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

VII SEMESTER B.TECH (ELECTRICAL & ELECTRONICS ENGINEERING)
PROCTORED ONLINE MAKEUP EXAMINATIONS, FEBRAUARY 2022

HVDC & FACTS [ELE 4083]
REVISED CREDIT SYSTEM

Time: 75 Minutes + 10 Minutes **Date: 17 February 2022** **Max. Marks: 20**

Instructions to Candidates:

- Answer **ALL** the questions.
- Missing data may be suitably assumed.
- Time: 75 minutes for writing + 10 minutes for uploading.

1A. With neat sketches, explain the different types of HVDC links with merits and demerits. ***(03)***

1B. A 3-phase, 24-pulse bridge rectifier is fed from a transformer with transformation ratio 0.48 and primary voltage 220 kV. Determine (i) the output voltage of rectifier when firing angle is 18°45″ and commutation angle 18°25″ (ii) fundamental component of ac line current, power factor, active and reactive power at primary side of transformer if the dc current is 2.5 kA. ***(04)***

1C. How can CC control, CEA control and CIA control be achieved using Individual Phase Control? ***(03)***

2A. With relevant sketches, explain the working of a 3-phase, 12-pulse STATCOM. ***(03)***

2B. A 500kV, 50Hz, 800km long symmetrical line is operated at the rated voltage. Natural impedance is 300Ω and phase β=0.065°/km.

i) What is the theoretical maximum power carried by the line and the midpoint voltage corresponding to this condition?

ii) Compute the rating of a series capacitor to be connected at midpoint of the line to double the power flow through the line when δ=65° and the power carried by the line.

iii) Compute the rating of the shunt capacitor if it were to replace the series capacitor in (ii)? ***(04)***

2C. A 400kV, 50Hz, 800km long, lossless, symmetrical line is operated at the rated voltage and the operating angle δ=65°. Natural impedance of the line= 300Ω and β=0.06°/km. A SVC is connected at the midpoint so as to increase the midpoint voltage to 390 kV. Compute the susceptance to be offered by SVC if the slope of control characteristics is 0.05pu and the maximum power carried by the line with SVC. ***(03)***