Code No: R203202D **R20** SET -1

III B. Tech II Semester Regular Examinations, July -2023
SWITCHGEAR AND PROTECTION
(Electrical and Electronics Engineering)

Time: 3 hours Max. Marks: 70

Answer any **FIVE** Questions **ONE** Question from **Each unit**
All Questions Carry Equal Marks
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UNIT-I

1. a) Discuss the current chopping phenomenon in the circuit breakers and relate its existence in the air blast circuit breakers? [7M]
   b) Explain in detail about the short circuit tripping in the MCB with neat diagram? [7M]

(OR)

2. a) Explain the basic construction of oil circuit breaker with diagram and write its advantages and disadvantages? [7M]
   b) A 50Hz, 33kV three phase alternator with earthed neutral has a reactance of 5.8 ohms per phase and is connected to the bus bar through a circuit breaker. The capacitance to earth between the alternator and the circuit breaker is 0.04 micro farad per phase. By neglecting the resistance of the generator find the maximum voltage across the circuit breaker contacts, the frequency of oscillations, the average rate of rise of restriking voltage up to the first peak? [7M]

UNIT-II

3. a) Draw the construction diagram and explain how the trip circuit is closed by attracting the armature? [7M]
   b) By drawing the structure of a mho relay analyze its R-X locus diagram? [7M]

(OR)

4. a) Draw the phasor diagram and explain in detail about the operation of directional relay along with applications? [7M]
   b) By drawing operating time verses multiplier setting characteristics explain the types of over current relays? [7M]

UNIT-III

5. a) What is meant by restricted earth fault protection in the alternators? Justify with circuit diagram? [7M]
   b) Explain with the help of neat diagram the connections of differential protection of a transformer. A three phase 66/8.6kV star delta connected transformer is protected by differential system. The CTs on the low voltage side have a ratio of 330/5.6A. Find the CTs ratio connected on the high voltage side? [7M]

(OR)

6. a) Write the principle of gas actuated protection device for transformer? Explain with diagram. [7M]
   b) A 3 phase 18MVA, 33kV generator is delivering a load of 9.4MW at 0.76 power factor. Determine the value of the neutral resistance, if 11% of the winding is unprotected. The relay setting is 24% and the per phase reactance is 13%? [7M]

UNIT-IV

7. a) By using linear couplers explain the differential protection of the bus bars with circuit diagram? [7M]
   b) Present the protection of transmission lines above 15km length by using suitable protection scheme? [7M]

(OR)

8. a) Explain the importance of PSM and TMS in the relay setting with an example? [7M]
   b) By using the circuit diagram explain the operation of UJT oscillator used in the static relay operation? [7M]

UNIT-V

9. a) Analyze the direct stroke effect on the tower top and on the substation by presenting the protection systems? [7M]
   b) Compare the three phase isolated system and capacitively grounded systems with phasor diagrams? [7M]

(OR)

10. a) Draw neat diagram and explain the operation of valve type surge arrester? Also draw operating characteristics? [7M]
    b) A 66kV, three phase 50Hz over head line of 78km long has a capacitance to ground of each line is 0.026 micro farads/km. Calculate the inductance and kVA ratings of the ground fault neutralizer? Also derive the expression used. [7M]

Code No: R203202D **R20** SET -2

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SWITCHGEAR AND PROTECTION
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Time: 3 hours Max. Marks: 70

Answer any **FIVE** Questions **ONE** Question from **Each unit**
All Questions Carry Equal Marks
*****

UNIT-I

1. a) Discuss the current chopping phenomenon in the circuit breakers and relate its existence in the SF_6 circuit breakers? [7M]
   b) Explain in detail about the over load tripping in the MCB with neat diagram? [7M]

(OR)

2. a) Explain the basic construction of vacuum circuit breaker with diagram and write its advantages and disadvantages? [7M]
   b) Determine the RRRV of a 210kV circuit breaker with earthed neutral. The short circuit test results are as follows:
   The current broken is symmetrical and the re-striking voltage has an oscillatory frequency of 17kHz. The power factor of the fault is 0.4. Assume the short circuit to be an earth fault? [7M]

UNIT-II

3. a) Draw the diagram and explain the disc relay operation based on the single phase induction motor principle? [7M]
   b) List out and explain the characteristic features different types of over current relays? [7M]

(OR)

4. a) Obtain the condition of maximum torque in the induction relay by deriving relevant equations? [7M]
   b) By drawing the structure of a reactance relay analyze its R-X locus diagram? [7M]

UNIT-III

5. a) Derive and analyze the expression for percentage of the turbo generator winding protected in case of resistance grounding? [7M]
   b) A 3 phase transformer having a line voltage ratio of 440V/66kV is connected in star-delta. The CTs on the 440V side have a current ratio of 900/7A. Calculate the ratio of CTs connected on the 66kV side of the transformer by drawing the connection diagram? [7M]

(OR)

6. a) Draw the connections of CTs on the primary and secondary sides of the transformer protected by using Merz price protection? [7M]
   b) The neutral point of a 12kV alternator is earthed through a resistance of 11.4 ohms the relay is set to operate when there is an out of balance current of 1.1A. The CT's have a ratio of 880/6A. Find the percentage of the winding is protected against fault to earth and what is the minimum value of the earthing resistance to give 87% protection on each phase winding? [7M]

UNIT-IV

7. a) Elaborate the protection of bus bars by using the current differential relay? [7M]
   b) Explain the relay which uses pilot wires to compare the phase relation between currents in protective zone? [7M]

(OR)

8. a) Draw the bus zone diagram and explain the time graded system by using definite time over current relays? [7M]
   b) Derive and analyze the general equation of the comparator used in the static relay tripping action? [7M]

UNIT-V

9. a) Draw the pilot leader and discuss in detail about lightning stroke formation? [7M]
   b) Analyze the equivalent circuit of a three phase capacitively grounded system and also draw relevant phasor diagram? [7M]

(OR)

10. a) Explain how the substation was protected from lightning strokes by using shielding method? [7M]
    b) A 50 Hz over head line has line to ground capacitance of 2.2 micro farads. A ground fault neutralizer is used. Determine the reactance to neutralize the capacitance of total length, 90%, 67% length of the line? Write the concluding remarks? [7M]

Code No: R203202D **R20** SET -3

III B. Tech II Semester Regular Examinations, July -2023
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Time: 3 hours Max. Marks: 70

Answer any **FIVE** Questions **ONE** Question from **Each unit**
All Questions Carry Equal Marks
*****

UNIT-I

1. a) Compare the operations of circuit breakers and auto re-closers with relevant to the applications? [7M]
   b) Write in detail about breaking and making capacities of a circuit breaker with waveforms? [7M]

(OR)

2. a) Explain the basic construction of double pressure type SF_6 breaker with diagram and write its advantages and disadvantages? [7M]
   b) In a 200kV system, the reactance and capacitance upto the location of the circuit breaker is 7.6 ohms and 0.039 micro farad respectively. A resistance of 515 ohms is connected across the contacts of the circuit breaker. Calculate the natural frequency of oscillations, damped frequency of oscillations, the critical value of the resistance which will give zero transient oscillations and the value of the resistances which will give damped frequency of oscillation and $1/3^{rd}$ natural frequency of oscillations? [7M]

UNIT-II

3. a) Draw the diagram, indicate and explain the plug setting of the shaded pole type induction relay? [7M]
   b) Compare the characteristics of inverse definite minimum relay with other over current relays with applications? [7M]

(OR)

4. a) By applying two actuating quantities explain the stationary core induction relay operation? [7M]
   b) Derive the generalized torque equation used to estimate the operation of distance relays? [7M]

UNIT-III

5. a) Derive and analyze the expression for percentage of the turbo generator winding unprotected in case of resistance grounding? [7M]
   b) List out the probable faults in a transformer and summarize the suggested remedial measures? [7M]

(OR)

6. a) Draw the connections of CTs on the primary and secondary sides of the transformer protected by using biased differential protection? [7M]
   b) A 22kV three phase alternator is rated at 1900kW at 0.9 power factor and its reactance is 11.7%. It is connected with a circulating current protection system which is set to operate at fault currents not less than 146A. Find the value of neutral earthing resistance require to protect 92 percent of the stator winding? [7M]

UNIT-IV

7. a) Elaborate the protection of bus bars by using the voltage differential relay? [7M]
   b) Describe the carrier protection and carrier blocking operations of relays in transmission line protection? [7M]

(OR)

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8. a) Draw the bus zone diagram and explain the current graded system by using instantaneous over current relays? [7M]
   b) Draw and explain the operation of rectifier bridge comparator used in the static relays with operating characteristics? [7M]

UNIT-V

9. a) Analyze the direct stroke effect on the over head line by drawing the equivalent circuit? [7M]
   b) Compare the characteristic features of resistance grounding and reactance grounding methods along with applications? [7M]

(OR)

10. a) Draw relevant characteristics and explain the spark over phenomenon of the surge diverter? [7M]
    b) A 220kV, three phase 50Hz transmission line 174km long consists of three conductors of effective diameter 28mm arranged in a symmetrical triangle shape with 3.6m spacing and regularly transposed? Determine the inductive reactance and size in kVA of the Peterson's coil? [7M]

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Time: 3 hours Max. Marks: 70

Answer any **FIVE** Questions **ONE** Question from **Each unit**
All Questions Carry Equal Marks
*****

UNIT-I

1. a) Compare the operations of circuit breakers and relays with relevant to the applications? [7M]
   b) Derive the expression for resistance connected in the circuit breaker contacts to get zero restriking oscillations? [7M]

(OR)

2. a) Explain the basic construction of single pressure type SF_6 breaker with diagram and write its advantages and disadvantages? [7M]
   b) For a system of 147kV the reactance and capacitance up to the location of the circuit breaker is 2.9 ohms and 0.067 micro farads respectively. Determine the frequency of transient oscillations, the maximum value of re-striking voltage across the breaker contacts and the maximum value of RRRV? [7M]

UNIT-II

3. a) Draw watt hour structure, explain the plug setting and operation of the induction relay? [7M]
   b) By applying the percentage differential relay explain the operation of balanced beam relay? [7M]

(OR)

4. a) By applying two actuating quantities explain the rotating cup induction relay operation? [7M]
   b) By drawing diagram explain the operation of directional over current relay operated with a rotating disc? [7M]

UNIT-III

5. a) List out the abnormal conditions of turbo generator and summarize the protection schemes? [7M]
   b) Draw the oil flow diagram between the transformer tank and the Buchholz's relay and explain the protection system? [7M]

(OR)

6. a) Draw the connections of CTs on the primary and secondary sides of the transformer protected by using percentage differential protection? [7M]
   b) A generator is protected with a pilot wire protection. The ratings are 10kV, 3500kVA. The percentage of the winding protected against ground falut is 84%. The relay setting is such that it trips for 23% out of balance. Determine the resistance to be added in the neutral to ground connection? [7M]

UNIT-IV

7. a) Discuss in detail about the importance and protection of bus bars along with circuit diagrams? [7M]
   b) Draw the transmitter and receiver connection diagrams and explain the tripping action of the relay used for the communication purpose? [7M]

(OR)

8. a) Mention and summarize the characteristic features of combination of time and current graded schemes of protection? [7M]
   b) Draw the circuit and explain the operation of the level detector used in the static relays operation with characteristics? [7M]

UNIT-V

9. a) Describe the lightning phenomenon by highlighting the discharge specifications? [7M]
   b) Compare the effects of reactance grounding and Peterson's coil methods along with applications? [7M]

(OR)

10. a) Describe the impact of lightning stroke on the transmission tower and the components on the transmission tower? [7M]
    b) Prove that the inductive reactance of the Peterson's coil increases with the decrease in the length of the transmission line by using an example? [7M]