Duration: 3 Hours **Total Marks: 80**

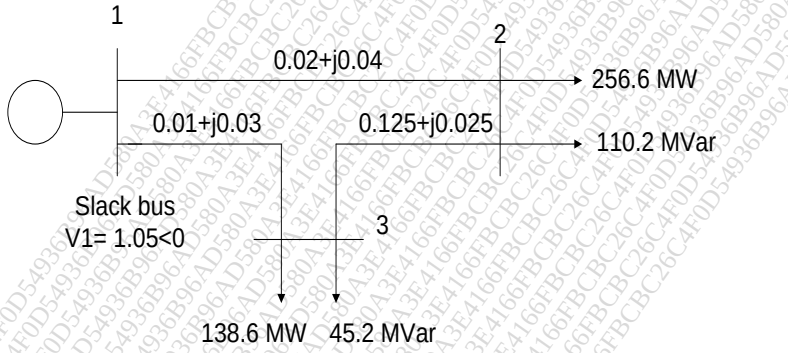
Note: 1. **Q. 1** is **compulsory.**
2. Solve any **3** questions out of remaining questions.
3. Assume suitable data if necessary.

Q.1 Solve any four [20]

a. Write assumptions made for obtaining approximate load flow equations
b. What is the importance of power pool in interchange of energy?
c. What is an equal area criterion?
d. What are the assumptions made in Fast decoupled load flow studies?
e. Draw heat rate and write its importance for economic load dispatch

Q2

a. For the given diagram of 3 bus system, line impedances are marked in pu on a 100MVA base, voltage at slack bus and scheduled loads are given at buses 2 and 3. Use GS method to calculate voltage at bus 2 and 3, after first iteration. [10]



b. Derive the swing equation for a synchronous machine that describes the rotor dynamics. [10]

Q3

a. Explain formation of Y bus by singular transformation. [10]

b. A two bus system is considered. If a load of 125MW is transmitted from plant 1 to load a loss of 15.635MW is increased. Determine generation schedule and load demand if cost of received power is Rs 24MW/hr. Solve the problem using coordination equations and penalty factor approach. The incremental production costs of plants are

$\frac{dF_1}{dP_1} = 0.025P_1+15$ $\frac{dF_2}{dP_2} = 0.05P_2+20$ [10]

Q4

a. Derive the expression for the exact coordination equation. [10]

b. Explain dynamic response of load frequency controller with and without integral control action. [10]

Q5

a. A 60Hz generator is delivering 50% of maximum permissible power through a transmission system to an infinite bus. A fault occurs and causes transfer reactance to increase to 400 % of the value before fault. When the fault is isolated and the maximum power transfer is 75% of the original maximum value. Determine the critical clearing angle using equal area criterion. [10]

b. Explain the load frequency control by turbine speed governing system and derive the speed governing model. [10]

Q. 6 Write short notes on [20]

a. Optimal Unit commitment and reliability considerations.
b. P-V curve for voltage stability analysis

Time : 3 Hours **Total marks : 80**

N. B.
(1) Question No. **1** is **compulsory**.
(2) **Attempt** any **three** questions out of remaining questions.
(3) **Figures** to the **right** indicate **full** marks.
(4) **Assume** suitable **data** if **necessary**.

1. Solve any **four** :- 20
a) Show location of different components of HVDC links
b) Show the hierarchy in the control of HVDC
c) Compare IPC and EPC scheme of firing of HVDC converter bridge
d) What is a self-clearing fault in HVDCT
e) Synthesize the harmonics produced in HVDC converters and name different filters used

2. a) For a bridge converter with grid control and overlap less than 60^0. Prove that 10

$$cos\emptyset \cong cos \propto - \frac{R_C . I_d}{V_{do}}$$

a) Investigate that single commutation with neat waveforms and diagrams. 10

3. a) Calculate the secondary line voltage of the transformer for a three phase bridge rectifier to provide dc voltage of 120KV. Assume $\alpha=30^0$ and $\mu=15^0$. What is the effective reactance? When the rectifier gives 800A of dc current. 10
a) Develop the complete control characteristic of HVDC control from the basic characteristic. 10

4. a) Show the conduction of different valves in HVDC converter for overlap angle $\mu<60^0$, $\mu=60^0$, $\mu>60^0$. Also show the number of valves conducting, state which conduction is normal, rare and abnormal. 10
a) Investigate what happens if current margin is not given and when it is very narrow 10

5. a) Discuss problems related to 'Ground return' 10
b) Describe 'Power reversal in HVDC' 10

6. a) Evaluate different faults and protections in HVDCT 10
b) Derive equations of fundamental current and rms current drawn by 6-pulse converter and the equation to decide converter transformer rating 10

Duration:- Three Hours **Total Marks : 80**

NOTE
1. Question No 1 is Compulsory.
2. Solve any three out of the remaining.
3. Figure to the right side indicates marks.
4. Assume the suitable data and mention the same if required

Q No 1Answer the following questions

a. Why the operating flux density is different in transformer and induction motor [5]

b. Why different types of mechanical forces are developed in the transformer. [5]

c.Why rotor voltage level is restricted in design of wound rotor for induction motor. [5]

d. Which factors decide the selection of insulation for a machine [5]

Q No 2a Derive the output equation for a three phase and single phase transformer. [10]

Q No 2b Draw a figure showing the main dimensions of a three phase core type transformer and hence the equations [10]

Q No 3a Derive the output equation for a three phase induction motor. [10]

Q No 3b Discuss the various factors affecting the choice of specific electric loading in induction motor. [10]

Q No 4a Derive the equation for leakage reactance of parallel sided slot. [10]

Q No 4b Discuss the designing of Squirrel cage rotor of an induction motor. [10]

Q No 5a Derive the equation for per unit leakage reactance of a two winding core type transformer. [10]

Q No 5b Discuss the design criteria for energy efficient induction motor. [10]

Q No 6a Discuss the designing of LV winding in transformer [10]

Q No 6b Discuss the impact of B60 concept on computation of performance parameters of induction motor. [10]

(3Hrs) **Total Marks:-80**

NB

1. Question No.1 is compulsory.
2. Attempt any three questions from remaining.
3. Use semi log paper where necessary.
4. Assume suitable data wherever necessary.

Q.1 Attempt any four questions.

a. Draw bode plot of lag compensator, why it is called as lag compensator? [5]

b. Explain scan cycle of execution in PLC. [5]

c. Explain reverse acting controller. [5]

d. Explain how digital compensator can be designed from s-plane. [5]

e. Explain configuration of observer? [5]

f. How many words are occupied by counter instruction in the counter file? [5]

Q.2

a. Find value of gain K for unity feedback system for transfer function given by $G(s) = \frac{K}{s(s+36)(s+100)}$ for 20% Overshoot. [10]

b.Consider a plant G(s) = 1 /(s(s+3)(s+7) whose state variables are not defined. Design an observer for OCF to yield transient response described by ζ=0.4 and ω_n= 75 rad/sec. [10]

Q. 3

a.Design an integral controller to yield a 10% overshoot and settling time of 0.5 second and zero steady state error for step input for following plant

$$\dot{X} = Ax + Bu \text{ And } Y = Cx$$

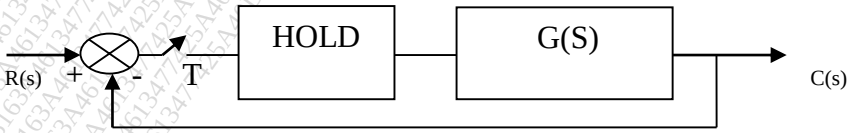
$$A = \begin{bmatrix} -2 & 1 \\ 0 & -5 \end{bmatrix}, B = \begin{bmatrix} 0 \\ 1 \end{bmatrix}, C = [1 \quad 1]$$ [10]

b.Prove that the transform of sampled output is the product of the transform of the sampled input and pulse transfer function of the system and thus derive transfer function of the system. [10]

Q.4

a. Explain the integral windup and anti-wind up circuit. [10]

b. For step and ramp input find the steady state error for unity feedback system shown in figure with sampling time interval "T=0.1 seconds" where for $G(S) = \frac{10}{S(S+1)}$. [10]



Q.5

a. Develop a flow chart for a digital compensator defined by

$$G_C(Z) = \frac{X(Z)}{E(Z)} = \frac{Z+0.5}{Z^2-0.5Z+0.7}$$ [10]

b. Explain different input and output field devices of PLC? [10]

Q.6

a. Explain what is three term PID controller. [10]

b. Write short note on any one. [10]

i) Memory unit of PLC.

ii) Arithmetic Instructions of PLC ladder programming.

iii) Counter instructions in PLC ladder programming.

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(3 Hours) **[Total Marks : 80]**

N.B : (1) Question **No 1 is compulsory.**

(2)Attempt **any three** out of the remaining.

(3)Assume **suitable data**, if necessary.

Q1 Attempt **any four**. (20)

(a) Explain the Properties of SF6 gas as good gaseous dielectrics

(b) What is primary ionization process.

(c) What are testing transformers.

(d) Explain the test done for insulation resistance.

(e)Explain treeing phenomenon in solid dielectrics.

Q2(a) What do you mean by pure and commercial liquids? Explain the conduction and Breakdown in Pure liquids. (10)

(b) A steady current of 400μamp flows through flat electrodes separated by distance of 5mm,when voltage of 10kv is applied. Determine first ionization coefficient if current of 50μA flows when distance of seperation reduces to 1mm and field is kept contant as previous. Find γ (10)

3 (a) What do you mean by term partial discharge. Derive the derivation for void cavity present in solid dielectrics. (10)

(b) Explain with a neat diagram construction and working of Cockroff Walton voltage multiplier circuit. (10)

4 (a) Explain existence of uniform and nonuniform fields between two various shapes of electrodes. (10)

(b)State the various methods of High voltage DC and HV AC. (10)

5 (a) Explain power frequency voltage withstand test for bushings. (10)

(b) Explain corona discharge. (10)

6(a)State properties of good transformer oil. Explain with a neat diagram transformer oil test procedure. (10)

(b)Write a note on "Earthing of HV Laboratory". (10)
