

Following Paper ID and Roll No. to be filled in your Answer Book)

PAPER ID : 2049

Roll No.

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B. Tech.

(SEM. IV) THEORY EXAMINATION 2010-11

ELECTRICAL MACHINES

Time : 3 Hours

Total Marks : 100

Note : Attempt all questions.

1. Attempt any **four** parts of the following : **(5×4=20)**
 - (a) Define an autotransformer. Distinguish clearly the difference between a resistive potential divider and autotransformer.
 - (b) What are the distinguishing features of Y-Y, Y-Δ, Δ-Y and Δ-Δ, 3 phase connections ? Compare their advantages and disadvantages.
 - (c) Why the condition of correct polarity is the most important and essential condition for parallel operation of transformers ?
 - (d) Define all-day efficiency in power transformer. For which type of transformers, all-day efficiency is important and why ?
 - (e) Draw the Scott connection of transformers and also mark the terminals and turn ratio. What are the applications of Scott connection ?

uptuonline.com (f) What are the disadvantages of current and voltage harmonics in transformer ? Explain how these harmonics can be eliminated ? uptuonline.com

2. Attempt any **two** parts of the following : (10×2=20)

- (a) Draw a neat diagram of dc shunt motor starter. How can the values of resistance elements be calculated ? Explain the function of Overload release and No-volt release coils ?
- (b) Derive an equation for induced emf of a dc machine. Which quantities are constant in the emf equation ?
- (c) A 4 Pole series wound fan motor has a speed of 600 rpm, when fed from 250 V dc mains and input current is 20A. The field coils are all in series. The load torque increases as the square of speed. The field coil are now connected in two parallel groups of two each. Find the speed and input current. Ignore losses. Assume that flux is proportional to current.

3. Attempt any **two** parts of the following : (10×2=20)

- (a) Derive the equation for torque developed by an induction motor. Draw a typical torque-slip curve and deduce the condition for maximum torque.
- (b) A 4-pole, 50 Hz, 3-phase induction motor develops a maximum torque of 110 N-m at 1360 rpm. The resistance of the Star-connected rotor is 0.25 Ω /phase. Calculate the

value of resistance that must be inserted in series, with each rotor phase to produce a starting torque equal to half the maximum torque.

- (c) Discuss briefly the various methods of speed control of 3 phase cage rotor and wound rotor induction motor.

4. Attempt any **two** parts of the following : **(10×2=20)**

- (a) Describe different methods of cooling of alternators. What are the advantages of hydrogen gas as a cooling medium as compared to air ? What special precautions should be taken for hydrogen cooled alternators ?
- (b) A 150 KVA, 3-phase, Star-connected 6.6 kV, 8 Pole, 50 Hz synchronous generator has a reactance of 0.6 pu and negligible resistance. Calculate the synchronizing power per mechanical degree at full load and 0.8 power factor lagging.
- (c) Explain with neat sketch the principle of operation of a 3 phase synchronous motor. Also explain why it will not run at other than synchronous speed ?

Attempt any **two** parts of the following : **(10×2=20)**

- (a) Write short notes on the following :
- (i) Starting of single phase induction motor
 - (ii) Capacitor motors
 - (iii) Shaded pole motor
 - (iv) Universal motor.

- (b) Draw and explain the equivalent circuit of a single-phase induction motors on the basis of double-revolving field theory. Also draw torque-slip characteristics of it.
- (c) A Universal series motor has a resistance of $30\ \Omega$ and an inductance of $0.5\ \text{H}$. When connected to a $250\ \text{V}$ dc supply and loaded to draw $0.8\ \text{A}$ current it runs at $2000\ \text{rpm}$. Determine the speed, torque and power factor, when connected to a $250\ \text{V}$, $50\ \text{Hz}$ ac supply and loaded to draw the same current.