Name: **Enrolment No:**	UPES

UNIVERSITY OF PETROLEUM AND ENERGY STUDIES
End Semester Examination, May 2019

Programme: B. Tech. PSE & B. Tech. Electrical **Semester: VI**
Course: Substation designing
Time: 03 hrs. **Max. Marks: 100**
Instructions: Attempt All Question

SECTION A

S. No.		Marks	CO
Q 1	Deduce an expression for transmission loss in terms of load current and the voltages of the HVDC transmission system	**4**	**CO4**
Q2	Explain the concept of touch potential & step potential in the station grounding system	**4**	**CO3**
Q3	Write a short note on advantages of Gas Insulated Substation	**4**	**CO3**
Q4	Explain the following terms and their units of measurement: a) Discharge current of surge arrester b) Impulse ratio	**4**	**CO3**
Q5	Discuss the type of neutral groundings practices in Industrial, Distribution system with their voltage levels in the AC substations.	**4**	**CO2**
	SECTION B		
Q6	Explain the evaluation of outage possibility factor for a single bus with bus sectionlizer for a system with eight feeders with the help of some suitable diagram under the following conditions: Maintenance of any one feeder/its breaker /line side isolator / bus side isolator and bus coupler breaker ii) Single fault on any one feeder/its breaker /line side isolator / bus side isolator and bus coupler breaker iii) One circuit breaker is under maintenance & and the fault in other feeder/ its breaker / line side isolator / bus side isolator and bus coupler breaker	**10**	**CO2**
Q7	Discuss the sequence of control actions during a line fault on HVDC Overhead line pole.	**10**	**CO4**
Q8	A generating station has three generators, each of 10 MVA, 10% reactance capacities, connected to a common bus through reactors of 8% to each	**10**	**CO2**

	generator. If a fault develops on the bus bar of one generator, calculate the short circuit MVA and compare it with a with a case when there is no reactors used OR Discuss the primary and back up protections of a 400 kV substation involving following equipment: 1. 400KV line. 2. 400 kV Busbar section I section II 3. Shunt reactor 400 kV line, 40 M Var 4. 220 kV lines Power Transformer 400kV/ 220kV/20kV, 120 MVA		
Q9	Suggest the schematic diagram of the load break switches and D.C. Breaker of the bipolar HVDC substation for the DC power transfer. Discuss the status of electrical equipment (isolator / breakers) under the following conditions i) One HVDC line is faulty. ii) One Thyrister valve system is faulty & power supply transmission through metallic return	**10**	**CO4**
	SECTION-C		
Q10	Draw a schematic diagram for the system and give your analysis for different surge conditions. The following data of a system received from the client to a design engineer as below: 1. Basic insulation level of Incoming feeder: 650kV 2. Surge arrester Normal Voltage: 120kV 3. Basic Insulation of surge arrester: 650kV 4. Discharge Voltage: 350 kV 5. Cable basic Insulation Level: 640kV 6. Transformer voltages: 132/ 66kV 7. Transformer basic insulation level: 550 kV		**CO3**
Q11	A lightning arrester is having a rating of 80kA is selected for 400 kV substation. Calculate the following on the basis of 75% and 80% arrestors a) Voltage rating; b) Arrestor discharge voltage c) Minimum insulation level protected against i) Impulse surges; ii) Switching surges iii) Power frequency over voltages Assume discharge factor value 3.0; Surge spark over voltage factor 1.7 Tolerance factor 15% and Margin factor 20% OR	**20**	**CO3**

	The following data available for the substation. Fault current: 3.1 kA for 3 sec. & Duration of fault current: 0.15 sec. Temperature Constant "S" = 160; Soil resistivity: $30x10^3$ ohm-cm Soil resistivity of surface material: $30x10^5$ ohm-cm Thickness of the gravel on the substation: 100 cm. Length of 100m and a width of 50m with 6 parallel rows and 8 parallel columns Grid conductors will be buried at a depth of 600mm Earthing rods on the corners and perimeter of the grid; 25 no's; Length of earthing rod: 3m Calculate the following; a) Touch potential. b) Step potential c) Grid resistance d) Grid potential rise		

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UNIVERSITY OF PETROLEUM AND ENERGY STUDIES
End Semester Examination, December 2018

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Course: Substation Designing
Time: 03 hrs. **Max. Marks: 100**
Instructions: Attempt all Questions

SECTION A

S. No.		Marks	CO
Q 1	With the help of neat diagram, explain the functioning of parallel compensator used for bus modules of gas insulated substation Statement of question	**4**	**CO2**
Q2	Explain the stresses on a Substation Equipment	**4**	**CO2**
Q3	Discuss the steps involved in "Busbar designing" of a 220 kV substation.	**4**	**CO1**
Q4	Explain the advantages and disadvantages of Gas Insulated Substation.	**4**	**CO3**
Q5	Define insulation coordination of the substation electrical equipment. Discuss the different types of insulation levels considered while studying Insulation system of a substation.	**4**	**CO3**
SECTION B			
Q 6	State the protective zones for HVDC terminals, show them on a single line diagram of HVDC terminal &protection for HVDC substation	**10**	**CO4**
Q7	With the help of neat detailed diagram, discuss the scheme for a system having a voltage levels of 400 kV AC & 220 kV Ac transmission of an interstate transmission system suitable for the grid system	**10**	**CO4**
Q8	Discuss the various activities of project planning of a substation **OR** Discuss the major activities for the planning of substation project and prepare a typical L2 bar chart for typical electrical erection activities.	**10**	**CO5**
Q9	With the help of neat diagram, explain the location of the surge arresters in a HVDC substation.	**10**	**CO4**

SECTION-C			
Q10	Two Generating stations P having the capacity of 75 MVA and reactance of 12% and Q having the capacity of 50 MVA and reactance of 6.5% connected through an interconnector of 9 percent reactance. A transformer of Capacity 0f 100 MVA with the reactance 8% is also connected to the bus bar of the generator through a reactor (X). The circuit breaker is used of 2000 MVA capacity. Calculate the capacity of reactor(X) in case the fault occurring on the outgoing feeder connected to transformer bus , so that circuit breaker could be used quite safely	**20**	**CO5**
Q11	In a 132 kV transformer substation, the "delta-star transformer" is connected through circuit breaker on 132 kV. The transformer is effectively earthed. Draw scheme of equipment, obtain the rating of lightning arrester for the transformer. Basic Insulation Level for transformer and other equipment are 550 KV and 630 KV respectively Assume the insulators allow a max. Surge voltage of 860 KV and Line surge impedance is 400 ohms. **OR** A lineman was working at a 33 kV substation yard on a sunny day to rectify a lighting point at the top of switchyard steel structure. The switchyard is laid with 7.5 cm thick gravel layer as a safety measure. While fixing and positioning the ladder in the switchyard manually, it went out of control, causing the ladder to fall on the 33kV Busbar. This caused an earth fault with the bus and the people on the scene heard an explosive sound. The power supply tripped instantly. The lineman fell on the ground after getting a severe shock. He sustained some burns on both hands and both feet causing bleeding. However, his life was saved. Explain what the factors that saved his life are. Assume his body resistance 1000 ohms with contact resistance of 100 ohms (Shoes).The 33kV bus fault level is 750 MVA. Make any reasonable assumption if required. Take Soil resistivity: 30 ohm-m Soil resistivity of surface material: 3000 ohm-m Grid resistance: 2.5 Ohms	**20**	**CO3**