Ref. No. : Ex/PG/PE/T/128C/2024

M.E. POWER ENGINEERING FIRST YEAR SECOND SEMESTER - 2024
POWER APPARATUS

Full Marks: 100
Time: 3 hrs

Group A: Answer any two questions (CO1)

1. Enumerate the importance of the reactive power compensation in the power system operation? Name different types of the Thyristorized VAR compensators. Draw the circuit diagram of Fixed Capacitor-Thyristor Controlled Reactors (FC-TCR) used for the reactive power compensation. Explain its working with the help of fundamental and harmonic component of the reactor current. Also draw the voltage vs reactive power characteristics of the FC-TCR. Draw the configuration of the combined TSC-TCR and the corresponding voltage-reactive power characteristics.
3+2+3+5+2+5

2. What are the different types of HVDC links? Explain with diagram. Name the major components of converter station of HVDC transmission? How is the transient reliability of the HVDC system calculated? Discuss the operation of the 6-pulse converter used in HVDC system and configure it in terms of valve rating and transformer rating. 1+4+3+12

3. Why SF6 is suitable for the circuit breaker operation? Discuss the advantages and disadvantages of SF6 CB. Describe the construction of the SF6 breaker with a suitable diagram and explain the interruption process.
4+5+6+5

Group B: Answer any two questions (CO2)

4. How the copper loss and impedance voltage test for a three phase interconnected star neutral earthing transformer are executed for three phase transformers? Why it is necessary to conduct the impedance voltage test at a reduced value of current. 4+4+2
What is the impulse voltage test? Explain for the power transformers. Discuss how the impulse voltage wave shapes are generated for this test. 6+4

5. Draw and explain the delta/delta connection for measuring temperature rise in case of oil immersed transformers. How is the duration of such test specified? 8+2
Why is the partial discharge measurement of power transformers needed? How are the partial discharge calibration and measurement done? Explain with suitable diagram. 3+3+4

6. Draw the connection diagram of separate source voltage test and explain with the phasor diagram. What is the role of the capacitance connected between the windings and between each winding and earth? Explain. 2+6+4
What is drying out on site? Discuss the short circuit method for drying out the transformer and the oil simultaneously in the tank and the transformer only out of its tank. 2+8

Group C: Answer any one question (CO3) 20

7. The AC line voltage of a 3 phase bridge inverter is 120kV, the extinction angle is 15^0 and the overlap angle is 20^0. Calculate the DC voltage at the inverter. Also calculate the necessary extinction angle to maintain the AC line voltage at 120kV, when there is a drop of 10kV in DC voltage. Assume constant overlap angle. Derive necessary equations.
8. Analyze the Graetz's circuit for two and three valve conduction in (i) rectifier and (ii) inverter operation with and without overlap.