Dept.: CSE (16th Batch, Section: B) CT-01 Total Marks:15 Time: 20 minutes

a. Draw the differentiator circuit using an op-amp hence derive the o/p equation. **05**

b. Design an op-amp circuit to perform the equation $Vo= 3V1 - 4V2 - 3\frac{dV3}{dt}$. **05**

c. Take a gate pulse waveform of amplitude +1V with time duration 0 to 1s. Now determine the o/p for an integrator circuit using op-amp for this gate pulse as a input (Let R=R ohm and C= 1/R ohm). **05**

Dept.: CSE (16th Batch, Section: B) CT-02 Total Marks:15 Time: 20 minutes

a. Write down the necessity of parallel condition and its conditions. **05**

b. Briefly describe the synchronous condenser. **05**

c. Determine the prime mover speed to generate 50Hz frequency in output when number of pole is 2 or 3. 05

1. Explain the types of DC generator. 8

A long-shunt compound generator delivers a load current of 50 A at 500 V and has armature, series field and shunt field resistances of 0.05 Ω, 0.03 Ω and 250 Ω respectively. Calculate the generated voltage and the armature current. Allow 1 V per brush for contact drop.

2. Explain the significance of back emf in DC motor. 7

A 220-V d.c. machine has an armature resistance of 0.5 Ω. If the full-load armature current is 20 A, find the induced e.m.f. when the machine acts as (i) generator (ii) motor.

1. Explain the losses in DC generator. 8

In a long-shunt compound generator, the terminal voltage is 230 V when generator delivers 150 A. Determine (i) induced e.m.f. (ii) total power generated and (iii) distribution of this power. Given that shunt field, series field, divertor and armature resistance are 92 Ω, 0.015 Ω, 0.03 Ω and 0.032 Ω respectively.

2. Explain the types of DC motor. 7

A 25-kW, 250-V, d.c. shunt generator has armature and field resistances of 0.06 Ω and 100 Ω respectively. Determine the total armature power developed when working (i) as a generator delivering 25 kW output and (ii) as a motor taking 25 kW input.

1. Explain the power stages of DC Motor. 8

The following information is given for a 300-kW, 600-V, long-shunt compound generator : Shunt field resistance = 75 Ω, armature resistance including brush resistance = 0.03 Ω, commutating field winding resistance = 0.011 Ω, series field resistance = 0.012 Ω, diverter resistance = 0.036 Ω. When the machine is delivering full load, calculate the voltage and power generated by the armature.

2. *A separately excited D.C. generator has armature circuit resistance of 0.1 ohm and the total brush-drop is 2 V. When running at 1000 r.p.m., it delivers a current of 100 A at 250 V to a load of constant resistance. If the generator speed drop to 700 r.p.m., with field-current unaltered, find the current delivered to load.* 7

- Explain the operating principle of three phase induction motor. (10)

- **A slip ring induction motor runs at *** (Last three digit of your ID) rpm at full load when connected to 50Hz supply. Determine the number of poles and slip. (5)**

- You're engineering a high-performance motor for a futuristic hovercraft. The stator of this **3-phase induction motor** has **3 slots per pole per phase**, and it operates at a supply frequency of **50 Hz**. (5)

  To optimize the design, you need to calculate:

1. The number of stator poles produced and the total number of slots on the stator.
2. The speed of the rotating stator magnetic field that will drive the hovercraft forward.

- Imagine you're designing a powerful induction motor to drive a high-tech cargo ship across the ocean. The motor operates at **440 V, 50 Hz**, and has **6 poles** in a **3-phase** system, with a power input to the rotor of **80 kW**. While testing, you observe that the rotor's electromotive force (EMF) completes **100 full alternations per minute**.

To ensure the motor runs at optimal efficiency, determine:

1. The slip percentage of the motor.
2. The rotor speed in revolutions per minute.
3. The rotor copper losses per phase.

- Illustrate the power flow diagram of the three phase induction motor.

Dept.: CSE (16th Batch, Section: B) **CT-05** **Total Marks:15** **Time: 20 minutes**

a.Draw an opamp based circuit to perform the $V_o = 3V_1 - \frac{d^2}{dt^2}V_2$. 10

b. Draw 4 different opamp circuit to get voltage buffer (vo=vi) 5