

Code No: R1641024

# R16

Set No. 1

IV B.Tech I Semester Regular/Supplementary Examinations, March - 2021

## SWITCHGEAR AND PROTECTION

(Electrical and Electronics Engineering)

Time: 3 hours

Max. Marks: 70

*Question paper consists of Part-A and Part-B*

*Answer ALL sub questions from Part-A*

*Answer any FOUR questions from Part-B*

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### PART-A (14 Marks)

1. a) What are the types of Miniature Circuit Breaker [2]
- b) How do you classify the electromagnetic relays as per their construction [3]
- c) Why do you protect the generator against faults [2]
- d) What is the need of bus bar Protection [2]
- e) What are the advantages of static relays [3]
- f) What are the types of surge arresters [2]

### PART-B (4x14 = 56 Marks)

2. a) Explain the causes and after effects of restriking voltage [7]
- b) What do you understand by auto reclosing? Explain its uses. [7]
3. a) Explain the under voltage relay with neat diagram [7]
- b) Compare between impedance relaying, reactance relaying and mho relaying schemes [7]
4. a) Explain the percentage differential protection of a transformer [7]
- b) A 6.6kV, 3 phase turbo alternator has a maximum continuous rating of 2MW at 0.8 power factor and its reactance is 12.5 %. It is equipped with Merz Price circulating current protection which is set to operate at fault currents not less than 200 A. Find at what value of the neutral earthing resistance leaves 10% of the windings unprotected. [7]
5. a) Describe the importance and use of PSM and TSM for the over current relays. [7]
- b) Explain the protection of bus bars by using Differential protection. [7]
6. a) What is a static relay? Make a list of the components used in the static relaying scheme. [7]
- b) Explain the merits of microprocessor- based relaying schemes. [7]
7. a) Describe the different types of overvoltage's and mention their causes of initiation. [7]
- b) What are the basic requirements of surge arresters? Differentiate between a surge absorber and a surge arrester. [7]

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**Set No. 2**

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**(Electrical and Electronics Engineering)**

**Time: 3 hours**

**Max. Marks: 70**

*Question paper consists of Part-A and Part-B*

*Answer ALL sub questions from Part-A*

*Answer any FOUR questions from Part-B*

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**PART-A (14 Marks)**

1. a) What is the concept of Auto reclosing [2]
- b) How do you classify the relays based on their construction [3]
- c) Why do you protect the transformer against faults [2]
- d) What are the various protection schemes as applied to feeder protection [3]
- e) What are the disadvantages of static relays [2]
- f) List the methods of neutral grounding [2]

**PART-B (4x14 = 56 Marks)**

2. a) With the help of simple circuit, describe the different components of a SF6 circuit breaker [7]
- b) Following observations were achieved on a single frequency transient during short circuit test on a circuit breaker:  
Time to reach the peak restriking voltage = 40 $\mu$ Sec  
Peak restriking voltage = 100 kV  
Calculate (i) the average RRRV and (ii) the frequency of oscillation [7]
3. a) Derive the expression for universal torque equation of a relay with diagram [7]
- b) Explain the working of induction cup relay with a neat diagram [7]
4. a) What are the typical values of percentage bias used for generator protection? How does this setting compare with that of similar protection for transformer [7]
- b) A 3phase power transformer has a voltage ratio of 33/6.6 kV and is star/ delta connected. The protective CTs on the 6.6 kV side have a current ratio 100 A. What must be the ratio of protective CTs on the 33 kV side [7]
5. a) Draw the schematic diagram and explain the Carrier current protection [7]
- b) A relay having 5 A is connected to a supply through a CT of current ratio 400/5. If a fault current of 3360 A flows in the circuit, determine the time of operation of the relay having setting of 120% and TSM = 0.5. Let the operating time for PSM set at 7 is 3 Sec [7]
6. a) Explain the static overcurrent protection scheme with a neat block diagram. [7]
- b) Describe how an impedance relay is realized by using microprocessors [7]
7. a) Explain the effects of lightning in general and in particular on the power system [7]
- b) Discuss the construction and principle of working of a valve type arrester [7]

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Set No. 3

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## SWITCHGEAR AND PROTECTION

(Electrical and Electronics Engineering)

Time: 3 hours

Max. Marks: 70

*Question paper consists of Part-A and Part-B*

*Answer ALL sub questions from Part-A*

*Answer any FOUR questions from Part-B*

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### PART-A (14 Marks)

1. a) How power factor influences current interruption in circuit breakers? [2]
- b) How is definite minimum time achieved in an IDMT relay? [2]
- c) What are the different types of faults, which occur in synchronous machine? [3]
- d) What are the reasons to failure of bus bars? [2]
- e) List out the major Static relay components. [3]
- f) What are the objectives of insulation coordination [2]

### PART-B (4x14 = 56 Marks)

2. a) Explain about the current interruption and arc control in Vacuum circuit breaker [7]
- b) Determine the RRRV for the circuit breaker installed on a 400 kV, 3 phase, 50Hz system. Following data were recorded, when a short circuit grounded fault occurred. Given: Recovery voltage =0.97 of full line value, power facot of a fault =0.45. Natural frequency for symmetrical breaking current =16 kHz [7]
3. a) Explain the balanced beam type attracted armature relay with a neat diagram. [7]
- b) Explain the working principle of the distance relay. [7]
4. a) Draw neatly the differential protection scheme of an alternator? List out its demerits and suggest remedies to overcome them. [7]
- b) A 3-phase, 220/11,000 V transformer is connected in star delta and the protective transformers on the 220 V sides have a current ratio of  $600/\frac{5}{\sqrt{3}}$ . What must be the ratio of the CTs on the 11000 V side and how shall they be connected. [7]
5. a) Explain the three zone distance relay using impedance relays. [7]
- b) Calculate the PSM suitable for a relay setting of 150%, if the fault current is 1500 A. The CT ratio is 150/5. Also determine the time of operation of the relay corresponding to the PSM. Find the time setting dial is set at 0.2 and the time of operation of the relay when set at 1.0 is 1.56. [7]
6. a) Write the advantages and limitations of static relays [7]
- b) With a neat block diagram, explain the static distance relay protection scheme [7]
7. a) Draw and explain the procedure adopted for construction of volt-time characteristic of a relay. [7]
- b) Discuss the construction and working of a zinc oxide arrester [7]

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**(Electrical and Electronics Engineering)**

**Time: 3 hours**

**Max. Marks: 70**

*Question paper consists of Part-A and Part-B*

*Answer ALL sub questions from Part-A*

*Answer any FOUR questions from Part-B*

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**PART-A (14 Marks)**

1. a) What are the CB ratings and list its specifications? [3]
- b) How do protective relays operate? [2]
- c) What do you understand by inrush magnetizing current in transformer? [3]
- d) What is the need of three zone distance relay scheme? [2]
- e) What are the merits of microprocessor based relaying scheme? [2]
- f) What are the internal and external causes of overvoltage's in a power system? [2]

**PART-B (4x14 = 56 Marks)**

2. a) Describe the elementary principles of arc interruption. [7]
- b) Compare between Air blast and SF6 circuit breakers. [7]
3. a) Derive the expression for torque production in an induction relay. [7]
- b) Explain the working of Mho relay with a neat connection diagram. [7]
4. a) Explain Buchholz relay and list out its merits and demerits. [7]
- b) A 5000 kVA, 6.6 kV star connected alternator has a synchronous reactance of 2 ohms per phase and 0.5 ohms resistance. It is protected by a Merz Price balanced current system which operates when the out-of-balance current exceeds 30% of the load current. Determine what proportion of the alternator winding is unprotected if the star-point is earthed through a resistor of 6.5 ohms. [7]
5. Describe the method of protecting busbars by applying differential relaying scheme. [14]
6. a) Explain the static over current relays with neat block diagram. [7]
- b) Describe how a Mho relay is realized by using microprocessors. [7]
7. a) What is meant by insulation coordination? How are the protective devices chosen for optimal insulation level in a power system? [7]
- b) Explain the effects of ungrounded neutral on system performance. [7]