



Reg No.: \_\_\_\_\_

Name: \_\_\_\_\_

**APJ ABDUL KALAM TECHNOLOGICAL UNIVERSITY**  
**SIXTH SEMESTER B.TECH DEGREE (HONS) EXAMINATION, MAY 2019**

**Course Code: EE364**

**Course Name: SWITCHED MODE POWER CONVERTERS**

Max. Marks: 100

Duration: 3 Hours

*Graph Sheets will be provided*

**PART A**

*Answer all questions, each carries 5 marks.*

Marks

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|---|--|-----|
| 1 | Derive the relation between output voltage and input voltage in a step-up dc-dc converter under CCM operation.   | (5) |
| 2 | Find the duty cycle and output voltage of a Ćuk dc-dc converter if the switch is on for $0.1\text{ ms}$ which is switched at $5\text{ kHz}$ .  | (5) |
| 3 | Obtain an expression for output voltage of flyback dc-dc converter operating under CCM.  | (5) |
| 4 | A single phase full bridge square wave dc-ac inverter is fed from a $500\text{ V DC}$ supply. If load is $R=10\Omega$ and $L=31.84\text{ mH}$ , find (i) rms output voltage (ii) rms output current (iii) fundamental rms output voltage | (5) |
| 5 | Compare DC utilization of Sine PWM and Space Vector Modulation technique.  | (5) |
| 6 | Explain programmed harmonic elimination technique used in a single phase voltage source inverter.  | (5) |
| 7 | Derive an expression for current through a simple un-damped series resonant circuit with a dc input voltage, $V$ , assuming initial capacitor voltage and initial inductor current as zero.  | (5) |
| 8 | Sketch the circuit configurations of L-type & M-type Zero Current Switching resonant converters used in dc-dc converters.  | (5) |

**PART B**

*Answer any two full questions, each carries 10 marks.*

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|----|---|------|
| 9  | Obtain a relation between input voltage and output voltage for a buck converter operating under DCM mode in terms of duty cycle, maximum possible output current at boundary condition and output current with constant output voltage.   | (10) |
| 10 | <div style="display: flex; justify-content: space-between;"> <div style="width: 80%;"> <p>a) Obtain the design equations of inductor and capacitor for a buck-boost dc-dc converter operating under continuous conduction.</p> <p>b) A Ćuk converter operating under CCM has following operating parameters: Input voltage is <math>12\text{ V}</math>, Duty Cycle is <math>0.25</math>, Switching frequency is <math>25\text{ kHz}</math>. Output filter inductance and capacitors are <math>150\mu\text{H}</math> and <math>220\mu\text{F}</math> respectively. Input inductance and capacitors are <math>180\mu\text{H}</math> and <math>200\mu\text{F}</math> respectively. Average load current is <math>1.25\text{ A}</math>. Determine (a) ripple current of input inductor (b) ripple voltage of input capacitor (c) ripple current of output inductor (d) ripple voltage of output</p> </div> <div style="width: 15%; text-align: right;">(5)</div> </div> |      |

capacitor (e) output voltage.

- 11 a) Draw the circuit diagram & waveforms for a Ćuk dc-dc converter operating under CCM and derive an expression for output voltage in terms of input voltage and duty cycle. (5)
- b) Obtain the design equations for inductors and capacitors of a Ćuk converter under CCM operation. (5)

### PART C

*Answer any two full questions, each carries 10 marks.*

- 12 With circuit diagram and waveforms, explain the operation of half bridge dc-dc converter. Also derive an expression for output voltage. (10)
- 13 a) Find an expression for maximum value of duty cycle in a practical forward dc-dc converter, if tertiary (demagnetising) and primary winding turns are  $N_3$  and  $N_1$  respectively. (5)
- b) Explain output voltage control in VSI by voltage cancellation method. (5)
- 14 Explain the bipolar sine PWM switching signal generation for controlling single phase dc-ac inverter. Also, draw the output voltage waveform. (10)

### PART D

*Answer any two full questions, each carries 10 marks.*

- 15 In Space Vector Modulation technique, find expressions for switching timings of each possible vector out of a switching period to obtain a reference vector in any one sector. (10)
- ~~16 a) Describe hysteresis current control of a single phase voltage source inverter. (5)~~
- b) With switch current and switch voltage waveforms, illustrate how ZVS configuration reduces switching loss using any one dc-dc converter. (5)
- 17 Explain series load resonant converter operating under the condition of switching frequency is less than half of resonant frequency, with resonant inductor current and capacitor voltage waveforms. (10)

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