GURU NANAK INSTITUTE OF TECHNOLOGY
An Autonomous Institute under MAKAUT
2022
POWER SYSTEM-II
EE602

TIME ALLOTTED: 3 HOURS   **FULL MARKS: 70**

The figures in the margin indicate full marks.
Candidates are required to give their answers in their own words as far as practicable

GROUP – A
(Multiple Choice Type Questions)

Answer any *ten* from the following, choosing the correct alternative of each question: **10×1=10**

		Marks	CO No.
1. i)	Load flow study is carried out for	1	CO1

  a) fault calculations
  b) stability studies
  c) system planning
  d) State estimation.

		Marks	CO No.
(ii)	An acceleration factor is used in load flow studies by	1	CO2

  a) Gauss-Siedel Method
  b) NR method
  c) Decoupled method
  d) None

		Marks	CO No.
(iii)	The operator 'a' rotates the vector through ------- in anti clockwise direction	1	CO3

  a) 120^0
  b) $90°$
  c) $-120°$
  d) $180°$

		Marks	CO No.
(iv)	In a load flow study Y_{bus} matrix is	1	CO2

  a) null matrix
  b) sparse matrix
  c) full matrix
  d) unity matrix

		Marks	CO No.
(v)	The zero sequence current will not flow in the	1	CO3

  a) L.G fault
  b) L.L.G fault
  c) L.L fault
  d) L.L.L.G fault

(vi) A 50 Hz, 4 pole alternator rated at 20 MVA, 13.2 KV has an inertia   1   CO1
constant H = 4 KW.sec/KVA. The K.E. stored in the rotor at synchronous
speed is
a) 80 KJ
b) 80 MJ
c) 40 MJ
d) 20 MJ

(vii) A 11 KV, 10 MVA alternator has impedance of 0.10 pu when referred to   1   CO2
its ratings as bases. The new value for base as 110 KV, 20 MVA will be
a) 0.002 pu
b) 0.20 pu
c) 0.10 pu
d) 0.02 pu.

(viii) Plug setting of a relay can be altered by varying-   1   CO1
a) Number of ampere turns
b) Air gap of magnetic path
c) Adjustable back up stop
d) None

(ix) The pick up current of a relay is 6.25 A and the fault current in system is   1   CO2
4000A.When the relay is connected through a 400/5 current transformer,
the PSM of the relay is:
a) 4
b) 8
c) 615
d) None

(x) FDLF method is suitable for   1   CO3
a) high voltage transmission system
b) medium voltage transmission system
c) distribution system
d) none of these

(xi) A Mho relay is: 1   CO2
a) Voltage restricted directional relay
b) Voltage control over current relay
c) Directional restrained over current relay
d) directional restrained over voltage relay

(xii) The unit of inertia constant is   1   CO3
a) MJs/MVA
b) MJ/MVA
c) KV/MVA
d) rad/MVA

GROUP – B
(Short Answer Type Questions)
(Answer any *three* of the following)

3 x 5 = 15

|		Marks	CO No.
2.	A 3-phase transmission line operating at 10 kV and having a resistance of 1Ω and reactance of 4 Ω is connected to the generating station bus-bars through 5 MVA step-up transformer having a reactance of 5%. The bus-bars are supplied by a 10 MVA alternator having 10% reactance. Calculate the short-circuit KVA fed to symmetrical fault between phases if it occurs (i) at the load end of transmission line (ii)at the high voltage terminals of transformer	5	CO1
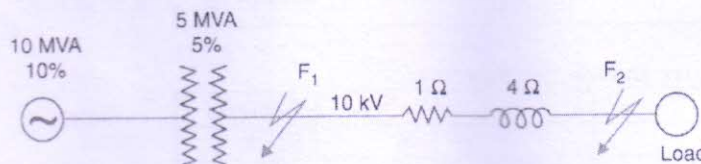
|		Marks	CO No.
3.	Derive the expression for Bus Admittance Matrix [Y] BUS considering a 4 bus 5 lines power network	5	CO2
4.	A generating station consists of two 100 MVA generators with 6% reactance each and one 150 MVA generator with 8% reactance as shown in Figure below. These generators are connected to a common bus bar from which loads are taken through a number of 50 MVA, step up transformers each having 5% reactance. Compute the rating of circuit breaker on (i) low voltage side and (ii) on high voltage side.	5	CO3
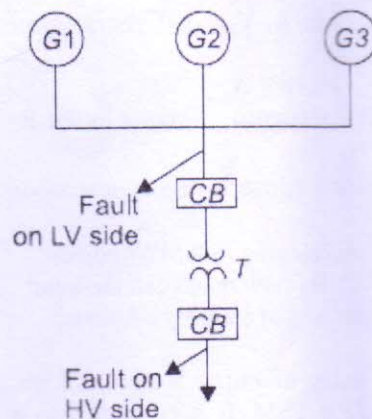
Figure: Single Line Diagram

		Marks	CO No.
5.	Derive the Torque equation for an Induction Disc Relay.	5	CO1
6.	A 500 MVA synchronous machine has H1 = 4.6 MJ/MVA and a 1500 MVA machine has H2 = 3.0 MJ/MVA. The two machines operate in parallel in a power plant. Find out Heq, relative to a 100 MVA base.	5	CO2

GROUP – C
(Long Answer Type Questions)
(Answer any *three* of the following)

3 x 15 = 45

| | Marks | CO No. |

7. a) The line admittance are-   9   CO1

Bus code	Admittance
1-2	2-j8.0
1-3	1-j4.0
2-3	0.666-j2.664
2-4	1-j4.0
3-4	2-j8.0

The schedule of active and reactive powers are-

Bus code	P	Q	V	Remarks
1	-	-	1.06	Slack
2	0.5	0.2	1+j0.0	PQ
3	0.4	0.3	1+j0.0	PQ
4	0.3	0.1	1+j0.0	PQ

Determine the voltage for bus 2 at the end of first iteration using Gauss Siedal method.Take $\alpha = 1.6$

b) Write the Flow chart for Gauss-Siedel method of solving load flow problem.   6   CO2

8.a) For Line to Ground Fault (L-G) draw the sequence network and find the sequence components of currents and voltages.   8   CO3

b) In a 3-phase, 4-wire system, the currents in R, Y and B lines under abnormal conditions of loading are as under: 7   CO2
$I_R = 100 \angle 30° A$; $I_Y = 50 \angle 300° A$; $I_B = 30 \angle 180° A$
Calculate the positive, negative and zero sequence currents in the R-line and return current in the neutral wire.

9.a) Starting from 1st principle derive the Swing equation of a synchronous machine.   7   CO3

b) A synchronous generator, capable of developing 500MW power per phase, operates at a power angle of 8°. By how much can the input shaft power be increased suddenly without loss of stability? Assume that Pmax will remain constant.   8   CO1

10.a) Determine the time of operation of a relay of rating 5 amp, 2.2 sec IDMT and having a relay setting of 125% TSM. It is connected to a supply circuit through a C.T 400/5 ratio. The fault current is 4000 amp.   6   CO2

Fig.
IDMT curve
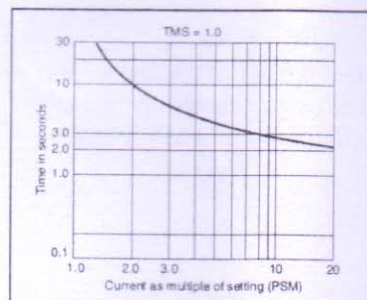
Standard 2.2 sec

b) Explain clearly the basic principle of operation of a differential relay. What is meant by per cent bias? How is this achieved in practice in differential relay? Under what circumstances is a percentage differential relay preferred over differential relay?   9   CO1

11.   Write Short Note on (Any Three)   3x5=15

a) Current chopping   5   CO3

b) Buchholz Relay   5   CO2

c) Different Types of Generator Relay protection schemes.   5   CO3

d) SF_6 circuit breaker and its operation   5   CO3

e) Operating principal of MOCB   5   CO2