Code No: R05320205 **Set No. 1**

III B.Tech II Semester Regular Examinations, Apr/May 2008
SWITCHGEAR AND PROTECTION
(Electrical & Electronic Engineering)

Time: 3 hours **Max Marks: 80**

Answer any FIVE Questions
All Questions carry equal marks

⋆ ⋆ ⋆ ⋆ ⋆

1. A generator connected through a 3-cycle Circuit Breaker to a transformer is rated 10MVA, 13.8kV with reactances of X''_d = 10%, X'_d =15% and X_d =100%. It is operating at no load and rated voltage when a 3-phase short circuit occurs between the breaker and the transformer. Determine
   (a) the sustained short circuit current in breaker;
   (b) the initial symmetrical rms current in the breaker;
   (c) the maximum possible d.c component of the short circuit current in the breaker;
   (d) the momentary current rating of the breaker;
   (e) the current to be interrupted by the breaker and
   (f) the interrupting kVA. [16]

2. Explain the principle of arc extinction and What are the different methods of arc extinction. [16]

3. Define the following terms and explain their significance in distance protection
   (a) Reach of a distance relay.
   (b) Under reach. [8+8]

4. Explain with a diagram, the application of the Merz-Price circulating current system to the protection of alternators. What precautions must be taken in installing this system? [8+8]

5. (a) A 3-phase, 66/11kV star-delta connected transformer is protected by Merz-price protection system. The CTs on the LT side have a ratio of 420/5 ampr. Show that the CTs on the HT side will have a ratio of 70:$\frac{5}{\sqrt{3}}$.
   (b) Explain with reasons the connections of C.T.s for protecting a delta/star transformer. Write the scheme of protection for [10+6]
      i. Internal fault and
      ii. External fault.

6. (a) Explain over current protection of feeder.
   (b) Explain a scheme of protection for a ring mains. [8+8]

7. (a) What are the reasons leading to the general practice of earthing the neutral point of a power system? Explain.
   (b) Explain the phenomenon of arcing grounds and discuss the method to minimize the effect of this phenomenon. [10+6]

8. (a) How over head transmission lines are protected from lightning strokes.
   (b) Why ground wire is provided as the top lost conductor in high voltage transmission lines. [6+10]

⋆ ⋆ ⋆ ⋆ ⋆

Code No: R05320205 **Set No. 2**

III B.Tech II Semester Regular Examinations, Apr/May 2008
SWITCHGEAR AND PROTECTION
(Electrical & Electronic Engineering)

Time: 3 hours **Max Marks: 80**

Answer any FIVE Questions
All Questions carry equal marks

⋆ ⋆ ⋆ ⋆ ⋆

1. Explain Slepian's theory of arc interruption and discuss its limitations. How does energy balance theory, explain the process of arc interruption? [8+8]

2. (a) Classify the types of circuit breakers when the arc quenching medium is the criterion?
   (b) Mention the voltage range for which a particular type of circuit breaker is recommended. [8+8]

3. Explain the 'Differential protection'. State the various applications of differential protection. [8+8]

4. (a) Explain how the inclusion of a resistance in the neutral earthing circuit of an alternator affects the performance of the differential protection of the three-phase stator.
   (b) Describe how protection is provided in large turbo-alternators against earth-fault in the rotor [8+8]

5. (a) Discuss biased differential protection for transformers.
   (b) A 3-phase, 33/6.6 kV transformer is connected in star/delta and the protecting current transformer on the LV side have a ratio of 300/5. What will be the ratio of the current transformer on the HV side? [6+10]

6. (a) Explain over-current protection of feeders.
   (b) How is the protection system graded with respect to the time of operation of relays. [8+8]

7. (a) Describe the various methods of grounding.
   (b) A 132kV, 3 phase, 50Hz overhead line of 100 km length has a capacitance to earth of each line of 0.01 μF per km. Determine inductance and kVA rating of the arc suppression suitable for this line. [10+6]

8. (a) What are volt time curves.
   (b) What is their significance in power system studies. [8+8]

⋆ ⋆ ⋆ ⋆ ⋆

Code No: R05320205 **Set No. 3**

III B.Tech II Semester Regular Examinations, Apr/May 2008
SWITCHGEAR AND PROTECTION
(Electrical & Electronic Engineering)

Time: 3 hours **Max Marks: 80**

Answer any FIVE Questions
All Questions carry equal marks

⋆ ⋆ ⋆ ⋆ ⋆

1. Calculate the RRRV of a 220kV circuit breaker with earthed neutral. The short circuit test data obtained is as follows:
   The current breaker is symmetrical and the restriking voltage has an oscillatory frequency of 15 kHz. The power factor of the fault is 0.2. Assume the short circuit to be an earthed fault. [16]

2. (a) Compare the arc rupture in oil and air blast circuit breakers and summarize the relative advantages and disadvantages of these types of switch gear.
   (b) Explain the operating duty of a circuit breaker. [8+8]

3. Describe the various types of construction of attracted armature type relay. Why can they operate in a.c and d.c?. State its salient features. [8+8]

4. An 11kV,100MVA generator is provided with differential scheme of protection. The percentage of the generator winding to be protected against phase to ground fault is 80%. The relay is said to operate when there is 15% out of balance current. Determine the value of resistance to be placed in the neutral to ground connection. [16]

5. Write short notes on the following:
   (a) Different transformer faults
   (b) Biased differential protection for transformer
   (c) Buchholtz Relay. [6+6+4]

6. (a) Explain bus bar protection need special attention. Why?
   (b) What is back up protection of bus bars? [10+6]

7. (a) Discuss the advantages of neutral grounding.
   (b) What is tower-footing resistance. [8+8]

8. (a) What are various methods of over voltage protection of overhead transmission lines.
   (b) Explain clearly how the rating of a lightning arrester is selected. What is the best location of a lightning arrester and why? [8+8]

⋆ ⋆ ⋆ ⋆ ⋆

Code No: R05320205 **Set No. 4**

III B.Tech II Semester Regular Examinations, Apr/May 2008
SWITCHGEAR AND PROTECTION
(Electrical & Electronic Engineering)

Time: 3 hours **Max Marks: 80**

Answer any FIVE Questions
All Questions carry equal marks

⋆ ⋆ ⋆ ⋆ ⋆

1. Calculate the RRRV of a 220kV circuit breaker with earthed neutral. The short circuit test data obtained is as follows:
   The current breaker is symmetrical and the restriking voltage has an oscillatory frequency of 15 kHz. The power factor of the fault is 0.2. Assume the short circuit to be an earthed fault. [16]

2. (a) Compare the arc rupture in oil and air blast circuit breakers and summarize the relative advantages and disadvantages of these types of switch gear.
   (b) Explain the operating duty of a circuit breaker. [8+8]

3. (a) Describe the construction of an induction disc relay. State its principle of operation. What are the advantages to induction relays. How is the current setting and time setting obtained?
   (b) With a neat sketch, describe the difference between definite characteristic and inverse characteristic of relays. [8+8]

4. (a) Explain how the inclusion of a resistance in the neutral earthing circuit of an alternator affects the performance of the differential protection of the three-phase stator.
   (b) Describe how protection is provided in large turbo-alternators against earth-fault in the rotor [8+8]

5. Explain with a neat circuit diagram of the percentage differential protection scheme to protect Y - Δ transformer. [16]

6. (a) Explain over current protection of feeder.
   (b) Explain a scheme of protection for a ring mains. [8+8]

7. (a) A 50Hz over head line has the line to ground capacitance of 1.2μF. It is decided to use a ground fault neutralizer. Determine the reactance to neutralize the capacitance of
   (i)100% of the length of the wire, and (ii) 80% of the length of the wire
   (b) Write short notes on biased differential protection for transformer. [10+6]

8. Write short notes of the following:
   (a) Causes of over voltages in a power system.
   (b) Switching surges.

(c) Protection against over voltages. [16]

⋆ ⋆ ⋆ ⋆ ⋆