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Question Paper Code : X 20493

B.E./B.Tech. DEGREE EXAMINATIONS, NOVEMBER/DECEMBER 2020
Sixth Semester
Electrical and Electronics Engineering
EE 6601 – SOLID STATE DRIVES
(Regulations 2013)
(Common to PTEE 6601 – Solid State Drives for B.E. Part-Time – Fifth Semester – Electrical and Electronics Engineering – Regulations 2014)

Time : Three Hours | Maximum : 100 Marks

Answer ALL questions

PART – A **(10×2=20 Marks)**

1. Define active load torque.

2. What are the drawbacks of mechanical braking systems ?

3. What are the applications of chopper fed DC drives ?

4. Draw the torque speed characteristics of single phase fully controlled rectifier fed separately excited DC motor with different firing angles.

5. List out the merits and demerits of stator voltage control.

6. Write down the consequences of increasing the frequency of induction motor without a change in the terminal voltage.

7. What are the different types of PMSM motor ?

8. Compare true synchronous mode and self controlled synchronous mode.

9. Highlight the factors to be considered for converter selection.

10. How current and speed controllers are implements in drives ?

PART – B **(5×13=65 Marks)**

11. a) Explain in detail about the multi-quadrant dynamics in the Speed-Torque plane with an example. **(13)**

(OR)

b) i) What are the classification of an Electric Drives ? **(3)**

ii) Draw the block diagram of Solid State Drive and explain the functions of an essential parts. **(10)**

12. a) A 220 V, 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 AC source voltage of 220V, 50Hz. Assume continuous conduction mode and find

i) Firing angle for rated torque at 750 rpm and – 500 rpm. **(7)**

ii) Motor speed for $\alpha = 160°$ at rated torque. **(6)**

(OR)

b) A 230 V, 960 rpm and 200 A separately excited DC motor has an armature resistance of 0.02Ω. The motor is fed from a chopper which provides both motoring and braking operations. The source has a voltage of 230 V. Assume continuous conduction.

i) Calculate duty ratio of chopper for motoring operation at rated torque and 350 rpm. **(5)**

ii) Calculate duty ratio of chopper for braking operation at rated torque and 350 rpm. **(4)**

iii) If maximum duty ratio of chopper is limited to 0.95 and maximum permissible motor current is twice the rated, calculate maximum permissible motor speed obtainable without field weakening and power fed to the source. **(4)**

13. a) i) Explain the concept of v/f control of induction motor drives. **(6)**

ii) A 3 phase, 50 Hz induction motor, has the following parameters for its equivalent circuit R1 = R2 = 0.02Ω and X1 = X2 = 0.1Ω is to be operated at one half of its rated voltage and 25 Hz frequency. Calculate (i) the maximum torque at this reduced voltage and frequency operation in terms of its normal value and (ii) the starting torque at this reduced frequency and voltage in terms of its normal value. **(7)**

(OR)

b) i) Describe the operation of voltage sources inverter fed induction motor drives. **(10)**

ii) State the drawbacks of an induction motor drive fed from stepped wave inverter. **(3)**

14. a) Explain the operation of self controlled synchronous motor in constant margin angle control technique. **(13)**

(OR)

b) Explain synchronous motor power factor control by the control of field excitation in detail with phasor diagram of 'V' curves. **(13)**

15. a) Derive the transfer function of DC motor-load system with converter fed armature voltage control. **(13)**

(OR)

b) Explain the design procedure of speed control with inner current controller of a separately excited DC motor. **(13)**

PART – C **(1×15=15 Marks)**

16. a) Explain the design procedure and derive the transfer function of the current controller. **(15)**

(OR)

b) Mention the factors involved in converter selection and equations involved in controller characteristics. **(15)**

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