USN | | | | | | | | | | |

10EE74

Seventh Semester B.E. Degree Examination, July/August 2021
Industrial Drives and Applications

Time: 3 hrs. Max. Marks:100

Note: ***Answer any FIVE full questions.***

1 a. With basic block diagram, explain the essential parts of electric drive. **(06 Marks)**

b. Prove that the operating point of a motor will be stable when $\frac{dT_\ell}{dw_m} > \frac{dT}{dw_m}$ when Δw_m approaches zero as t approaches infinity. **(07 Marks)**

c. A motor is required to drive the take-up roll on a plastic strip line. The mandrel on which the strip is wound is 15cm in diameter and the strip build upto a roll 25cm in diameter. Strip tension is maintained constant at 1000N. The strip moves at a uniform speed of 25m/s. The motor is coupled to a mandrel by a reduction gear with a = 0.5. The gear have an approximate efficiency of 87% at all speeds. Determine the speed and power rating of the motor required for this application. **(07 Marks)**

2 a. Obtain the expression for the rise in temperature of a motor on load using thermal model of the motor. **(06 Marks)**

b. Explain the different methods to determine the motors rating for fluctuating and intermittent loads. **(07 Marks)**

c. The outer surface of a 12hp (8.82kw) total enclosed motor is equivalent to a cylinder of 65cm diameter and 1m length. The motor weights 400kg, the material having a specific heat of 700J/kg/°C. The outer surface is capable of dissipating heat at the rate of 12.5W/m^2/°C. Find the final temperature rise and the thermal time constant of the motor when operating at full load with an efficiency of 90%. **(07 Marks)**

3 a. Explain the transient analysis of separately excited dc motor with armature control using its dynamic equivalent circuit. **(06 Marks)**

b. Explain with neat circuit diagram and waveform the operation of a single phase half controlled rectifier control of separately excited dc motor for continuous conduction and obtain the equation for speed. **(08 Marks)**

c. A 220V, 970rpm, 100A dc separately excited motor has an armature resistance of 0.05Ω. It is braked by plugging from an initial speed of 1000rpm. Calculate: i) Resistance placed in the armature circuit to limit braking current to twice the full load value ii) Braking toque iii) Torque when speed has fallen to zero. **(06 Marks)**

4 a. Obtain the speed torque relationship for a chopper controlled separately excited dc motor drive in its motoring operation. For different duty ratio draw the speed-torque characteristics during motoring. **(07 Marks)**

b. Explain the four quadrant operation of a dc separately excited motor employing single fully controlled rectifier with a reversing switch. **(06 Marks)**

c. A 220V, 1500rpm, 50A separately excited motor with armature resistance of 0.5Ω is fed from a 3-phase fully controlled rectifier. Available ac source has a line voltage of 440V, 50Hz. Determine the value of firing angle when:
i) Motor is running at 1200rpm and rated torque.
ii) Motor is running at -800rpm and twice the rated torque.
The motor terminal voltage equals rated voltage when converter firing angle is zero. **(07 Marks)**

5 a. Which are the different starters employed for starting an induction motor? Explain Star-Delta starter. **(06 Marks)**

b. From the equation for transient operation of an induction motor drive show that starting time t_s is a function of slip at maximum torque. **(07 Marks)**

c. A 400V, star connected, 3 phase, 6 pole, 50Hz induction motor has following parameters referred to the stator: $R_s = R'_r = 1\Omega$, $X_s = X'_r = 2\Omega$. For regenerative braking operation of this motor determine the maximum overhauling torque it can hold and range of speed for safe operation. **(07 Marks)**

6 a. Explain with waveforms how variable supply frequency is obtained to control induction motor drive using VSI employing transistors. **(07 Marks)**

b. With a neat diagram, explain the current source inverter fed inductance motor drive. **(07 Marks)**

c. Show that a variable frequency induction motor drive, develops at all frequencies the same torque for a given slip-speed when operating at constant flux. **(06 Marks)**

7 a. Obtain the equation showing the variation of power angle 'δ' with time to determine the dynamic stability of synchronous motor-load system. **(06 Marks)**

b. With neat figure explain the variable frequency control of multiple synchronous motors. **(07 Marks)**

c. Explain how the effects of harmonics are reduced in high power synchronous motor drive. **(07 Marks)**

8 a. Explain the weaving mill and write about the machine drives used in the mill. **(06 Marks)**

b. Write a short notes on any two of the following:
   i) Steel rolling mill
   ii) Cement mill
   iii) Paper mill. **(14 Marks)**

* * * * *