitance between Gate to Drain in Active region.
  - (b) A parasitic BJT is embedded in the cell structure of an IGBT.
  - (c) The forward voltage drop of an IGBT in the saturation region remains approximately constant.
  - (d) A forward Converter is supplied by 600 V DC. The turn ratio of primary to tertiary winding is 1:2. Then in order to get a DC output voltage of 60V, the ratio of secondary to primary winding must be more than 33%.
  - (e) The dead zone time between two half cycles of a basic series resonant inverter should be more than turn off time of Thyristor.
- Q2 (a) Explain switching mechanism of IGBT with the help of waveforms consisting of Gate to Emitter Voltage (V<sub>GE</sub>), Collector to Emitter voltage (V<sub>CE</sub>) and Collector Current (I<sub>C</sub>) on same time axis [2]
- (b) In the diode and LC network, the capacitor is charged to voltage V<sub>o</sub> with upper plate positive. Switch S is closed at t=0. Derive expressions for current through and voltage across C. Suppose capacitor C is charged initially to 50V then find out final voltage across C. Supply voltage V<sub>s</sub>= 100V [3]



- Q3 (a) Differentiate major dissimilarities between ZCS and ZVS resonant converters. [2]
- (b) The L-type ZCS Resonant converter delivers a maximum power of 400mW at output voltage of 4V. the supply voltage is 12V. The maximum operating frequency is 50kHz. Determine the values of L and C. Assume that the intervals t<sub>1</sub> and t<sub>3</sub> are small, and x=(peak inductor current/output current)=1.5. [3]
- Q4 (a) Analyze the role of tertiary winding in the case Forward converter with the help of primary voltage, secondary voltage waveform and primary current waveform [2]
- (b) The average output voltage of forward converter is 24V at a resistive load of 0.8Ω. The ON-state voltage drops of transistors and diodes are 1.2 V and 0.7V, respectively. The duty cycle is 0.4 and switching frequency is 1kHz. The DC supply voltage is 12V. The turn ratio of transformer a=N<sub>s</sub>/N<sub>p</sub>=0.25. Determine [3]
- (a) Input current (b) Input power (c) Open circuit transistor voltage.

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- Q5 (a) Draw the waveform of load current and capacitor voltage of basic series resonant inverter on same time axis. [2]  
(b) Apply the principle of resonant operation for obtaining expression of capacitor voltage in the basic series resonant inverter during first half cycle in the case of basic series inverter. [3]
- Q6 (a) Obtain expression for frequency response of series loaded resonant inverter. [2]  
(b) Explain and draw the operational modes including waveforms of ZVS Resonant Converter. [3]

:::::: 01/10/2019 :::::M