Time: 3 Hours **Total Marks: 80**

Q.1 is compulsory.

Solve ANY THREE questions out of remaining.

ASSUME SUITABLE DATA wherever necessary.

Q.1 **(20Marks)**

a) What is voltage regulation? Derive the condition for zero voltage regulation.

b) Explain the term 'all day efficiency' in case of transformer.

c) Explain any one connection from group no. 4 and 3 of transformer phasor group.

d) Explain the methods used to suppress harmonics in three phase transformer.

Q.2 **(20Marks)**

a) Explain effect of 'incorrect phase sequence' and 'phase difference' on parallel operation of three phase transformers.

b) Two three phase transformers connected in parallel supply a load requiring an active power of 800 kW and lagging reactive power of 600 kVAR. Transformer 1 is rated at 400 KVA and has p.u. impedance of $(0.01 + j0.06)$ ohm while transformer 2 is rated at 600 KVA and has p.u. impedance of $(0.01 + j0.05)$ohm. Determine active power shared by each transformer and operating power factor.

Q.3 **(20Marks)**

a) Write a short note on 'Scott Connection'.

b) A 5 KVA, 200/100 V, 50 Hz, single phase ideal two winding transformer is to be used to step up a voltage of 200 V to 300 V by connecting it like an auto transformer. Show the connection diagram to achieve this. Calculate the maximum kVA that can be handled by the auto-transformer (without over loading any of the HV and LV coil). How much of this KVA is transferred magnetically and how much is transferred by electrical conduction?

Q.4 **(20Marks)**

a) Derive relation of length of stamping and width of stampings to diameter of circumscribing circle for maximum core area in 'Cruciform core' type construction.

b) Calculate KVA output of 1 phase transformer using following data:
ratio of core height to distance between core center is 2.8, ratio of diameter of circumscribing circle to distance between core centers is 0.56, ratio of net iron area to area of circumscribing circle is 0.7, current density 2.3 A/mm^2, window space factor 0.27, flux density = 1.2 Wb/m^2, distance between core centers = 0.4m.

Q.5 **(20Marks)**

a) Draw neat labeled phasor diagram for current transformer and potential transformer.

b) A 300 KVA, 11000/440 V, three phase transformer connected in delta-star fashion has

distance between core centers as 0.36 m, window height = 44 cm, height of yoke = 17 cm, total weight of magnetic frame = 700 Kg, average specific iron loss = 2.1 W/Kg, outer diameter of HV winding = 35 cm, resistance of LV and HV windings per phase are 0.0047 Ω and 9.74 Ω respectively. Determine number of cooling tubes required if temperature rise is not to exceed 35^0 C. Assume length wise clearance of 8cm, widthwise clearance of 10cm and height wise clearance of 45cm.

Q.6 **(20 Marks)**

a) Write short note on mechanical forces in transformer.

b) Determine main dimensions of a 1250KVA 33/6.6KV, 50 Hz, 3 phase core type power transformer based on following information

Maximum flux density=1.5 tesla, current density = 2.5 A/mm^2, window space factor=0.21, assume 3 stepped core, ratio of height of window to width of window is 3, emf per turn is 12.5V.
