Printed Pages : 4

NEE-301

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

PAPER ID : 121312

Roll No. | | | | | | | | | |

B. Tech.

(SEM. III) (ODD SEM.) THEORY EXAMINATION, 2014-15

ELECTRO-MECHANICAL ENERGY CONVERSION – I

Time : 3 Hours] [Total Marks : 100

1 Attempt any **four** parts : 5×4=20

(a) Explain how flow of energy takes place in electromechanical device.

(b) The magnetic flux density on the surface of an iron face is 1.6 T which is a typical saturation level value for ferromagnetic material. Find the force density on the iron face.

(c) Derive the expression for magnetic torque and force developed in doubly excited system.

(d) Describe in detail account on energy stored in magnetic system.

(e) Draw the circuit and explain the concept of a doubly excited magnetic system.

(f) Define energy and Co-energy.

2 Attempt any **two** parts : 10×2=20

(a) Discuss in detail the phenomenon of commutation in dc machines and also explain the methods adopted to improve commutation.

(b) Explain the effects of armature reaction on the operation of a dc machines. How the effects of armature reactions can be minimized?

(c) Derive an expression for the emf generated in the armature winding of a dc machine.

3 Attempt any **two** parts : 10×2=20

(a) A 15 kW, 250 V, 1200 rpm, shunt motor has 4 poles, 4 parallel armature paths and 900 armature conductors. Assume $R_a = 0.2\,\Omega$. At rated speed and rated output the armature current is 75 A and $I_f = 1.5$A.

Calculate :

(i) the flux/pole

(ii) the torque developed

(iii) Rotational losses

(iv) Efficiency

(v) the shaft load.

(b) Derive an expression for the torque developed in the armature of a d.c. motor.

(c) A 250 V d.c. shunt motor has a shunt field resistance of $200\,\Omega$ and an armature resistance of $0.3\,\Omega$. for given load, motor runs at 1500 r.p.m. drawing a current of 22 A from the supply. If a resistance of $150\,\Omega$ is added in series with the field winding, find the new armature current and the speed. Assume load torque constant and magnetization curve to be linear.

4 Attempt any **two** parts : **10×2=20**

(a) The parameters of the equivalent circuit of a 150 kVA, 2400/240V transformer are : $R_1 = 0.2\,\Omega$, $R_2 = 2 * 10^{-3}\,\Omega$, $X_1 = 0.45\,\Omega$, $X_2 = 4.5 * 10^{-3}\,\Omega$, $R_i = 10\,k\Omega$, $X_m = 1.6\,k\Omega$ (as seen from 2400V side).

Calculate :

(i) Open circuit current, power and power factor when LV is excited at rated voltage.

(ii) The voltage at which the HV should be excited to conduct a short circuit test (LV shorted) with full load current flowing. What is the input power and is Power factor?

(b) A 500 kVA transformer has an efficiency of 95% at full load and also at 60% of full load; both at Unity Power Factor.

(i) Separate out the losses of the transformer.

(ii) Determine the efficiency of the transformer at $3/4^{th}$ full load.

(c) A 400/100V, 10kVA, 2-winding transformer is to be employed as an autotransformer to supply a 400 V circuit from a 500 V source. When tested as a 2-winding transformer at rated load, 0.85 Power factor lagging, its efficiency is 0.97%.

(i) Determine its kVA rating as an autotransformer.

(ii) Find its efficiency as an autotransformer.

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