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

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**End Semester Examination – Nov/Dec – 2018**

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| **Code :** | **17EE3030** | **Duration :** | **3hrs** |
| **Sub. Name :** | **MODELING OF POWER CONVERTERS** | **Max. marks :** | **100** |

**ANSWER ALL QUESTIONS (5 x 20 = 100 Marks)**

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| **Q. No.** |  | **Questions** | **Course**  **Outcome** | **Marks** |
| 1. |  | Analyse and design a buck boost converter shown below.    Design for the given specification: Vg:40V, V=-20V, R=4 ohm, Switching frequency: 30kHz.   1. Find D and I. 2. Calculate the value of L that will make the peak inductor current ripple equal to ten percentof the average inductor current I. 3. Choose C such that the peak output voltage ripple is 0.1 V. | CO1, CO2 | 20 |
| (OR) | | | | |
| 2. |  | Derive a small signal ac equivalent circuit of the flyback converter containing transformer as shown below.    The flyback transformer has magnetizing inductance L, referred to the primary winding, and turns ratio 1:n. MOSFEThas on-resistance Ron. Other loss elements, as well as the transformer leakage inductances and the switching losses, are negligible | CO1 | 20 |
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| 3. |  | Design a DCM buck boost converter which is to be operated under the following operating condition.  136 V<Vg<204 V, 5 W<Pload<100 W, V=-150 V, fs=100 kHz. You may assume that a feedback loop will vary to transistor duty cycle as necessary to maintain a constant output voltage of – 150 V. Design the converter, subject to the following considerations:   * The converter should operate in the discontinuous conduction mode at all times * Given the above requirements, choose the element values to minimize the peak inductor current * The output voltage peak ripple should be less than 1V.   Specify:   * The inductor value *L* * The output capacitor value *C* * The worst-case peak inductor current   The maximum and minimum values of the transistor duty cycle *D* | CO3, CO4 | 20 |
| (OR) | | | | |
| 4. |  | Using state space averaging method model a non ideal buck boost converter with fixed output voltage. Consider the conduction loss of the MOSFET having an onstate resistance Ron and the forward voltage drop of the diode D. | CO1 | 20 |
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| 5. |  | For the equivalent circuit of buck boost converter shown above, derive and plot the following transfer functions of the circuit   1. Control-to-output 2. Line-to-output | CO4 | 20 |
| (OR) | | | | |
| 6. |  | Discuss in detail the procedure to measure the AC transfer function and impedances. Also narrate its significance of these measures. | CO1 | 20 |
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| 7. |  | The element values in the buck converter are : Vg=120 V, R=10 ohm, L = 550uH, D=0.6, Rg = 2 ohm, C=100uF    Determine an analytical expression for the control-to-output transfer function Gvg(s) of this converter.  Find analytical expressions for the salient features of Gvg(s)  Construct magnitude and phase asymptotes for Gvg. Label the numerical values of all slopes andother important features. | CO1 | 20 |
| (OR) | | | | |
| 8. |  | Discuss in detail the need for Input Filter Design and the problems associated with the filter design for an application. Also elaborate how the Input filter affects the converter transfer function. | CO4 | 20 |
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|  | | **Compulsory**: |  |  |
| 9. |  | Discuss about Hopf and period doubling bifurcation in switched dynamical power converters. | CO6 | 20 |