

JK LAKSHMIPAT UNIVERSITY, JAIPUR

INSTITUTE OF ENGINEERING AND TECHNOLOGY

End Term Examination (Regular/Backlog), Nov.-Dec. 2015

B. Tech. in Electrical Engineering, Semester VI

Roll No.....

EE-502: 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 Objective type multiple choice questions (10 questions @ 1 mark) 10

- i. Differential relays are used for the protection of equipments against: (a) Internal faults (b) Over-current (c) Reverse current (d) Reverse power
- ii. A negative sequence relay is commonly used to protect (a) an alternator (b) an transformer (c) a transmission line (d) a bus bar
- iii. The component used to achieve time delay according to inverse time over current characteristics in a static relay is (a) differentiator (b) comparator (c) R-C circuit (d) integrator.
- iv. The part of a generator which is prone to damage under heavy unbalanced loading of the generator is the (a) stator core (b) stator winding (c) rotor core (d) rotor winding.
- v. Wave trap is used to trap waves of (a) power frequencies (b) higher frequencies entering generator or transformer units (c) either of the above (d) none of the above
- vi. Which of the following relays has inherent directional characteristics: (a) Mho relay (b) Impedance relay (c) Reactance relay (d) Distance relay
- vii. In circuit-breakers the contact space is ionized by (a) thermal ionization of gas (b) thermal emission from surface of contacts (c) field emission from the surface of contacts (d) any of the above.
- viii. During arc extinction SF_6 gas (a) decomposes into S and F ions (b) decomposes into SF_4 and SF_2 (c) gets oxidized (d) reduces to SF_3 .
- ix. In the high-impedance relaying scheme for bus zone protection, a non-linear resistor is specifically used to (a) make the relay insensitive to any dc voltage (b) ensure stability for external faults and sensitivity for internal faults (c) supervise the CT connections (d) none of the above
- x. The torque developed in Induction type relay is: (a) Directly proportional to the current (b) Directly proportional to the square of the current (c) Directly proportional to square root of the current (d) Inversely proportional to the current

Q.2 Short answer type questions (4 questions @ 2.5 marks) 10

- i. Compare Static and Electromagnetic relay.
- ii. Why neutral of the transformer in a distribution substation must be earthed?
- iii. A relay is connected to 400/5 ratio current transformer with current setting of 150%. Calculate the Plug Setting Multiplier when circuit carries a fault current of 4000 A.

iv.	Where is Buchholz relay placed? State its limitations.	
Q.3A	Why I.D.M.T. relays are widely used for over-current protection?	05
Q.3B	Discuss a protective scheme for parallel feeders.	05
Q.4A	Explain the relaying schemes which are employed for the protection of a modern alternator.	05
Q.4B	What type of a protective scheme is employed for the protection of the field winding of the alternator against ground faults?	05
Q.5A	Explain the phenomenon of current chopping in a circuit breaker. What measures are taken to reduce it?	05
Q.5B	Define (a) arc voltage, (b) restriking voltage, (c) recovery voltage and (d) breaking capacity of a circuit breaker.	05
Q.6A	Discuss the various methods of arc quenching in circuit breakers.	05
Q.6B	Explain a static definite -time over current relay.	05
OR		
Q.6B	A 3 Φ transformer of 220/11000 line volts is connected in Y/ Δ . The protective transformers on 220 Volts side have a current ratio of 600/5 Amps. What should be the CT ratio on 11000 Volts side?	05
Q.7A	Explain stepped time - distance characteristics of three distance relaying units used for I, II and III zone of protection.	05
Q.7B	What is adaptive relaying? Which feature of numerical relays make them suitable for adaptive relaying?	05
OR		
Q.7B	What is the importance of arc resistance? On which factor does it depend?	05
Q.8	In a 132kV systems, the reactance and capacitance up to the location of the circuit breaker is 5 ohm and 0.02 μ F respectively. A resistance of 500 Ohm is connected across the contacts of the circuit breaker. Determine (i) natural frequency of oscillations (ii) frequency of damped oscillations (iii) critical value of resistance (iv) the value of resistance which will give frequency of damped oscillations which is equal to 1/4th the natural frequency	10
Q.9A	Briefly discuss the protection of an alternator against. (i) Vibration of distortion of motor (ii) Bearing overheating (iii) Auxiliary failure (iv) Voltage regulator failure	10
Q.9B	A 3-phase alternator has the line voltage of 11kV. The generator is connected to a circuit breaker. The inductive reactance upto the circuit breaker is 5 Ω /phase. the distributed capacitance upto circuit breaker between phase and neutral is 0.001 μ F. Determine peak restriking voltage across the CB, frequency of restriking voltage, average rate of restriking voltage upto peak restriking voltage, maximum RRRV.	10
OR		
Q.9B	Describe the construction and principle of operation of an induction type directional over current relay.	10