

JK LAKSHMIPAT UNIVERSITY, JAIPUR

INSTITUTE OF ENGINEERING AND TECHNOLOGY

End Term Examination (Regular), November 2016

B. Tech in Electrical Engineering, Semester V

Roll No.....

EE502: Power System Switchgear & Protection

Time: 3 hours

Max. Marks: 100

Instructions to students:

1. Do not write anything other than your roll number on question paper.
2. Assume suitable data wherever required and mention it clearly.
3. Writing appropriate units, nomenclature, and drawing neat sketches/schematics/ flow chart wherever, required are an integral part of the answer.

Q.1A	Short answer/ objective type questions (10 questions @ 1 mark)	10
i.	Short circuit currents are due to (a) single-phase to earth fault (b) phase to phase fault (c) three-phase to earth fault (d) all of them	
ii.	Which of the following results in a symmetrical fault? (a) single-phase to earth fault (b) phase to phase fault (c) three-phase to earth fault (d) all of them	
iii.	Series reactors are used to (a) improve the transmission efficiency (b) bring down the fault level within the capacity of the switchgear (c) improve the power factor of the power system (d) improve the voltage regulation	
iv.	A balanced 3-phase system consists of (a) positive-sequence currents only (b) negative-sequence currents only (c) Negative and zero sequence currents (d) zero, negative and positive sequence currents	
v.	The primary function of a fuse is to (a) open the circuit (b) protect the appliance (c) protect the line (d) prevent excessive currents flow through the circuit	
vi.	The material used in liquid fuse is (a) SF_6 (b) distilled water (c) carbon tetra chloride (d) transformer oil	
vii.	When a fault occurs in a high voltage transmission line, first the (a) circuit breaker operates then the relay (b) relay operates then the circuit breaker (c) relay operates, then successively the isolator and the circuit breaker (d) isolator operates, then successively the relay and the circuit breaker	
viii.	Both current and voltage signals are required for (a) a directional relay (b) a plain overcurrent relay (c) a differential relay (d) a biased differential relay	

ix.	A negative sequence relay is commonly used to protect a (a) transformer (b) transmission line (c) bus bar (d) alternator
x.	Mho relay is usually employed for the protection of (a) short lines only (b) medium lines only (c) long lines only (d) any line

Q.2	Short answer type questions (4 questions @ 2.5 marks)	10
i.	Draw a table showing approximately percentage of various causes of faults.	
ii.	Draw a table showing frequency of fault occurrence in different links of a power system.	
iii.	Draw a table showing percentage of most frequent kinds of short-circuit faults in transmission lines.	
iv.	What is the meaning of short circuit?	

Q.3A	Three generators are rated as follows: Generator 1: 100 MVA, 33 kV, reactance = 10% Generator 2: 150 MVA, 32 kV, reactance = 8% Generator 3: 110 MVA, 30 kV, reactance = 12% Choosing 200 MVA and 35 kV as base quantities, compute per unit reactances of the 3 generators referred to these base quantities. Draw reactance diagram and mark per unit reactances. The 3 generators are connected to common bus-bars.	05
Q.3B	Explain how an unsymmetrical system of 3-phase currents can be resolved into 3 symmetrical component systems.	05

Q.4A	What are the major duties that a circuit breaker required to perform? Explain them clearly?	05
Q.4B	Explain different methods of arc extinction in a circuit breaker.	05

Q.5A	Explain the features of an air break circuit breaker by means of simple sketches.	05
Q.5B	Compare a static relay with electromagnetic relay.	05

Q.6A	Describe the general principle of operation of generator differential protection scheme. Give the three phase connection of the biased scheme.	3+2
Q.6B	Describe with suitable diagrams how the stator windings of a three-phase alternators are protected from earth faults on the stator windings.	05
OR		
	What are the types of faults that are likely to occur in a 3-phase induction motor? If the motor is not fully loaded, is it necessary to provide protection against single phasing? Explain why?	2+3

Q.7A	Explain 3-phase transformer differential protection. Show that Y-Δ differential protection CTs are connected in Δ and Y respectively.	05
Q.7B	What are the different types of bus bar arrangements used in substations? Illustrate your answer with suitable diagram.	1+4
OR		
	How is bus-bar protected?	05

Q.8A	Describe a suitable protection system for a ring main formed by a power station and four substations, and explain clearly its working when a fault occurs. Explain the special features that a protective relay should possess in this case and also indicate the limitations of the system.	5+5
Q.9A	A 50 MVA, 132/66 kV, Δ/Y , 3-phase power transformer is protected by percentage differential relays. If the CTs located on delta and wye sides of the power transformer are 300/5 A and 1200/5 A respectively, determine (a) the output current at full load (b) the relay current at full load (c) the minimum relay current setting to permit 25% overload.	5+2 +3
Q.9B	Write a short note on any two of the following: (a) Thermal relays (b) Buchholz relay (c) Induction relays	5+5
OR		
	Write a short note on any two of the following: (a) Directional overcurrent relay (b) Reactance relay (c) Mho relay	5+5