Enrollment No.....................................

Faculty of Engineering
End Sem Examination Dec-2023
EE3CO44 Electric Drives

Programme: B.Tech.   Branch/Specialisation: EE

Duration: 3 Hrs.   **Maximum Marks: 60**

Note: All questions are compulsory. Internal choices, if any, are indicated. Answers of Q.1 (MCQs) should be written in full instead of only a, b, c or d. Assume suitable data if necessary. Notations and symbols have their usual meaning.

Q.1 i. Which of the following is a component of drive system? **1**
(a) Power modulator   (b) Motor
(c) Load   (d) All of these

ii. Which of the following braking method has highest efficiency? **1**
(a) Dynamic braking   (b) Plugging
(c) Regenerative braking   (d) None of these

iii. A 3ϕ - semi converter fed dc drive operates in- **1**
(a) One quadrant   (b) Two quadrant
(c) Three quadrant   (d) None of these

iv. Which of the following converter provides four quadrant operations? **1**
(a) 3ϕ - full converter   (b) 3ϕ - semi converter
(c) Dual converter   (d) None of these

v. In which of the following mode, output current of chopper becomes zero for some time? **1**
(a) Continuous conduction   (b) Discontinuous conduction
(c) Both (a) & (b)   (d) None of these

vi. What is the maximum value of duty cycle of chopper? **1**
(a) 0   (b) 1   (c) 1.5   (d) 2

vii. The rotor resistance control is suitable for- **1**
(a) 3-phase squirrel cage induction motor
(b) 3-phase slip ring induction motor
(c) Both (a) & (b)
(d) None of these

viii. PWM stands for- **1**
(a) Pulse Window Modulation   (b) Pulse Width Method
(c) Pulse Width Modulation   (d) None of these

ix. The advantage/s of load commutation over forced commutation is/are- **1**
(a) It does not require commutation circuit
(b) Frequency of operation can be higher
(c) It can operate at power levels beyond the capability of forced commutation
(d) All of these

x. PMSM rotor is made up of- **1**
(a) Field winding
(b) Permanent magnet
(c) Silicon steel
(d) None of these

Q.2 i. What is the difference between active load torques and passive load torques? **2**

ii. Draw the block diagram of electric drive system and write down the function of each component. **3**

iii. With the help of circuit diagram, explain the dynamic braking and plugging operation of separately excited d.c motor. **5**

OR iv. With neat sketch, describe the four quadrant operation of electric drive system using a hoist load. **5**

Q.3 i. Write down the speed-torque equation of d.c series motor and define each term. **2**

ii. The speed of a 125HP, 600V, 1800 r.p.m separately excited d.c motor is controlled by a 3-phase full converter. The converter is operated from a 3-phase, 480V and 50Hz supply. (Rated armature current (I_a) = 165A, Armature resistance (R_a) = 0.0874Ω, Armature inductance (L_a) = 6.5mH, Constant ($K_a\phi$) = 0.33 V/r.p.m) **8**
(a) Calculate the no load speed (N_o) at firing angle (α) = 30^0, assuming no load armature current (I_{ao}) to be 10% of rated I_a.
(b) Find α to obtain rated speed of 1800 r.p.m at rated armature current.

OR iii. With the help of circuit diagram, describe the circulating as well as non-circulating current mode of operation of dual converter. **8**

Q.4 i. Write down the torque-speed equation of one quadrant (Class-A) chopper fed D.C separately excited motor. Also draw speed-torque characteristics. **3**

ii. With neat sketch, describe the operation of Class-E chopper. **7**

OR iii. A 220V, 70A D.C series motor has combined resistance of armature and field of 0.12Ω. Running on no load with the field winding connected to a separate source, it gave the following magnetization characteristics at 600 r.p.m: **7**

Field current If (A)	10	20	30	40	50	60	70	80
Voltage Vt (V)	64	118	150	170	184	194	202	212

Motor is controlled by a chopper with a source voltage = 220V. Calculate motor speed for a duty ratio of 0.6 and motor current of 60A.

Q.5 i. Write down the torque equation of 3-phase induction motor and draw speed-torque characteristics for stator voltage control. **4**

ii. Describe the V/f control method of 3-phase induction motor controlled by PWM voltage source inverter. **6**

OR iii. Describe the static rotor resistance control method of 3-phase induction motor. **6**

Q.6 Attempt any two:
i. With the help of block diagram, explain the open loop V/f speed control of multiple synchronous motors. **5**

ii. Compare between self and separately controlled synchronous motor drives. **5**

iii. Write short note on PMSM. **5**

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