Name: **Enrolment No:**	UPES

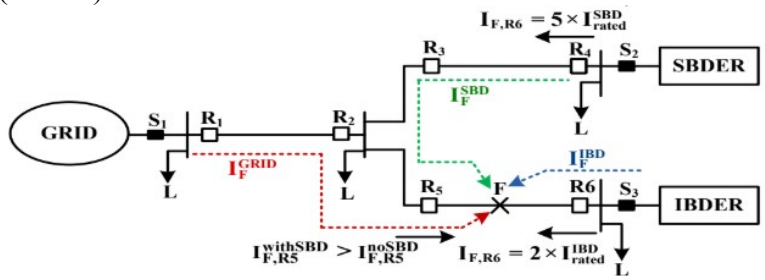
UNIVERSITY OF PETROLEUM AND ENERGY STUDIES
End Semester Examination, December 2018

Course: AUTOMATION IN POWER SYSTEMS (PSEG483) **Semester: VII**
Programme:B.TECH ELECRICAL & PSE

Time: 03 hrs. **Max. Marks: 100**

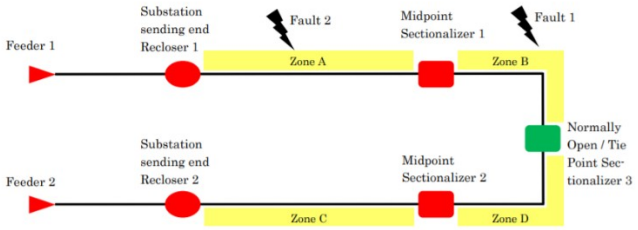
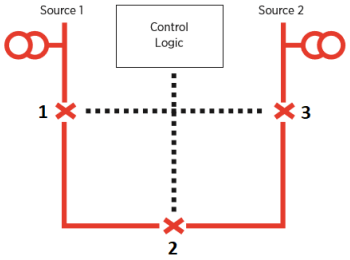
Instructions:

SECTION A

S. No.		Marks	CO
Q1	Define and explain the following terms a)Relay Reliability? b) Relay Dependability c) Relay security ? with the help of an example	**5**	**CO1**
Q2	Explain different applications of WAMS wrt Power system automation	**5**	**CO3**
Q3	Explain in detail about Digital Fault Recorder Analysis Software Modules.	**5**	**CO1**
Q4	A 4-bus distribution network as shown in fig with grid, synchronous based DER (SBDER), Inverter based DER (IBDER) and having switches (S1-S3) and relays (R1-R6) is considered.  For the Fault at point "F" Identify which relays will experience the following protection issues a) Dynamics in level of fault currents: b) False tripping: c) Blinding of protection:	**5**	**CO1**

SECTION B(Internal choice Q8 or Q9)

Q5	Illustrate and discuss in detail about Advanced Metering Infrastructure architecture and functional components.	**10**	**CO3**
Q6	Explain how Does HART Work ? Explain the properties of all HART field devices must have?	**10**	**CO1**
Q7	Illustrate syncrophasor technology architecture, with the help of block diagrams?	**10**	**CO4**
Q8	In the power system automation we require collective technology to monitor power system dynamics in real time, identify system stability related weakness and helps to design and implement counter measures. (IEEE) Explain in detail about Wide Area Monitoring (WAMS) with the help functional blocks and associated components .	**10**	**CO2**

Q9	One of the practical application of Sectionalizer is shown in the above diagram. Two Feeders 1 and 2 and connected through a Sectionalizer which is in normally open condition with voltage sensing provided on both incoming and outgoing sides. Reclosers are provided for the fault interruption while a Sectionalizer is provided at midpoint location for fault isolation. For better understanding, scenario are discussed below:1) For any permanent Fault 1in Zone B, Sectionalizer 1 shall open after preset number of retries from Recloser 1. Finally,Zone B get isolated automatically while supply in Zone A,C and D shall remain active. **Write the Algorithm and PLC program to implement the above scheme.** 	**10**	**CO3**
	SECTION-C (Internal choice Q10 or Q11)		
Q 10	Explain the following protection issues in Power system automation with the help of an example? a) Dynamics in level of fault currents b) Bi-directional fault current c) False tripping d) Blinding of Protection	**20**	**CO1**
Q11	Illustrate Wired and wireless Protocols for HART Communication Layers?	**20**	**CO4**
Q12	The Automatic Control Switch (ATS) controls the switching between two or more electrical power sources connected on the same network. Automatic switching is required in order to ensure maximum continuity of service when one of the sources is lost due to fault or any other power loss **Normal Operation** : •The normal operation of the scheme is either: •Source 1 main supply, Source 2 alternative supply and bus section closed or •Source 2 main supply, Source 1 alternative supply and bus section closed.  **Main Supply Loss** • Loss of supply is detected when an under voltage condition is present on one of the phases. •When the main supply is lost, providing an alternative supply is available, the main supply circuit breaker is opened, the standby supply circuit breaker is closed and bus-section remains closed, completing the transfer between sources. • If the main supply circuit breaker does not open or the alternative supply circuit breaker does not close, further operation is inhibited until it is manually re-configured and reset. **Main Supply Loss due to Fault** : In the presence of a fault condition detected by the protection scheme of the main supply, the bus-section is opened, and the alternative supply is closed keeping half of the network healthy. • If the main supply circuit breaker does not open or the alternative supply circuit breaker does not close, further operation is inhibited until it is manually re-configured and reset. **Restoration of Main Supply** •Restoration can be done either manually or automatic • If Manual restoration is selected, the transfer to the original configuration can be done manually. • If Automatic restoration is selected, the transfer back to the original configuration is completed when main supply is back in the healthy state. • Synchronising the	**20**	**CO3**

	sources on restoration is possible by means of a synchronising relay. This avoids loss of supply on returning to the normal operation. **Main and Alternative Supply Loss** • If both supplies are lost, the transfer scheme is inhibited until one of the supplies is restored back to the healthy state. Thereafter transfer to the healthy supply is done. **Write the Algorithm and PLC program to implement the above ATS scheme.**		

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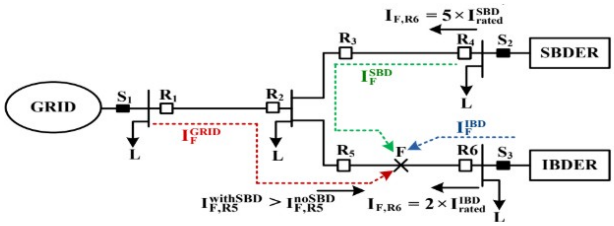
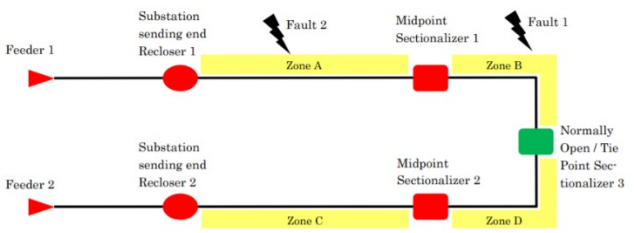
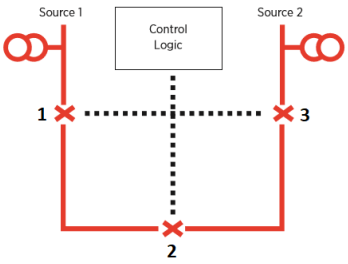
SECTION A

S. No.		Marks	CO
Q1	A 4-bus distribution network as shown in fig with grid, synchronous based DER (SBDER), Inverter based DER (IBDER) and having switches (S1-S3) and relays (R1-R6) is considered.  For the Fault at point "F" Identify which protection issues will be experienced by the following relays a) R5 b)R4 or R3 c)R1,R6	5	CO1
Q2	Explain different Data resources of WAMS wrt Power system automation	5	CO3
Q3	Explain in detail about Digital Protective Relay Analysis Software Modules.	5	CO1
Q4	Explain the difference in the SCADA based and PMU based power system automation	5	CO2
	SECTION B(Internal choice Q6 or Q7)		
Q 5	In the power system automation we require collective technology to monitor power system dynamics in real time, identify system stability related weakness and helps to design and implement counter measures. (IEEE) Explain in detail about Wide Area Monitoring (WAMS) with the help functional blocks and associated components.	10	CO3
Q6	Explain Advantages of Microgrids and Islanding Detection Techniques(IDTs)	10	C01
Q7	One of the practical application of Sectionalizer is shown in the above diagram. Two Feeders 1 and 2 and connected through a Sectionalizer which is in normally open condition with voltage sensing provided on both incoming and outgoing sides. Reclosers are provided for the fault interruption while a Sectionalizer is provided at midpoint location for fault isolation. For better understanding, **Scenario**:For any permanent Fault 2 in Zone A, only Recloser 1 shall  	10	C03

	open and lockout after completing the duty cycle. It is here when Sectionalizer 3 will sense the voltage outage on one of its side and it will close automatically to restore supply in Zone B. Finally, Zone A will get isolated automatically while supply in Zone B, C and D shall remain active. **Write the Algorithm and PLC program to implement the above scheme.**		
Q8	Explain the need of smart metering system and Functional block diagram and significance of each block in a smart metering system.	**10**	**C01**
Q9	Illustrate in detail about the HART Network Topologies?	**10**	**CO4**
	SECTION-C(Internal choice Q10 or Q11)		
Q 10	Distribution automation refers to the automation of all functions related to the distribution system using information collected from substation devices, devices deployed on feeders, and meters deployed at consumer locations. Thus, SCADA system that monitors, and controls distribution substations is considered a DA function. In the distribution automation(DA) operation master to individual IEDs are relayed through the concentrator. The polling frequency for DA IEDs may be smaller (say, every 5-30s) than the every 2–5 s typically used by SCADA systems to collect periodic measurements and status from the IEDs in a distribution substation. I. Explain how distribution automation can be done with the help of an example of feeder devices included in distribution automation II. Illustrate the SCADA System with the help of following architecture a)Typical modern EMS architecture, b)RTU software architecture. c)SCADA system data flow architecture.	**20**	**CO3**
Q11	Illustrate HART Communication Layers for Wired and wireless Protocols?	**20**	**CO4**
Q12	The Automatic Control Switch (ATS) controls the switching between two or more electrical power sources connected on the same network. Automatic switching is required in order to ensure maximum continuity of service when one of the sources is lost due to fault or any other power loss **Normal Operation** • Source 1 and Source 2 healthy with circuit breaker closed and the bus section open **Source of Supply Loss** • Loss of supply is detected when an under voltage condition is present on one of the phases. • When one of the supplies is lost, providing that an alternative supply is available, the lost supply circuit breaker is opened and the bus-section is closed. •If the main supply circuit breaker does not open or the bus section circuit breaker does not close, further operation is inhibited until it is manually re-configured and reset. **Source of Supply Loss due to Fault** • In the presence of a fault condition detected by the protection scheme of one of the sources, the system is inhibited and no transfer is done. Further operation is inhibited until system is reset manually. • If the source supply circuit breaker does not open or the bus section circuit breaker does not close, further operation is inhibited until it is manually re-configured and reset. **Restoration of Supply** • Restoration can be done either manually or automatic •If Manual restoration is selected, the transfer to the original configuration can be only done manually. •If Automatic restoration is selected, the transfer back to the original configuration is completed when both supplies are both in the healthy state. •Synchronising the	**20**	**CO3**



	sources on restoration is possible by means of a synchronising relay. This avoids loss of supply on returning to the normal operation. **Main and Alternative Supply Loss** • If both supplies are lost, the transfer scheme is inhibited until one of the supplies is restored back to the healthy state. Transfer to this supply is done. **Write the Algorithm and PLC program to implement the above ATS scheme .**		