QP Code : 31290

(3 Hrs.)   [Total Marks 80]

N. B.
(1) Question No. **1** is **compulsory**.
(2) **Attempt** any **three** questions out of remaining questions.
(3) **Figures** to the **right** indicate **full** marks.
(4) **Assume** suitable **data** if **necessary**.

1.   Solve any **four** :-   20
    a) Enlist limitations of AC transmission and advantages of HVDCT
    b) Derive the output dc voltage equation of a 6 pulse converter operating with delay
        angle (α) and overlap angle (μ). When ($\mu < 60$)
    c) Compare IPC and EPC schemes of converter firing control
    d) Explain By-pass valve
    e) Explain causes and consequences of harmonics in HVDC system

2.   a) Explain protection against over voltage and over current in HVDC   10
     b) Explain means of reducing characteristics and non-characteristic harmonics on ac as   10
         well as dc side of HVDCT line

3.   a) Show the relation between delay angle and power factor angle with waveforms and   10
         pahsors. Also show the effect of overlap angle (μ) on conduction of valves for $\mu = 0$,
         $\mu < 60°$ and $\mu > 60°$
     b) Explain basic control characteristics of HVDC, also explain the actual control   10
         characteristics with modifications

4.   a) In a monopolar HVDC link which is energized with 3 phase 50 Hz 440 KV source,   10
         the dc current is 1.2 KA and the rectifier (6 pulse converter) dc voltage is 500 KV.
         For delay angle of 15° -
         a) Find commutation resistance
         b) Find angle of overlap
         c) If ac voltage is reduced to 200 KV. Find the overlap angle.
         Assume the dc current is constant
     b) Explain two methods of IPC (individual phase control)   10

5.   a) Explain converter transformer in detail also explain how different it is from a normal   10
         power transformer
     b) Explain power reversal in HVDC and significance of current margin   10

6.   a) Drive equivalent circuit of a 6 pulse bridge rectifier   10
     b) Explain causes, analysis (with waveforms), symptoms, cure of a single commutation   10
         failure