[6010]-50

B.E. (Electrical Engineering) (Insem)
SWITCHGEAR & PROTECTION
(2019 Pattern) (Semester - VIII) (403148)

Time : 1 Hour]   *[Max. Marks : 30*

Instructions to the candidates:

1) Solve Q.1 or Q.2, Q.3 or Q.4.
2) Figures to the right indicate full marks.
3) Neat diagrams must be drawn wherever necessary.
4) Assume suitable data, if necessary.
5) Use of non-programmable calculator is allowed.

Q1) a) Discuss various causes of faults in a power system.   **[3]**

b) Explain following essential properties of protective relaying -   **[6]**

   i)   Selectivity

   ii) Stability

   iii) Adequateness

c) The current rating of an overcurrent relay is 5 A. The relay has a plug setting of 150% and time multiplier setting (TMS) of 0.5. The CT ratio is 400/5. Determine the operating time of relay for a fault current of 6000 A. At TMS = 1, operating time at various PSM are given below   **[6]**

PSM	2	4	5	8	10	20
Operating time in Sec.	10	5	4	3	2.8	2.4

OR

Q2) a) Draw trip circuit of circuit breaker.   **[3]**

b) Derive the torque equation in case of induction type of relays.   **[6]**

c) With neat diagram, explain the construction & working of induction type nondirectional overcurrent relay.   **[6]**

P.T.O.

Q3) a) Explain high and low resistance principles of arc interruption in case of circuit breakers. **[8]**

b) Explain following terms with respect to circuit breaker switching - **[7]**

   i) RRRV

   ii) Restriking voltage

   iii) Recovery voltage

   iv) Arc voltage

<div align="center">OR</div>

Q4) a) A three phase alternator has the line voltage of 11 kV. The generator is connected to a circuit breaker. The inductive reactance upto the circuit breaker is 5 ohm per phase. The distributed capacitance up to circuit breaker between phase and neutral is 0.01 micro farad. Determine - **[8]**

   i) Peak restriking voltage across the circuit breaker.

   ii) Frequency of restriking voltage transient.

   iii) Average rate of restriking voltage up to peak restriking voltage.

   iv) Maximum RRRV.

b) With help of voltage & current waveform, explain the current chopping phenomenon associated with CB. In which circuit breaker this phenomenon occurs? What measures are taken to reduce it? **[7]**

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B.E. (Electrical)
SWITCHGEAR & PROTECTION
(2015 Pattern) (End sem.) (Semester-II) (403147)

Time : 2½Hours] *[Max. Marks : 70*

Instructions to the candidates:

1) *Answer Q.1 or Q.2, Q.3 or Q.4, Q.5 or Q.6, Q.7 or Q.8*
2) *Neat diagrams must be drawn wherever necessary.*
3) *Figures to the right indicate full marks.*
4) *Use of non-programmable scientific calculator is allowed.*
5) *Assume suitable data, if necessary.*

Q1) a) Explain the need of protective system. What are different causes of fault? Explain the effects of fault. **[6]**

b) Derive the expression for restriking voltage and calculate the value of $RRRV_{max}$ **[7]**

c) Draw neat diagram and explain the construction and working principle of vacuum circuit breaker. **[7]**

OR

Q2) a) The current rating of an overcurrent relay is 5 A. The relay hacan plug setting of 150% and time multiplier setting (TMS) of 0.4. The CT ratio is 400/5. Determine the operating time of relay for a fault current of 6000 A. at TMS=1, operating time at various PSM are given table below. **[6]**

PSM	2	4	5	8	10	20
Operating time in Second	10	5	4	3	2.8	2.4

b) Describe in details the concept of resistance switching associated with high voltage circuit breaker. **[7]**

c) Draw neat diagram and explain the construction and working principle of puffer type SF_6 circuit breaker. **[7]**

Q3) a) With neat block diagram explain Numerical relays. Also state its advantages and disadvantages. **[10]**

b) Explain with neat diagram single phase preventer in case of three phase induction motor. **[8]**

OR

P.T.O.

Q4) a) What are the abnormal conditions and causes of failure in three phaes induction motor? **[8]**

b) State and explain the sampling theorem. Also explain anti-aliasing filter. **[10]**

Q5) a) Explain the protection of alternator against: **[8]**

    i)   Unbalanced loading.

    ii)   Loss of prime mover

b) A three phase, 11kV/132kV, Delta-Star connected power transformer is protected by differential protection. The CTs on the LV side have a current ratio of 500/5. What must be the current ratios of CTs on the HV side and how should they be connected? **[8]**

OR

Q6) a) Explain the 'magnetic inrush current' phenomenon in transformer. Suggest suitable protection for the same. **[8]**

b) A 3 phase, 12kV alternator winding is required to be protected against earth faults. The 80% of winding is protected against earth fault by a relay having pick up current of 1 Amp. The CT has a ratio of 1000/5. Calculate resistance to be connected between neutral to ground. If resistance of 10 ohm is connected between neutral to ground, how much percentage of winding is protected against earth fault. **[8]**

Q7) a) What do you mean by power swings and arc resistance? Explain the effect of power swings and arc resistance on the performance of the distance relay. **[8]**

b) Explain the three stepped distance protection for transmission line with neat diagram. **[8]**

OR

Q8) a) Draw block diagram and explain components of power Line carrier Communication (PLCC) for long transmission lines. **[8]**

b) Write s short note on Wide Area Measurement System (WAMS) **[8]**

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Total No. of Questions : 10]

SEAT No. :

P2298

[Total No. of Pages : 3

[5254]-632

B.E. (Electrical)

SWITCHGEAR & PROTECTION

(2012 Pattern) (Semester - II)

Time : 2½ Hours]

[Max. Marks : 70

Instructions to the candidates:

1) *Answer Q. No.1 or 2, Q.No.3 or 4, Q. No.5 or 6, Q. No.7or 8, Q. No.9 or 10*
2) *Neat diagrams must be drawn wherever necessary.*
3) *Figures to the right indicate full marks.*
4) *Use of electronic pocket calculator is allowed.*
5) *Assume suitable data, if necessary.*

Q1) a) What are essential qualities of protective relaying. **[6]**

b) Write a short note on current chopping. **[4]**

OR

Q2) a) Explain the following terms w.r.t. circuit breaker. **[6]**

i) Restriking voltage.

ii) R.R.R.V.

iii) Recovery voltage.

b) An instantaneous value of magnetizing current of 5.5 A in a 132 kV transmission line having line to ground capacitance of 0.015 μF and inductance of 5 H is required to be interrupted. Determine **[4]**

(i) the voltage across the contacts of circuit breaker at the time of current interruption.

(ii) the resistance to be inserted in the contacts in order to avoid restriking voltage.

P.T.O.

Q3) a) Explain construction and working of vacuum circuit breaker. **[6]**

b) Explain the term resistance switching. **[4]**

OR

Q4) a) Explain current graded overcurrent protection scheme. **[4]**

b) Explain puffer type SF6 circuit breaker. **[6]**

Q5) a) Compare static relays with electromechanical relays with respect to construction, working principle, advantages and limitations. **[8]**

b) Compare gap type and gapless type lightning arresters. **[8]**

OR

Q6) a) Write a short note on : **[8]**
   i) Anti-Aliasing filter.
   ii) Sampling theorem.

b) With suitable diagram explain construction and working of Rod-gap arrester. ` **[8]**

Q7) a) Explain the phenomenon of overfluxing in the transformer and protection used against it. **[9]**

b) A 3 phase 12 kV alternator winding is required to be protected against earth faults. The 80% of winding is protected against earth faults by a relay having pick up current of 1 Amp. The CT has a ratio of 1000/5. Calculate resistance to be connected between neutral and ground. If resistance of 10 ohms is connected between neutral to ground, how much percentage of winding is protected against earth fault. **[9]**

OR

Q8) a) Explain protection against single phasing in 3 phase induction motor.**[9]**

b) Explain the abnormal conditions like unbalance loading, overspeeding and loss of prime mover in case of alternator. **[9]**

Q9) a) Explain the step distance protection scheme for transmission line. Also draw the neat sketch for the same. **[8]**

b) Explain the need of high impedance relay for differential protection of busbar. **[8]**

OR

Q10) a) Write a short note on Wide Area Measurement System (WAM). **[8]**

b) Explain how reactance relay is used for distance protection. Derive its torque equation. Draw its characteristics on R-X diagram. **[8]**

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BE/Insem/APR - 191
B.E. (Electrical)
SWITCHGEAR & PROTECTION
(2015 Pattern)

Time : 1 Hour]   *[Max. Marks : 30*

Instructions to the candidates :

1) *Answer Q.1 or Q.2, Q.3 or Q.4, Q.5 or Q.6.*
2) *Neat diagrams must be drawn wherever necessary.*
3) *Figure to right indicate full marks.*
4) *Use of Non-programmable Scientific Calculator is allowed.*
5) *Assume suitable data if necessary.*

Q1) a) Obtain the torque equation of Induction type Relay.   **[4]**

   b) What is 'Backup Protection'? Explain the various types of Back protections used worldwide.   **[6]**

OR

Q2) a) Explain the terms PSM and TMS in case of Relays.   **[4]**

   b) Classify the various types of relays based construction, principal of operation and applications.   **[6]**

Q3) a) Explain the concept of current chopping with neat waveform.   **[4]**

   b) Explain the theories related to Arc Extinction.   **[6]**

OR

Q4) a) In a 132 kV system, phase to ground capacitance is 0.01 microfarad and series inductance is 6 H. Calculate the voltage across the breaker pole of Air blast CB, if magnetizing current of 10A is interrupted. Also calculate the resistance to be used to eliminate the restriking voltage transients. **[4]**

   b) Derive the expression for restriking voltage and thereafter the value of $RRRV_{max}$.   **[6]**

P.T.O.

Q5) a) Explain the significance of terms related to H.V. Circuit breaker **[4]**

    i)   Rated frequency

    ii)   Rated insulation level

    b) Draw the construction diagram and explain the working principle of Air circuit breaker. **[6]**

OR

Q6) a) Explain the working of Auto reclosure as used for EHV lines in India. **[4]**

    b) Draw the neat sketch & explain the construction & working principle of SF6 circuit breaker. **[6]**

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Total No. of Questions :8]

P3917

SEAT No. :

[Total No. of Pages :2

[5561]-587

B.E. (Electrical)

SWITCHGEAR & PROTECTION

(2015 Pattern) (403147) (Semester - II)

Time : 2½ Hours] *[Max. Marks : 70*

Instructions to the candidates:

1) Answer Q.1 or Q.2, Q.3 or Q.4, Q.5 or Q.6, Q.7 or Q.8.

2) Neat diagrams must be drawn wherever necessary.

3) Figures to the right indicate full marks.

4) Use of Non-Programmable Scientific Calculator is allowed.

5) Assume suitable data, if necessary.

Q1) a) What is fault? What are the causes of faults? State the different types of fault. **[6]**

b) Explain the resistance switching in case of circuit breaker. **[7]**

c) Explain the rated characteristics of High Voltage circuit breakers as per IS-2516. **[7]**

OR

Q2) a) What are the essential qualities of protective relaying? Explain. **[6]**

b) A 11 kV, 3-ph, 50Hz alternator is protected by the circuit breaker. The inductive reactance upto to circuit breakers is 5ohm and distributed capacitor. between phase and neutral is 0.01 microfarad. Determine- (i) peak restriking voltage across cb. (ii) Frequency of restriking voltage. (iii) Average rate of restriking voltage up to peak value. (iv) Maximum value of RRRV. **[7]**

c) Draw the neat sketch & explain in detail the construction & working principle of SF6 circuit breaker. **[7]**

Q3) a) Enlist the abnormal operating conditions and causes of failure of 3-phase induction motor? **[8]**

b) With neat block diagram, explain numerical relays. Also enlist its advantages. **[10]**

OR

P.T.O.

Q4) a) Explain the protection against the single phasing of 3-ph Induction motor. **[8]**

b) Explain static relays with block diagram and operating principle. Also state its merits and demerits. **[10]**

Q5) a) Explain the phenomenon of over fluxing in the transformer. Suggest suitable protection for the same. **[8]**

b) A 3-phase, 2-pole, 11 kV, 10 MVA alternator has neutral grounding resistance of 5 ohm. The machine is protected by differential protection in which relay trips when its current exceeds 25% of full load current. Determine percentage of winding protected against earth fault. **[8]**

OR

Q6) a) Prepare a list of various types of faults taking place in alternator on stator side and rotor side and explain protection against- (i) Loss of field (ii) Rotor temperature rise. **[8]**

b) A 3 phase, 33/3.3 kV star/delta connected transformer is protected by differential protection. CT's on LT side have a ratio of 400/5. Determine the CT ratio on HT side. Draw the connection diagram. **[8]**

Q7) a) Draw the block diagram and explain the working of carrier current protection scheme for long transmission lines. **[8]**

b) What do you mean by power swings and arc resistance? Explain the effect of power swings and arc resistance on the performance of the distance relay. **[8]**

OR

Q8) a) Compare Impedance relay, Reactance relay and Mho relay with reference to application and characteristics used for protection of transmission line. **[8]**

b) Draw the necessary sketches for 3-zone distance protection scheme for transmission lines and explain it. **[8]**

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[6181]-135

B.E. (Electrical Engineering)
SWITCHGEAR & PROTECTION
(2019 Pattern) (Semester - VIII) (403148)

Time : 2½ Hours]

[Max. Marks : 70

Instructions to the candidates:

1) *Answer Q1 or Q2, Q3 or Q4, Q5 or Q6, Q7 or Q8.*
2) *Neat diagrams must be drawn wherever necessary.*
3) *Figures to the right side indicate full marks.*
4) *Assume suitable additional data if necessary.*
5) *Use of non-programmable calculator is allowed.*

Q1) a) State the various type tests on high voltage AC Circuit Breaker. **[4]**

b) A 3 phase VCB is rated as 1500 A, 1000 MVA, 33 kV, 3 seconds.

Determine - **[6]**

i) Symmetrical breaking current

ii) Rated making current

iii) Short time rating

iv) Rated normal current

v) Breaking capacity

vi) Rated service voltage

c) Compare VCB with SF6 CB with reference to application, advantages, disadvantages, arc interrupting medium. **[8]**

OR

Q2) a) Discuss chemical properties of SF6 gas. **[4]**

b) Compare Gas Insulated Substation with Air insulated Substation. **[6]**

c) With neat diagram explain temperature rise test of Circuit Breaker. **[8]**

P.T.O.

Q3) a) Draw block diagram of static relay. Explain its working. State its advantages & disadvantages. **[10]**

b) Explain the use of Anti-Aliasing filter in the numerical relay **[7]**

OR

Q4) a) Draw a block diagram of numerical relay. Explain its working. State its advantages over conventional and static relays. **[10]**

b) Draw and explain block diagram of PMU. **[7]**

Q5) a) With neat diagram, explain inter turn fault protection in case of 3 phase alternator. **[4]**

b) A three phase 11 kV/ 132 kV, delta / star connected power transformer is protected by percentage differential protection scheme. The CTs on LT side have ratio of 600/5. Determine the CT ratio on HT side. **[6]**

c) With neat diagram, explain construction & working of Buchhloz relay. **[8]**

OR

Q6) a) What is single phasing in case of 3 phase induction motor? Draw neat diagram of single phase preventor. **[4]**

b) An 11 kV, 100 MVA, three phase alternator is protected by percentage differential scheme. Its neutral point is earthed through a resistance. The relay is set to operate when there is an out of balance current of 1A. The CT's have a ratio of 1000/5. If 90 % winding is protected against earth fault, what must be value of resistance to be connected in neutral to ground circuit? **[6]**

c) Discuss the following abnormal operating conditions in 3 phase alternator- **[8]**

   i) Loss of prime mover

   ii) Unbalanced loading Suggest suitable protection scheme in each of above cases.

Q7) a) Explain with diagram how impedance relay is used for distance protection? State drawbacks of impedance relay. Draw its characteristics on R-X plane. **[10]**

b) Draw block diagram of PLCC scheme used for transmission line protection. Briefly explain its components. **[7]**

OR

Q8) a) Explain the effect of - **[10]**

    i) arc resistance

    ii) Power swing on the operation of distance relays. In each of these cases, which relay gets highly effected?

b) Discuss Wide Area Measurement System. **[7]**

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[5561]-587

B.E. (Electrical)
SWITCHGEAR & PROTECTION
(2015 Pattern) (403147) (Semester - II)

Time : 2½ Hours]   *[Max. Marks : 70*

Instructions to the candidates:

1) *Answer Q.1 or Q.2, Q.3 or Q.4, Q.5 or Q.6, Q.7 or Q.8.*
2) *Neat diagrams must be drawn wherever necessary.*
3) *Figures to the right indicate full marks.*
4) *Use of Non-Programmable Scientific Calculator is allowed.*
5) *Assume suitable data, if necessary.*

Q1) a) What is fault? What are the causes of faults? State the different types of fault. **[6]**

    b) Explain the resistance switching in case of circuit breaker. **[7]**

    c) Explain the rated characteristics of High Voltage circuit breakers as per IS-2516. **[7]**

OR

Q2) a) What are the essential qualities of protective relaying? Explain. **[6]**

    b) A 11 kV, 3-ph, 50Hz alternator is protected by the circuit breaker. The inductive reactance upto to circuit breakers is 5ohm and distributed capacitor. between phase and neutral is 0.01 microfarad. Determine- (i) peak restriking voltage across cb. (ii) Frequency of restriking voltage. (iii) Average rate of restriking voltage up to peak value. (iv) Maximum value of RRRV. **[7]**

    c) Draw the neat sketch & explain in detail the construction & working principle of SF6 circuit breaker. **[7]**

Q3) a) Enlist the abnormal operating conditions and causes of failure of 3-phase induction motor? **[8]**

    b) With neat block diagram, explain numerical relays. Also enlist its advantages. **[10]**

OR

P.T.O.

Q4) a) Explain the protection against the single phasing of 3-ph Induction motor.
[8]

b) Explain static relays with block diagram and operating principle. Also state its merits and demerits. **[10]**

Q5) a) Explain the phenomenon of over fluxing in the transformer. Suggest suitable protection for the same. **[8]**

b) A 3-phase, 2-pole, 11 kV, 10 MVA alternator has neutral grounding resistance of 5 ohm. The machine is protected by differential protection in which relay trips when its current exceeds 25% of full load current. Determine percentage of winding protected against earth fault. **[8]**

OR

Q6) a) Prepare a list of various types of faults taking place in alternator on stator side and rotor side and explain protection against- (i) Loss of field (ii) Rotor temperature rise. **[8]**

b) A 3 phase, 33/3.3 kV star/delta connected transformer is protected by differential protection. CT's on LT side have a ratio of 400/5. Determine the CT ratio on HT side. Draw the connection diagram. **[8]**

Q7) a) Draw the block diagram and explain the working of carrier current protection scheme for long transmission lines. **[8]**

b) What do you mean by power swings and arc resistance? Explain the effect of power swings and arc resistance on the performance of the distance relay. **[8]**

OR

Q8) a) Compare Impedance relay, Reactance relay and Mho relay with reference to application and characteristics used for protection of transmission line. **[8]**

b) Draw the necessary sketches for 3-zone distance protection scheme for transmission lines and explain it. **[8]**

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