BIRLA INSTITUTE OF TECHNOLOGY, MESRA, RANCHI
(END SEMESTER EXAMINATION)

CLASS: MTECH/PRE-PHD **SEMESTER : I / NA**
BRANCH: EEE **SESSION : MO/18**

SUBJECT: EE521 DYNAMIC BEHAVIOR OF ELECTRICAL MACHINES

TIME: 3:00 HRS. **FULL MARKS: 50**

INSTRUCTIONS:
1. The question paper contains 5 questions each of 10 marks and total 50 marks.
2. Attempt all questions.
3. The missing data, if any, may be assumed suitably.
***4*. Before attempting the question paper, be sure that you have got the correct question paper.**
5. Tables/Data hand book/Graph paper etc. to be supplied to the candidates in the examination hall.

Q.1(a) Outline taxonomy of electrical machines. Elucidate: Linear Transformation and Coenergy. [5]
Q.1(b) Derive an expression for energy stored in a magnetic field. Describe Kron's Model. [5]

Q.2(a) Why BLDC motor is gaining ground in modern world? Highlight applications of a three phase synchronous motor. [5]
Q.2(b) Apply Two Reaction Theory to draw phasor diagram of salient pole synchronous motor for leading power factor and derive expression for tanδ. Where δ is load angle of machine. [5]

Q.3(a) Two coupled coils have self and mutual inductance of $L_{11}=2+1/2x$: $L_{22}=1+1/2x$; $L_{21}=L_{21}=1/2x$ over the certain range of linear displacement x. Find the time value of time average force at x=0.5, if both coils are connected in parallel and fed from 100sin314t volts supply. [5]
Q.3(b) For a steady –state balanced operation with $i_\alpha=I\cos(\omega t+\alpha)$ and $i_\beta=I\sin(\omega t+\Phi)$, determine the primitive coil current i_d and i_q and show that these are steady dc values. [5]

Q.4(a) The stator of a three phase, 10 pole, synchronous generator consists of double layer sinusoidal distributed winding in 72 slots. The phase sequence is ABC. Find pole pitch and slot angle. Develop Coil Group Table. [5]
Q.4(b) A separately excited 220V, 1400rpm dc motor. It has inertia of motor and load 10kgm^2. Coefficient of friction is zero. Also it has Ra=1ohm and La=1mH. Kv= 1 Develop transfer function for close control. [5]

Q.5(a) A 3- phase induction motor has maximum torque 4-times the starting torque. The power output at maximum torque is 12kW. The inertia of rotating parts is 2kgm^2. The shaft is unloaded and DOL starter is employed. Estimate the time to accelerate this motor from rest to 1440rpm. [5]
Q.5(b) Compare induction and synchronous machine in order to validate its applications. Stepper motor is a variable reluctance motor. Justify with suitable sketch. [5]

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