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Code No. : 21713

VASAVI COLLEGE OF ENGINEERING (*Autonomous*), HYDERABAD

M.E. (EEE: CBCS) I-Semester Main Examinations, January-2019

(Power Systems & Power Electronics)

Power Electronic Converters

Time: 3 hours

Max. Marks: 60

Note: Answer ALL questions in Part-A and any FIVE from Part-B

Q.No.	Stem of the question	M	L	CO	PO
Part-A (10 × 2 = 20 Marks)					
1.	Find the current 'i' at t=1sec of the given circuit with $V_s=10V$, $R=20\Omega$ & $L=5H$, when switch 'S' is closed at t=0 & assume initial current through inductor is zero.	2	4	1	1,2,3,4,9
2.	For the above circuit shown in Fig. (a). Draw the voltage waveform across inductor ' v_L '	2	1	1	1,2,3,4,9
3.	In 3-phase full converter with RLE load, draw the output voltage Waveform ' V_o ' for 60° firing angle in continuous conduction mode.	2	2	2	1,2,3,4,9
4.	Find the Peak inverse voltage of the diode in 1-phase full wave diode bridge rectifier with R-load if source voltage $V_s=325\sin\omega t$.	2	2	2	1,2,3,4,9
5.	In a buck converter to maintain regulated voltage of 10V for the input voltage variations 20-50V. Find the D_{min} and D_{max} in continuous conduction mode.	2	4	3	1,2,3,4,9
6.	Draw circuit diagram of Cuk dc-dc converter.	2	1	3	1,2,3,4,9
7.	Write the Fourier series expression of output voltage waveform for a single-phase half- bridge inverter.	2	4	4	1,2,3,4,9
8.	List the applications of inverters.	2	1	4	1,2,3,4,9
9.	Sketch the output current waveform of single-phase voltage controller with R-L load for $\alpha > \phi$.	2	1	5	1,2,3,4,9
10.	Sketch the output voltage waveform of single-phase step-up cycloconverter with R-load.	2	1	5	1,2,3,4,9
Part-B (5 × 8 = 40 Marks)					
11. a)	Derive Average and R.M.S output voltage of 1-phase Half wave Diode Rectifier with R-load.	4	2	1	1,2,3,4,9
b)	If $V_s=230V$ at 50Hz, $R=10\Omega$, $L=5mH$, Extinction angle $\beta=210^\circ$. Find Average value of Output Voltage and Output Current for single-phase half-wave uncontrolled rectifier connected to R-L load.	4	2	1	1,2,3,4,9
12. a)	Draw circuit diagram of three-phase semi-converter with RLE load and also output voltage waveforms for firing angle $\alpha=15^\circ$ & $\alpha=90^\circ$ (assume continuous conduction mode)	4	4	2	1,2,3,4,9
b)	Derive Average output voltage of 1-phase full-wave mid-point converter with RL load and also draw output voltage and output current waveforms for continuous conduction mode. Estimate average output voltage for 1-phase input voltage of 230V, 50Hz with $\alpha=30^\circ$	4	4	2	1,2,3,4,9

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13. a)	Explain the operation of buck converter with neat diagram. Derive the expression for output voltage in continuous conduction mode.	4	2	3	1,2,3,4,9
b)	In a boost converter, consider all components to be ideal. Let V_d be 8-16 V, $V_o=24V$ (regulated), $f_s=kHz$ and $C=470\mu F$. Calculate D_{max} , D_{min} & L_{min} that will keep the converter operating in a continuous conduction mode if $P_o \geq 10W$.	4	3	3	1,2,3,4,9
14. a)	Describe the working of a single-phase full bridge inverter (VSI) with neat diagram and sketch the output voltage waveform for R-load.	3	3	4	1,2,3,4,9
b)	Discuss the principle of working of a three-phase bridge inverter (VSI) with an appropriate circuit diagram. Draw any one phase and one line voltage waveform for 180° mode of operation of SCRs with star-connected resistive load. The sequence of firing of various SCRs should also be indicated in the diagram.	5	5	4	1,2,3,4,9
15. a)	Discuss the principle of phase control in single phase full-wave ac voltage controller with R-load. Derive expression for the R.M.S value of its output voltage.	4	2	5	1,2,3,4,9
b)	Describe the basic principle of working of single -phase to single -phase step-up cycloconverter with the help of mid-point configuration. Illustrate your answer with appropriate circuit and waveforms. The conduction of various thyristors must also be indicated on the waveform.	4	3	5	1,2,3,4,9
16. a)	Derive $i(t)$ & $v_L(t)$ for the given circuit diagram and also draw their waveforms, when switch S is closed at $t=0$ and all initial values of $i(t)$, $v_L(t)$ & $v_C(t)$ are assume to zero.	4	2	1	1,2,3,4,9
b)	Deduce average output voltage of 3-phase full converter with RLE load and also draw output voltage waveform for firing angle $\alpha=15^\circ$ & $\alpha=90^\circ$ (assume continuous conduction mode).	4	2	2	1,2,3,4,9
17.	Answer any <i>two</i> of the following:				
a)	Explain the operation of Buck-Boost converter in continuous mode with neat diagram. Derive expression of output voltage in continuous conduction mode.	4	2	3	1,2,3,4,9
b)	Derive Fourier series expression for the output voltage obtained from single-phase full bridge inverter.	4	5	4	1,2,3,4,9
c)	For a single -phase voltage controller feeding a R-L load, draw the waveforms of source voltage, gating signals, output voltage and output currents. Describe its working with reference to the waveforms drawn.	4	2	5	1,2,3,4,9

M: Marks; L: Bloom's Taxonomy Level; CO: Course Outcome; PO: Programme Outcome

S. No.	Criteria for questions	Percentage
1	Fundamental knowledge (Level-1 & 2)	57.5%
2	Knowledge on application and analysis (Level-3 & 4)	31.25%
3	*Critical thinking and ability to design (Level-5 & 6) (*wherever applicable)	11.25%