B. Power Engg. 4th Year 1st Semester Supplementary Examination, 2017

POWER SYSTEM PROTECTION

TIME: THREE HOURS

FULL MARKS: 100

(50 marks for each Part)
Use a separate Answer-script for each part

PART – I

Answer question No. 1 and any two from the rest.

1. a) A lightning arrester connected between the line and earth in a power system
(i) protects the terminal equipment against traveling surges
(ii) protects the transmission line against direct lightning stroke
(iii) suppresses high frequency oscillations in the line
(iv) reflects back the traveling wave approaching it

b) The insulation strength of an HV transmission line is governed by
(i) lightning over voltage (ii) switching over voltage (iii) switching over voltage and lightning over voltage (iv) corona

c) In connection with the arc extinction in circuit breaker, the resistance switching is employed where in a resistance is placed in parallel with the contacts of the circuit breaker. This process introduces damping in the LC circuit. For critical damping, the value of 'r' should be equal to

(i) $\sqrt{\dfrac{C}{L}}$ (ii) $0.5\sqrt{\dfrac{C}{L}}$ (iii) $0.5\sqrt{\dfrac{L}{C}}$ (iv) $\dfrac{1}{2\Pi}\sqrt{\dfrac{L}{C}}$

d) Air-blast circuit breaker is suitable for _____.

e) The stability of arc in vacuum depends on
(i) the contact material only
(ii) the contact material and its vapor pressure
(iii) the circuit parameters only
(iv) the combination of (ii) and (iii)   5x2

2. a) Discuss the mechanism of arc initiation in a circuit breaker.   8
b) Give a note on vacuum circuit breaker.   12

3. a) Give a note on air-blast circuit breaker.   14
b) Give a note on RRRV.   6

4. a) Discuss the advantages of using SF_6 in circuit breaker.   10
b) Discuss why gapless arresters have replaced the conventional type of lightning
arrester.   10

5. a) Discuss various types of over voltages.   16
b) What are the essential characteristics of lightning arrester?   4

B. Power Engineering 4th YR, 1st SEM. Supplemental)' EXAM.- 2017

Subject: Power System Protection (Part-II) Time: Three Hours Full Marks: 50 (2 marks are allotted for neatness & use separate answer script for each part)

(Answer any THREE questions from Part -II)

l.a) State the characteristics of relaying in power system application.(4)

b) Explain the basic structure of relaying with a basic figure.(8)

c) What is primary & backup protection? 2+2

2.a) Define: Plug Setting Multiplier (PSM) & Time Setting Multiplier (TSM) 2+2

b) State the primary consideration for selecting pickup current of any over current relay.8

c) Compare the characteristics between IDMTL relay & fuse. 4

3.a) Briefly explain how multi zone protection is carried out using distance relay.(4)

b) State the necessity of % bias differential relay. (2)

c) Derive the equation of % bias differential relay considering relay operation as electromagnetic comparator & static amplitude comparator.(10)

4.a) As in following figure a 20 MVA transformer which may be called upon to operate at 10% overload feeds 11 KV bus bar through a circuit breaker. Other circuit breakers supply out going feeders. The transformer circuit breaker is equipped with 1000/2 Amps C.Ts & feeder transformers with 300/3 Amps C.Ts & all C.Ts feeds IDMTL relays having characteristics for T.S.M=I.0 as in table (For nonlinear IDMTL characteristics use linear interpolation for any intermediate PSM value). The relays on the feeder circuit breakers have 130% plug setting & 0.3 time setting. If a fault current of 2000Amps flows from the transformer to working feeders --- a) Find the operating time of the feeder relay. b) Suggest suitable plug & time setting for the transformer relay to ensure adequate discrimination in the above fault current (allow 0.5 sec. time discrimination for feeder relay). (8)

PSM   1 2 3 5 10 15 20
             ↓ ↓ ↓ ↓   ↓   ↓   ↓
Time in Sec. 12 8 5 4.0 3.8 2.9' 1.8

b) A synchronous generator & motor are rated 40,000KVA, 13.2 KV, & both have sub-transient reactance of 20%.The line connecting them has a reactance of 10% on the base of the machine ratings. The motor is drawing 20,000 KW at 0.8 power factor leading & terminal voltage of] 1 KV when a symmetrical three phase fault occurs at the motor terminals. Find the subtransient current in the generator, motor & in the fault point by using the internal voltage of the machines. (8)

5. Short note: (answer anyone ofthe following) a) Motor protection b) Generator protection. (16)

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