

Total Pages : 6

B. Tech - 3rd (EE/EEE)

Electrical Machines - I

Full Marks : 50

Time : 2 : 30 hours

Answer **all** questions.

*The figures in the right-hand margin
indicate marks.*

Symbols carry usual meaning.

Any supplementary materials to be provided.

1. Answer *all* questions.

2 × 5

(a) Why transformer rating is expressed in terms of kVA ?

(b) Name of the various parts of a D.C. machine. Explain the construction of any one part.

(Turn Over)

(c) Define critical field resistance and critical speed of a D.C. shunt generator.

(d) Why D.C. series motor should not be started at no load.

(e) Draw with relevant circuit and emf phasor diagram of a Y- Δ 3-phase transformer connection.

2. A 200 kVA, 1-phase transformer has an efficiency of 98% at full load. If the maximum efficiency occurs at $\frac{3}{4}$ full load, calculate the

8

(i) Iron losses

(ii) Copper losses at full load,

(iii) Efficiency at half full load and

(iv) Efficiency at $\frac{1}{5}$ full load.

Assume a p.f of 0.8 at all loads.

Or

What is voltage regulation of a transformer ? Derive the conditions for maximum and zero voltage regulation in a transformer. Also derive expression for maximum efficiency of a 1-phase transformer and for load at maximum efficiency. 8

3. Explain the effect of armature reaction in a D.C. shunt generator. How are its demagnetizing and cross magnetizing ampere turn calculated. 8

Or

A 6-pole, 120kW, 500V, wave wound DC shunt generator has 756 armature conductors. The shunt field resistance 50Ω when delivering full load the brushes are displaced from the geometrical neutral axis by 24° electrical degrees. Find the demagnetizing ampere turns/pole and cross magnetizing ampere turns/pole. Also determine the number of additional shunt field turns required to neutralize the demagnetizing effect. 8

4. A 230V DC shunt generator has a full load current of 150A. Its armature and field resistances are 0.1Ω and 230Ω respectively. The stray losses are 1500W. Find the 8

- (i) Prime mover output in kW, when the generator is on full load,
- (ii) Full load efficiency, and
- (iii) load current at which generator efficiency is maximum.

Or

What is compound generator? Draw the external characteristics of over, level and under compounded generators and explain. 8

5. A 200 V, DC series motor runs at 750 rpm when taking a current of 30 A. The resistance of the armature is 0.5Ω and field is 0.3Ω . If the current remains constant, calculate the resistance necessary to reduce the speed to 250 rpm. 8

Or

What are advantages of Hopkinson's test over Swinburne's test and what are its limits. 8

6. A 3-phase step-down transformer is connected to 6600V mains and it takes 20A. Calculate the secondary line voltage, line current and output for the following connections. 8

- (i) Y-Y
- (ii) $\Delta - \Delta$
- (iii) Y- Δ
- (iv) Δ -Y

Turns ratio per phase is 10.

Or

Draw the Phasor diagrams and winding connection of three-phase transformer for : 8

- (i) Phase displacement of zero degrees

- (ii) Phase displacement of -30 degrees
 - (iii) Phase displacement of +30 degrees
 - (iv) Phase displacement of 180 degrees
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