MANIPAL INSTITUTE OF TECHNOLOGY
MANIPAL
(A constituent Institution of MAHE, Manipal)

I SEMESTER M.TECH (POWER ELECTRONICS & DRIVES)
END SEMESTER EXAMINATIONS, NOVEMBER 2018

SUBJECT: APPLICATION OF POWER ELECTRONICS IN POWER SYSTEMS [ELE 5122]
REVISED CREDIT SYSTEM

Time: 3 Hours	Date: 22, November 2018	Max. Marks: 50

Instructions to Candidates:
- ❖ Answer **ALL** the questions.
- ❖ Missing data may be suitably assumed.

1A. What are components of HVDC system and explain about each? *(02)*

1B. What are the different HVDC transmission links possible and explain about each configuration? *(03)*

1C. What is the role of power electronic converters in a power system with distributed energy resources such as photovoltaic, wind energy conversion systems and energy storage devices? *(03)*

1D. What are the differences between current source converter and voltage source converter? *(02)*

2A. Describe the working of 6-pulse converter with a neat circuit diagram. Also determine it's output voltage V_d in terms of valve firing angle of α. *(03)*

2B. Prove that for a loss less HVDC converter $\cos\phi = \cos\alpha$ (α is valve firing angle, $\cos\phi$ is power factor) and comment on limitations of α. *(02)*

2C. Derive the relation for the output voltage of a 6-pulse converter with a valve firing angle of α and overlap angle ($u < 60^0$). *(05)*

3A. Derive the equivalent circuit model for a two terminal HVDC system in terms of valve firing angle α, extinction angle γ, commutation resistance R_C and line resistance R_L. *(04)*

3B. What are the different Control strategies used in HVDC and explain about them with proper characteristics? *(03)*

3C. A monopolar HVDC link has one bridge at each terminal. The parameters of the link are: $\alpha_{min}=5^o$, $\gamma_{min}=18^o$, $R_L=5\Omega$, $R_{cr}=10\Omega$, $R_{ci}=12\Omega$. $V_{doi}=117.5$kV, I_{Ref} at the rectifier is 1kA, I_{Ref} at the inverter is 900A.

       i. If, $V_{dor} = 120kV$, Calculate $I_d, \alpha, \gamma, P_r, Q_r$

       ii. Repeat (i) if $V_{dor}=115$kV *(03)*

4A. What are the different types of FACTS controllers used in power system and draw their circuit models? *(03)*

4B. What are the different types of static VAR compensators (SVC) and explain about their working principle? *(05)*

4C. What are the general characteristics of SVC? *(02)*

5A. What are the possible benefits from FACTS devices? *(02)*

5B. Explain about the 12-pulse Thyristor controlled reactor (TCR) with a circuit diagram. *(02)*

5C. What is the importance of Thyristor controlled transformer (TCT) in an SVC and mention it advantages over TCR? *(02)*

5D Explain about the working of STATCOM with proper circuit diagram and compare STATCOM with SVC. *(04)*