

Code No: RT32022

R13

SET - 1

III B. Tech II Semester Regular/Supplementary Examinations, April -2018
SWITCHGEAR AND PROTECTION
(Electrical and Electronics Engineering)

Time: 3 hours

Max. Marks: 70

- Note: 1. Question Paper consists of two parts (**Part-A** and **Part-B**)
2. Answering the question in **Part-A** is compulsory
3. Answer any **THREE** Questions from **Part-B**

PART -A

- | | | | |
|---|----|---|------|
| 1 | a) | What is meant by current chopping? | [3M] |
| | b) | What is meant by overlapping of the relays? | [4M] |
| | c) | Write how many faults may develop in a power transformer? | [3M] |
| | d) | What are the requirements for protection of lines? | [4M] |
| | e) | What are the advantages of digital relays? | [4M] |
| | f) | What is meant by earthing screen? | [4M] |

PART -B

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|---|----|---|------|
| 2 | a) | Write the operation of an oil circuit breaker with neat diagram also Lists its advantages and disadvantages? | [8M] |
| | b) | A 50Hz, 11kV, 3 phase alternator with earthed neutral has a reactance of 5 ohms per phase and is connected to a bus bar through a circuit breaker. The distributed capacitance up to circuit breaker between phase and neutral is 0.01micro farad. Then find the peak re-striking voltage across the contacts of the circuit breaker, frequency of oscillations and the average rate of rise of re-striking voltage up to first peak? | [8M] |
| 3 | a) | Explain the operation of a non directional induction relay with neat sketch? | [8M] |
| | b) | Draw and explain the R-X locus of a directional distance relay? | [8M] |
| 4 | a) | A three phase transformer of 220/11000 line volts is connected in star/delta. The protective transformers on 220V side have a current ratio of 600/5. What should be ratio of current transformers on 11000V side? Draw the circuit also? | [8M] |
| | b) | A star connected three phase, 10MVA, 6.6kV alternator is protected by Merz-price circulating current protection principle by using 1000/5 amperes current transformers. The star point of the alternator is earthed through a resistance of 7.5 ohms. If the minimum operating current for the relay is 0.51 A, find the percentage of each phase of the stator winding which is un protected against earth faults when the machine is operating at normal voltage? | [8M] |
| 5 | a) | Discuss in detail about the fault bus protection by using circuit diagram? | [8M] |
| | b) | Explain in detail about the time graded over current protection? | [8M] |
| 6 | a) | Write the advantages and disadvantages of static relays? | [8M] |
| | b) | Draw the circuit and explain the operation of static IDMT relay? | [8M] |
| 7 | a) | Explain in detail about the internal causes of over voltages? | [8M] |
| | b) | A transmission line has a capacitance of 0.1micro farad per phase. Find the inductance of the Peterson coil to neutralize the effect of capacitance of complete length of the line, 96 % of the line and 85 % of the line. The frequency is 50Hz? Also comment on the result? | [8M] |

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PART -A

- 1 a) What are the properties of Arc struck in the circuit breaker? [3M]
- b) Compare the different distance relays? [4M]
- c) What are the possible connections of current transformers to protect a power transformer by differential protection? [3M]
- d) How the pilot wire relays built for bus bar protection? [4M]
- e) What is the need of digital relays? [4M]
- f) What is the role of non linear resistor in a lightning arrester? [4M]

PART -B

- 2 a) What are the ratings and specifications of a circuit breaker? [8M]
- b) Explain the concept of resistance switching by deriving necessary expressions? [8M]
- 3 a) Draw and explain about induction type reverse power relay? [8M]
- b) Discuss why R-X loci of impedance relay is a circle having center as origin? [8M]
- 4 a) A 3 phase transformer having line-voltage ratio of 0.4kV/11kV is connected in star delta and protective transformers on low voltage side have a ratio of 500/5. What is the ratio of current transformers on the high voltage side? Also draw the protection circuit? [8M]
- b) A 10MVA, 6.6kV, three phase star connected alternator is protected by merz-price protection scheme. If the ratio of the current transformer is 1000/5, the minimum operating current of the relay is 0.75A and neutral point earthing resistance is 8 ohms. Find the percentage of each stator windings which is un protected against earth faults when the machine is operating at normal voltage, the minimum resistance to provide protection for 85% of stator winding? [8M]
- 5 a) Draw and explain the circuit for the protection of parallel feeders? [8M]
- b) Discuss the operation of differential protection of bus bars with diagram? [8M]
- 6 a) Explain the basic block diagram of a static relay? [8M]
- b) Discuss the operation of static instantaneous over current relay with circuit diagram? [8M]
- 7 a) Discuss the advantages and disadvantages of over head ground wires? [8M]
- b) Explain in detail about the insulation coordination? [8M]

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SET - 3

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2. Answering the question in **Part-A** is compulsory

3. Answer any **THREE** Questions from **Part-B**

PART -A

- 1 a) What are the applications of SF₆ circuit breaker? [3M]
- b) What is the difference between a circuit breaker and a relay? [4M]
- c) Write the list of faults that may occur on the stator side of an alternator? [3M]
- d) How the pilot wire relays built for transmission line protection? [4M]
- e) What are the merits of Static relays? [4M]
- f) What are the internal causes for the over voltages in power system? [4M]

PART -B

- 2 a) Discuss the role of bimetallic strip in MCB with neat diagram? [8M]
- b) A circuit breaker is rated at 2500A, 1500MVA, 33kV, 3 sec, 3 phase oil circuit breaker. Find the normal rated current, breaking current, making current and shot time current rating by defining each term? [8M]
- 3 a) Explain the differences between differential relay and a percentage differential relay? [8M]
- b) Draw and explain the time verses PSM curve with an example? [8M]
- 4 a) Discuss in detail about the circulating current scheme for transformer protection? [8M]
- b) A star connected three phase, 10MVA, 6.6kV alternator is protected by using circulating current protection, the star point is earthed by using a resistor 'r'. Estimate the value of earthing resistor if 80% of the stator winding is protected against earth faults. Assume an earth fault setting of 20%. Neglect the impedance of the alternator? [8M]
- 5 a) Draw and explain the circuit for the protection of ring main system? [8M]
- b) Explain the schematic arrangement of translay protection scheme? [8M]
- 6 a) Explain the operation of rectifier type comparator in a static relay? [8M]
- b) Discuss the operation of static distance relay with neat diagram? [8M]
- 7 a) A 230kV,3 phase,50Hz,200km transmission line has a capacitance to earth of 0.04 micro farad/km per phase. Find the inductance and rating of the Peterson coil used for earthing the above system? [8M]
- b) Explain about horn gap and multi gap lightning arresters with diagrams? [8M]

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PART -A

- 1 a) What is meant by making capacity of a circuit breaker? [3M]
- b) If the pickup value of a relay is 8A, the fault current is 30A. Find its PSM? [4M]
- c) Write the list of faults that may occur on the rotor side of an alternator? [3M]
- d) Write the list of components required to protect a bus bar by differential protection? [4M]
- e) What are the disadvantages of static relays? [4M]
- f) Explain the requirement of Grounding Practice? [4M]

PART -B

- 2 a) Explain the operation of air blast circuit breaker and discuss its relation with current chopping phenomenon? [8M]
- b) A circuit breaker is rated at 1500A, 2000MVA, 33kV, 3 sec, 3 phase oil circuit breaker. Find the normal rated current, breaking current, making current and shot time current rating by defining each term? [8M]
- 3 a) Discuss in detail about the fundamental requirements of a protective relay? [8M]
- b) Derive the equation for the torque developed in an induction relay? [8M]
- 4 a) Explain the operation of merz-price protection of an alternator? [8M]
- b) A star connected, 3 phase, 10MVA, 6.6kV alternator has per phase reactance of 10%. It is protected by merz-price protection which is set to operate for the fault currents not less than 175A. Calculate the value of earthing resistance to be provided to ensure only 5% alternator winding remains as un protected? [8M]
- 5 a) Discuss in detail about the three zone protection of transmission lines [8M]
- b) Explain about the current graded system of protection and its disadvantages? [8M]
- 6 a) Explain the role of zero crossing detector and polarity detectors in the operation of static relay? [8M]
- b) Draw the block diagram and explain the operation of micro processor based digital relays? [8M]
- 7 a) Discuss about the device which absorbs the steepness of wave front of a surge? [8M]
- b) Explain the differences between equipment grounding and system grounding? [8M]
