

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

CLASS: MTECH
BRANCH: EEE

SEMESTER : I
SESSION : MO/19

SUBJECT: EE521 DYNAMIC BEHAVIOUR OF ELECTRICAL MACHINES

TIME: 3.00Hrs.

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.
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- Q.1(a) Elucidate following terms with suitable figures: Dynamics of Electric Machines, Co-energy, Field Oriented Control, Power Invariance and Time constant. [5]
- Q.1(b) Which is the best electric machine and why? Why Induction motor is called Horse Power of industry? [5]
- Q.2(a) A dc series motor has an emf constant 2.4Vs/rad . The motor is fed from 2-pulse rectifier whose firing angle is $\pi/3$ rad. The rectifier is connected to 200V, 50Hz single phase balanced supply. The motor is controlled by armature voltage via triggering angle. The machine has $R_{se} + R_a = 1\text{ohm}$, and $L_{se} + L_a = 0.4\text{H}$. The inertia constant of motor and load is 2kgm^2 . The B is zero. Draw power circuit and Load voltage profile, supply current with respect to input voltage. Determine dc value of output voltage for $\alpha = \pi/3\text{rad}$. [5]
- Q.2(b) To analyse its speed for step armature voltage, draw control block diagram to develop its Transfer function. [5]
- Q.3(a) Apply Park transformation in order to transform 3 phase stator current to d-q axis stator current. What is its significance? [5]
- Q.3(b) A 3 phase, 6 pole and 50Hz induction motor has ratio of maximum to starting torque is 2. The power output is 48kW. Estimate the time required to accelerate this motor from rest to 950rpm in case inertia of motor and load is 8kgm^2 . The DOL starter is used and shaft is unloaded. [5]
- Q.4(a) Develop expression for armature to field mutual inductance and armature self inductance for a salient pole synchronous machine. Also write dynamic voltage equation for phase A if phase sequence is ABC. [5]
- Q.4(b) Design a suitable converter for electric drive in power electronics lab. Mention the components. Give power and firing circuit. Draw load voltage, current wrt input voltage as well as firing pulses. [5]
- Q.5(a) Validate performance of BLDC motor with circuit and phasor diagram. Why three phase CSI has been chosen in implementation of BLDC motor? [5]
- Q.5(b) Choose a IGBT converter for 8/6 pole SRM and describe its operation. Evaluate its performance in regenerative mode with variable inductance, phase current and motor torque waveforms. [5]

:::06/12/2019E:::