Total No. of Questions: 6 *Total No. of Printed Pages:3*

Enrollment No.....

Faculty of Engineering

End Sem (Even) Examination May-2019

EE3CO10 / EX3CO10 Switchgear & Protection

Programme: B.Tech. Branch/Specialisation: EE/EX

Duration: 3 Hrs. **Maximum Marks: 60**

Note: All questions are compulsory. Internal choices, if any, are indicated.Answers of Q.1 (MCQs) should be written in full instead of only a, b, c or d.

Q.1 i. What are the terminal conditions in case of SLG fault, if the fault occurs in the phase A? **1**

(a) Vb = 0, Ia = 0, Ic = 0 (b) Va = 0, Ib = 0, Ic = 0

(c) Va = 0, Ia = 0, Ic = 0 (d) Vb = 0, Ia = 0, Ib = 0

ii. Which among these is the most severe fault? **1**

(a) Single line to ground fault

(b) Double line to ground fault

(c) Line to line fault

(d) Symmetrical fault.

iii. Protective relays can be designed to respond to _____ **1**

(a) Light intensity, impedance

(b) Temperature, resistance, reactance

(c) Voltage and current

(d) All of these

iv. Plug setting of an electromagnetic relay can be altered by varying **1**

(a) Number of ampere turns (b) Air gap of magnetic path

(c) Adjustable back stop (d) None of these

v. SF6 gas **1**

(a) Is yellow in colour (b) Has pungent odour

(c) Is highly toxic (d) Is non-inflammable

vi. The transient voltage that appears across the contacts at the instant of arc extinction is called **1**

(a) Recovery voltage (b) Re striking voltage

(c) Supply voltage (d) Peak voltage

P.T.O.

vii. A Merz-price protection is suitable for **1**
(a) Transformers (b) Distributors
(c) Feeders (d) Transmission lines

viii. In large generators protection provided against external faults is **1**
(a) Inter-turn fault protection
(b) Sensitive earth fault protection
(c) Biased differential protection
(d) All of these

ix. Ungrounded neutral transmission system is not recommended because of system **1**
(a) Insulation being overstressed due to over voltages
(b) Insulation overstress may lead to failure and subsequent phase to phase faults
(c) Being inadequately protected against ground fault
(d) All of these

x. Which of the following statements is incorrect? **1**
(a) Lightning arrestors are used before the switchgear
(b) Shunt reactors are used as compensation reactors
(c) The peak short current is (1.8 xV2) times the A.C. component
(d) The MVA at fault is equal to base MVA divided by per unit equivalent fault reactance

Q.2 i. Explain unsymmetrical fault? **4**

ii. The section bus-bars A and B are linked by a bus bar reactor rated at 8000KVA with 10% reactance. On bus-bar A, there are two generators each of 10,000 KVA with 10% reactance and on B two generators each of 12000KVA with 12% reactance. Find the steady MVA fed into a dead short circuit between all phases on B with bus-bar reactor in the circuit. **6**

OR iii. Derive an expression for fault current and phase voltage for line to line fault by symmetrical components method. **6**

Q.3 i. Mention different types of relays? Discuss their field of applications. **4**

ii. Describe the construction and principle of operation of an induction type directional over current relay. **6**

OR iii. Write a detailed note on differential relays. **6**

Q.4 i. Explain the phenomenon of current chopping in a circuit breaker. **4**

ii. Discuss the operating principle of SF6 circuit breaker. What are its advantages over other types of circuit breakers? **6**

OR iii. Explain terms: **6**
(a) Restriking voltage
(b) RRRV
(c) Derive expressions for restriking voltage and RRRV.

Q.5 i. Enlist various abnormalities that would affect an alternator? **4**

ii. What type of a protective device is used for the protection of an alternator against overheating of its (a) stator (b) rotor? **6**

OR iii. Describe the construction and working of a Buchholz relay. **6**

Q.6 Attempt any two:

i. Explain lightning. Describe the mechanism of lightning discharge. **5**

ii. What is the basic principle of operation of a surge diverter? **5**

iii. Explain equipment earthing and its need. **5**

******

Marking Scheme
EE3CO10 / EX3CO10 Switchgear & Protection

Q.1	i.	What are the terminal conditions in case of SLG fault, if the fault occurs in the phase A? (b) Va = 0, Ib = 0, Ic = 0		**1**
	ii.	Which among these is the most severe fault? (d) Symmetrical fault.		**1**
	iii.	Protective relays can be designed to respond to _____ (d) All of these		**1**
	iv.	Plug setting of an electromagnetic relay can be altered by varying (a) Number of ampere turns		**1**
	v.	SF6 gas (d) Is non-inflammable		**1**
	vi.	The transient voltage that appears across the contacts at the instant of arc extinction is called (b) Re striking voltage		**1**
	vii.	A Merz-price protection is suitable for (b) Distributors		**1**
	viii.	In large generators protection provided against external faults is (d) All of these		**1**
	ix.	Ungrounded neutral transmission system is not recommended because of system (d) All of these		**1**
	x.	Which of the following statements is incorrect? (c) The peak short current is (1.8 xV2) times the A.C. component		**1**
Q.2	i.	Unsymmetrical fault		**4**
		Definition	2 marks	
		Different types	2 marks	
	ii.	Find the steady MVA fed into a dead short circuit between all phases on B with bus-bar reactor in the circuit.		**6**
		Reactance diagram	3 marks	
		Short circuit MVA	3 marks	
OR	iii.	Expression for fault current and phase voltage for line to line fault by symmetrical components method.		**6**
		Expression for fault current	3 marks	
		Expression for phase voltage	3 marks	
Q.3	i.	Different types of relays	2 marks	**4**
		Applications.	2 marks	
	ii.	Constructional diagram	2 marks	**6**
		Constructional detail	2 marks	
		Principle of operation	2 marks	
OR	iii.	Differential relays.		**6**
		Constructional diagram	2 marks	
		Constructional detail	2 marks	
		Principle of operation	2 marks	
Q.4	i.	phenomenon of current chopping	2 marks	**4**
		Waveforms	2 marks	
	ii.	Operating principle of SF6 circuit breaker		**6**
		Constructional diagram	1 mark	
		Principle of operation	3 marks	
		Advantages over other types	2 marks	
OR	iii.	Explain terms:		**6**
		(a) Restriking voltage	2 marks	
		(b) RRRV	2 marks	
		(c) Expressions for restriking voltage and RRRV.	2 marks	
Q.5	i.	Enlist various abnormalities that would affect an alternator?		**4**
		Various type of abnormalities	2 marks	
		abnormalities detail	2 marks	
	ii.	Protective device for stator and its diagram	1 mark	**6**
		Protective device for stator and its details	2 marks	
		Protective device for rotor and its diagram	1 mark	
		Protective device for rotor and its details	2 marks	
OR	iii.	Construction and working of a Buchholz relay		**6**
		Constructional diagram	2 marks	
		Constructional detail	2 marks	
		Principle of operation	2 marks	
Q.6		Attempt any two:		
	i.	Lightning definition	2 marks	**5**
		mechanism of lightning discharge	3 marks	
	ii.	surge diverter	2 marks	**5**
		Principle of operation	3 marks	
	iii.	Equipment grounding.	2 marks	**5**
		Need of equipment grounding	3 marks	

******