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Total Number of Pages: 02

Integrated Dual Degree (B.Tech and M.Tech)

Sub\_Code: REL4C002/REE4C002

4<sup>th</sup> Semester Regular/Back Examination: 2023-24

SUBJECT: Electrical Machines-I

BRANCH(S): ELECTRICAL, EEE, EE

Time: 3 Hour

Max Marks: 100

Q.Code: P315

Answer Question No.1 (Part-1) which is compulsory, any eight from Part-II and any two from Part-III.

The figures in the right hand margin indicate marks.

**Part-I**

**Q1 Answer the following questions:**

**(2 x 10)**

- What is the voltage regulation of a transformer?
- What is the difference between lap and wave winding?
- What is the purpose of interpoles and compensating windings in dc machines?
- Define Biot Savart Law.
- Draw the open circuit characteristic of a separately excited DC generator.
- What are the conditions for the voltage build-up in a shunt generator?
- What is Ampere Law?
- What is commutation in DC machine?
- Define flux, reluctance, and inductance of the magnetic circuit.
- A single-phase transformer when supplied from 200 V, 50 Hz has eddy current loss of 50 W. If the transform is connected to a voltage 300 V, 50 Hz, what will be the eddy current loss?

**Part-II**

**Q2 Only Focused-Short Answer Type Questions- (Answer Any Eight out of Twelve)**

**(6 x 8)**

- By using a phasor diagram explain the Scott connection of the transformer.
- The efficiency of a 500 KVA, 110/220 V, 50 Hz, single-phase transformer is 98.5% at half load at 0.85 pf leading and 98.8% at full-load upf. Determine (I) iron loss (II) Full-load copper-loss
- Explain the Open delta (V) connection and draw the necessary diagram.
- Explain how to separate the hysteresis and eddy current losses in 1 phase transformer.
- Explain different types of cooling systems used in Transformer.
- Explain the Parallel operation of 3-phase transformers.
- Explain the inrush current of the transformer during the starting condition.
- Derive the EMF equation of the DC generator.
- Derive the torque equation of the DC machine.

- j) Explain the open circuit test and find out the  $R_o$  and  $X_m$  of the transformer.
- k) Derive the torque equation as a partial derivative of stored energy concerning the angular position of a rotating element.
- l) The 2000/200 V, 20 kVA transformer is connected as a step-up auto-transformer. The 200 V winding has enough insulation to withstand 2200 V to ground. Calculate: (i) The LV and HV side voltage ratings of the autotransformer (ii) its kVA rating (iii) kVA transferred inductively and conductively.

### Part-III

#### Only Long Answer Type Questions (Answer Any Two out of Four)

- Q3** Draw the equivalent circuit, approximate equivalent circuit, and the phase diagram of the transformer. **(16)**
- Q4** Explain neutral floating of 3phase Y Y connection? What is the remedy to overcome the problem? **(16)**
- Q5** A 400 KVA load at 0.7 power factor lagging is supplied by three single-phase transformers connected in Delta-Delta. Each of the Delta-Delta transformers is rated at 200 KVA, 2300/230 V. If one defective transformer is removed from service, calculate for the V-V connection;  
I. The KVA load carried by each transformer, II. Percent rated load carried by each transformer, III. Total KVA ratings of the transformer bank V-V, IV. Ratio of V-V bank to Delta-Delta bank transformer ratings, V. Percent increases in load on each transformer when one transformer is removed. **(16)**
- Q6** What is the armature reaction of the DC machine? Explain the cross-magnetization and demagnetization effect. **(16)**