CBCS SCHEME

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18EE741

Seventh Semester B.E. Degree Examination, Dec.2024/Jan.2025
Industrial Drives and Application

Time: 3 hrs. Max. Marks: 100

Note: *Answer any FIVE full questions, choosing ONE full question from each module.*

Module-1

1 a. Explain clearly different components of load torque with its characteristics. **(06 Marks)**

b. Explain the speed torque conventions and multi-quadrant operation on a motor. **(08 Marks)**

c. What are the advantages of electrical drives? **(06 Marks)**

OR

2 a. Obtain expression for equivalent moment of inertia and load torque of a motor drive with rotational motion loads. **(06 Marks)**

b. With a neat diagram explain closed-loop torque control closed-loop speed control. **(08 Marks)**

c. A drives has the following parameters :
$J = 10$ Kg-m^2, $T = 100\text{-}0.1N$, N-m, passive load torque $T_\ell = 0.05N$, N-m where N is the speed in rpm. Initially the drive is operating in steady-state. Now it is to be reversed. For this motor characteristics is changed to $T = -100\text{-}0.1N$, N-m. Calculate the time of reversed. **(06 Marks)**

Module-2

3 a. Explain the operation of single-phase fully controlled rectifier control of DC separately excited motor with continuous conduction. **(08 Marks)**

b. Explain Field current reversal in multi-quadrant operation and dc separately excited motor. **(06 Marks)**

c. A 200V, 875 rpm, 150 A separately excited dc motor has an armature resistance of 0.06Ω. It is fed from a single phase fully controlled rectifier with an ac source voltage of 220V, 50Hz. Assuming continuous conduction. Calculate :
i) Firing angle for rated motor torque and 750 rpm
ii) Motor speed for $\alpha = 160^\circ$ and rated torque **(06 Marks)**

OR

4 a. Expl ain the rectifier control of dc series motor and draw its speed torque curves. **(08 Marks)**

b. Explain the chopper control of separately excited dc motor for regenerative braking. **(06 Marks)**

c. A 220V, 1500 rpm, 50 A superlatively excited motor with armature resistor of 0.5Ω is fed from a 3 phase fully controlled rectifier. Available ac source has a line voltage of 440 V, 50 Hz. Determine the value of firing angle when
i) Motor is running at 1200 rpm and rated torque
ii) Motor is running at -800 rpm and twice the rated torque. **(06 Marks)**

Module-3

5 a. Explain the behaviour of Induction motor when fed from a Non-sinusoidal voltage supply. **(06 Marks)**

b. Obtain the analysis and performance of a three-phase induction motors. **(08 Marks)**

c. Explain the operation of three-phase induction motor with unbalanced rotor impedance and draw speed-torque curves. **(06 Marks)**

OR

6 a. With a neat diagram, explain source-delta and Auto transformer method of starting of three phase induction motor. **(08 Marks)**

b. What are the methods employed for braking of an induction motor? Explain in brief Regenerative braking. **(06 Marks)**

c. Explain ac dynamic braking of three phase induction motor with two lead connections. **(06 Marks)**

Module-4

7 a. Explain with relevant diagrams the voltage source inverter control of three phase induction motor. **(08 Marks)**

b. Explain the three-phase Induction motor fed from a variable frequency control from a current source. **(06 Marks)**

c. With a neat diagram, explain cycloconverter control of three phase induction motor. **(06 Marks)**

OR

8 a. With a neat diagram, explain variable frequency control of multiple synchronous motors. **(06 Marks)**

b. Explain the closed-loop speed control and converter rating for VSI and cyclo-converter Induction motor drives. **(08 Marks)**

c. What are the modes of variable frequency control in synchronous motor and briefly explain. **(06 Marks)**

Module-5

9 a. Explain self controlled synchronous motor drive employing load commutated thristor inverter. **(08 Marks)**

b. Draw Torque Vs stepping rate characteristics and explain in stepper motor drives. **(06 Marks)**

c. Explain single-stack variable reluctance type stepper motor. **(06 Marks)**

OR

10 a. With the help of equivalent circuits and phasor diagrams, explain sinusoidal PMAC motor drives. **(08 Marks)**

b. What are the advantages and disadvantages of stepper motors? **(06 Marks)**

c. What are drive requirements for cranes and hoists? **(06 Marks)**

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