CLASS: MTECH   SEMESTER : II
BRANCH: EEE   SESSION : SP/22

SUBJECT: EE559 Electric Drives

TIME: 2Hrs   FULL MARKS: 50

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

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1. Draw the block diagram of an electrical drive. Give a classification of different types of load torques.   [5 marks]

2. The motor operates on a periodic duty cycle in which it is clutched to its load for 10 mins and declutched to run on no load for 20 mins. Minimum temperature rises 40°C. Heating and cooling time constants are equal and have a value of 60 mins. When load is declutched continuously temperature rises 15°C. a) During the duty period, at what maximum temperature motor is running? b) When load is clutched continuously, what is the steady state temperature?   [5 marks]

3. Derive transient analysis of separately excited motor with armature control. [5 marks]

4. A 220V, 970rpm, 100A dc separately excited motor has an armature resistance of 0.05Ω. It is rated by plugging from an initial speed of 1000rpm. Calculate a) resistance to be placed in armature. b.) Braking torque.   [5 marks]

5 Explain current controlled voltage fed inverter drive along with block diagram and characteristics curve   [5 marks]

6. A 440V, 50Hz, 6-pole, 950rpm, Y-connected induction motor has following parameters referred to the stator: $R_s= 0.5\Omega$, $R_r'=0.4\Omega$, $X_s=X_r'=1.2\Omega$, $X_m=50\Omega$. Motor is driving a fan load torque of which is given by $T_L=0.0123\omega_m^2$. Now one phase of the motor fails, calculate motor speed and current.   [5 marks]

7. Draw the principle of vector control of induction machine block diagram? Elucidate about the direct or feedback vector control?   [5 marks] .

8. A 440V, 50Hz, 6-pole, Y-connected wound rotor induction motor has the following parameters: $R_s= 0.5\Omega$, $R_r'=0.4\Omega$, $X_s= X_r'=50\Omega$. Stator to rotor turns ratio is 3.5. Motor is controlled by static rotor resistance control. External resistance is chosen such that the breakdown torque is produced at standstill for a duty of zero. Calculate the value of external resistance. How duty ratio should be varied with speed so that the motor accelerates at maximum torque.   [5 marks]

9. State unique features of self-controlled synchronous machine which makes it different from DC motor   [5 marks].

10. A 500 kW, 3-phase, 3.3 kV, 50 Hz, 0.8 (lagging) power factor, 4 pole, star-connected synchronous motor has following parameters: X, = 15 Q, R, = 0. Rated field current is 10 A. Calculate(i) Armature current and power factor at half the rated torque and rated field current. (ii) Field current to get unity power factor at the rated torque.   [5 marks].

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