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UNIVERSITY OF PETROLEUM AND ENERGY STUDIES

End Semester Examination, December 2017

Program: B. Tech. PSE
Subject (Course): Substation Designing
Course Code : PSEG402
No. of page/s: 2

Semester – VII
Max. Marks : 100
Duration : 3 Hrs

SECTION-A

ATTEMPT ALL QUESTIONS

5x4=20 marks

Q. No.	CO	Question
1	CO 1	Discuss the type of groundings practiced in Industrial, Distribution system with their voltage levels in the AC substations
2	CO 2,3	Explain the following terms and their units of measurement: a) The chopped wave insulation level b) Insulation coordination c) Discharge current d) Impulse ratio
3	CO4	Explain the concept of touch potential & step potential in the station grounding system
4	CO 3,4	Deduce an expression for transmission loss in terms of load current and the voltages of the HVDC transmission system
5	CO 5	Write a short note on advantages of Gas Insulated Substation

SECTION B

ATTEMPT ALL QUESTIONS

4 X 10 =40 Marks

Q. No.	CO	Question
6	CO3	A generating station has three generators, each of 10 MVA, 10% reactance capacities, are connected to a common bus through reactors of 8% to each generator. If a fault develops on the bus bar of one generator, calculate the short circuit MVA and compare it with a case when there is no reactors used

7	CO5	State the protective zones for HVDC terminals, show them on a single line diagram of HVDC terminal & protection for HVDC substation
8	CO 4,5	With neat 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 two different grid system
9	CO3	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: i) Maintenance of any one feeder breaker / line / bus isolator or bus coupler breaker ii) Single fault on any one equipment mentioned above (feeder breaker / line or bus isolator and bus coupler breaker). iii) One circuit breaker is under maintenance & and the fault in any one feeder breaker / line / bus isolator and bus coupler breaker

SECTION C

ATTEMPT ALL QUESTIONS.

Marks: 2 X 20=40

Q. No.	CO	Question
10	CO3	<p>The following data of a system is made available to the engineer and he was asked to analyze it for different lightning impulse condition and his comments. Give your analysis for the system and draw a schematic diagram for the system</p> <ol style="list-style-type: none"> 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
11	CO 3,4	<p style="text-align: right;">5+15 =20 marks</p> <p>a) a) Discuss the steps in bus bar design of a 220 kV substation.</p> <p>b) Design the Busbar system for the following specifications: Rated Voltage: 400kv ; Rated normal current: 2000A Rated short circuit current: 40kA rms ; Type of Busbar: Aluminum & Rigid i) Phase to phase 5 M ; ii) Phase to ground 3.5 M; iii) Creepage value: 24mm/kV</p>

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Name of Examination (Please tick, symbol is given)	:	MID		END	☐	SUPPLE	
Name of the College (Please tick, symbol is given)	:	COES	☐	CMES		COLS	
Program	:	B. Tech. PSE					
Semester	:	VII					
Name of the Subject (Course)	:	Substation Designing					
Course Code	:	PSEG 402					
Name of Question Paper Setter	:	Ram Mohan Sharma					
Employee Code	:	40000868					
Mobile & Extension	:	9997636035 /1241					
Note: Please mention additional Stationery to be provided, during examination such as Table/Graph Sheet etc. else mention "NOT APPLICABLE":							
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Note: - Pl. start your question paper from next page

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SECTION-A

ATTEMPT ALL QUESTIONS

Marks: 5x4=20

Q. No.	CO	Question
1	CO 1,4	a) Explain the functions of substation Earthing system. b) Discuss the various modes of operations of breakers and isolators in a substation.
2	CO 3	Discuss the steps in bus bar design of a 220 kV substation.
3	CO3	Discuss the following for HVDC Earth system a) Earth electrode
4	CO4	Discuss the zones of protection of HVDC system.
5	CO5	Explain the advantages and disadvantages of Gas Insulated Substation.

SECTION B

ATTEMPT ALL QUESTIONS

Marks: 4 X 10 =40

Q. No.	CO	Question
6	CO 3,4	Discuss the sequence of control actions during a line fault on HVDC Overhead line pole
7	CO 3,4	With the help of neat diagram, explain the location of the surge arresters in a HVDC substation.
8	CO 3	a). Explain the criterion adopted for a HVDC earthing system. b) Discuss the ring type earthing system for HVDC system.
9	CO 2	Explain the essential equipments & control panels required for control room & switchyard of a 132 kV substation. OR

	CO 6	State the major activities for the planning of substation project and prepare a typical L2 bar chart for typical electrical erection activities.
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SECTION C

ATTEMPT ALL QUESTIONS.

Marks: 2 X 20=40

Q. No.	CO	Question
10	CO4	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% are connected through an interconnector of 9 percent reactance. A transformer of Capacity of 100 MVA with the reactance 8% is also connected to the bus bar of the generator through a reactor (X) . Is 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
11	CO4	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) Arrester discharge voltage c) Minimum insulation level protected against i) Impulse surges ii) Switching surges Take discharge factor value 3.0 Switching surge voltage factor = 3.88 Impulse surge voltage insulation level (kV) = $1.15(1.10 * E_d + 40)$

