BTS (C) – IV – (S) – 07 – 005 (K)

B. Tech Degree IV Semester (Special Supplementary) Examination, March 2007

EE 405 ELECTRICAL MACHINES I

(1999 Admissions Onwards)

Time : 3 Hours Maximum Marks : 100

(All questions carry ***EQUAL*** marks)

I. (a) What is the principle of operation of a dc generator? Why is a commutator and brush arrangement necessary for the operation of a dc generator?

(b) A 4 pole lap wound shunt generator supplies to 50 lamps of 100 watts, 200 V each. The field and armature resistances are 50Ω and 0.2Ω respectively. Allowing a brush drop of 1V per each brush, calculate the following : (i) Armature current (ii) Current per path (iii) Generated emf.

OR

II. (a) Derive the emf equation of a dc generator.

(b) A 4 pole generator supplies a current of 143 A. It has 492 armature conductors – (i) wave wound (ii) lap wound. When delivering full load, the brushes are given an actual lead of 10^{o}. Calculate the demagnetizing ampere-turns per pole. The field winding is shunt connected and take 10 A. Find the number of extra shunt field turns to neutralize the demagnetization.

III. (a) Enumerate the reasons which cause terminal voltage under load conditions to be different from the terminal voltage under no load conditions for dc shunt generator.

(b) A separately excited dc generator running at 1000 rpm gave the following o c c :-

Field current (A)	-	1.2	2.4	3.6	5.0	6.2	7.4
EMF (V)	-	140	280	375	440	490	520

Calculate –

(i) The voltage developed when the machine is excited as a shunt generator with a field resistance of 80Ω at 1000 rpm.

(ii) The speed at which the machine just fails to excite.

(iii) The additional resistance which should be inserted in the field circuit to reduce the voltage to 360 V at 1000 rpm.

OR

IV. (a) Draw and explain the external characteristics of shunt, series and compound generators.

(b) Two DC shunt generators with emfs of 120 V and 115 V, armature resistances of 0.05Ω and $.04\Omega$ and field resistances of 20Ω and 25Ω respectively are in parallel supplying a total load of 25 KW. How do they share the load?

V. (a) Draw the characteristics of dc shunt and series motors. Use these curves to explain the applications for which these motors are used.

(Turn Over)

(b) A 4 – pole 250 V, wave connected shunt motor gives 10 KW when running at 1000 rpm and drawing armature and field currents of 60 A and 1 A respectively. It has 560 conductors. Its armature resistance is 0.2 Ohm. Assuming a drop of 1 V per brush. Calculate –

(i) Total torque (ii) Useful torque
(iii) Useful flux/pole (iv) Rotational losses
(iv) Efficiency.

OR

VI. (a) Describe how a swin burne's test is conducted on DC machines. State its advantages and disadvantages.

(b) A 10 KW, 240 V, dc shunt motor draws a line current of 5.2 A while running at no load speed of 1200 rpm from a 240 DC supply. It has an armature resistance of 0.25Ω and a field resistance of 160Ω. Estimate the efficiency of the motor when it delivers rated load.

VII. (a) Draw the phasor diagram of the transformer on lagging pf load and explain it.

(b) The high voltage and low voltage winding of a 2200/220 V single phase 50 Hz transformer has resistances of 4.8Ω and 0.04Ω and reactances 2Ω and 0.018Ω respectively. The low voltage winding is connected to a load having an impedance of $(6+j4)\Omega$. Determine –

(i) Current in l.v. winding and h.v. winding
(ii) Load voltage
(iii) Power consumed by the load.

OR

VIII. (a) Develop the equivalent circuit of a single phase transformer.

(b) A single phase transformer is connected to a 230 V, 50 Hz supply. The net cross sectional area of the core is 60 cm^2. the number of turns in the primary is 500 and in the secondary is 100. Determine : (i) Transformation ratio (ii) Emf induced in the secondary winding (iii) Maximum value of flux density in the core.

IX. (a) Explain with circuit diagrams, the open circuit and short circuit tests to be carried out in the laboratory for the determination of parameters of a single phase transformer.

(b) The following readings were obtained from OC and SC tests on 8 KVA 400/120 V 50 Hz transformer :

OC test : 120 V, 4 A, 75 W
SC test : 9.5 V, 20 A, 110 W.

Calculate - (i) Voltage regulation and efficiency for 0.8 pf lagging, full load
(ii) The efficiency at half full load 0.8 pf lagging load.

OR

X. (a) Write short notes on :

(i) Y – Y connections
(ii) V – V connection.

(b) Two single phase transformers with equal turns have impedance of $(0.6+j4)$ and $(0.8+j10)\Omega$ with respect to the secondary. If they operate in parallel determine how they will share total load of 120 KW at 0.8 pf lagging.

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