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Course Code 

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Seventh Semester B.E. Degree Examinations, February 2025

**INDUSTRIAL DRIVES AND APPLICATIONS**

Duration: 3 hrs

Max. Marks: 100

**Note:** 1. Answer any FIVE full questions, choosing ONE full question from each module.  
2. Missing data, if any, may be suitably assumed

<u>Q. No</u>	<u>Question</u>	<u>Marks</u>	<u>(RBTL:CO:PI)</u>
<b>Module-1</b>			
1. a.	Obtain the expression for the equivalent load torque and equivalent moment of inertia for loads with translational motion and rotational motion.	10	(2 : 1 : 1.4.1)
b.	A drive has the following parameters: $J = 10 \text{ kg-m}^2$ , $T = 100-0.1N$ , N-m, Passive load torque $T_1 = 0.05N$ , 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 $T = -100-0.1N$ , N-m. Calculate the time of reversal.	10	(3 : 2 : 2.1.3)
<b>(OR)</b>			
2. a.	Explain the term “Electric drive”. Mention the factors which decide the choice of electric drives. What are the advantages of an electric drive system?	10	(2 : 1 : 1.4.1)
b.	A motor drives two loads. One has rotational motion. It is coupled to the motor through a reduction gear with $a = 0.1$ and efficiency of 92 %. The load has a moment of inertia of $12 \text{ kg-m}^2$ and a torque of $10 \text{ N-m}$ . Other load has translational motion consists of $1000 \text{ kg}$ weight to be lifted up to an uniform speed of $1.5 \text{ m/s}$ . Coupling between this load and the motor has an efficiency of 85 %. Motor has an inertia of $0.3 \text{ Kg-m}^2$ and runs at a constant speed of $1420 \text{ rpm}$ . Determine equivalent inertia referred to the motor shaft and power developed by the motor	10	(3 : 2 : 2.1.3)
<b>Module-2</b>			
3. a.	Derive the expression for overloading factor for the short time duty of the motor.	10	(2 : 4 : 2.1.2)
b.	A thyristor converter fed dc motor has the following specifications. Rated armature current = $500 \text{ A}$ , armature resistance = $0.01 \Omega$ . The drive operates on the following duty cycle. (i) Acceleration at twice the rated armature current for $15\text{sec}$ . (ii) Running at full load for $12 \text{ sec}$ (iii) Deceleration at twice the rated armature current for $12\text{sec}$ . (iv) Idling interval The core loss is constant at $1.2 \text{ kW}$ . If $\beta$ has a value of $0.4$ , determine the maximum frequency of drive operation.	10	(3 : 4 : 2.1.3)
<b>(OR)</b>			
4. a.	Explain the chopper control of separately excited DC motor for motoring and regenerative operation with a neat diagram.	10	(2 : 4 : 2.1.2)

- b. A 220 V, 960 rpm and 200 A separately excited DC motor has an armature resistance of  $0.02\ \Omega$ , Operated in dynamic braking with chopper control with a braking resistance of  $2\ \Omega$ . **10** (3 :4 : 2.1.3)
- (i) Calculate duty ratio of chopper for a motor speed of 700 rpm and braking torque of twice the rated value.
- (ii) What will be the motor speed for a duty ratio of 0.65 and motor torque equal to twice its rated torque?

### **Module-3**

5. a. Explain the analysis and performance of three phase induction motor. **10** (2 :5 : 1.4.1)
- b. With a neat circuit diagram, explain the variable frequency control of an induction Motor. **10** (2 :5 : 1.4.1)

**(OR)**

6. a. Explain the following starting methods of three phase induction motor **10** (2 :5 : 1.4.1)  
(i) Star-Delta (ii) Rotor resistance (iii) Auto Transformer
- b. Explain the operation of three phase induction motor with unbalanced source voltage and single phasing. **10** (2 :5 : 1.4.1)

### **Module-4**

7. a. With a neat circuit diagram, explain the voltage source inverter for an induction motor drive. **10** (2 :5 : 1.4.1)
- b. With a neat circuit diagram, explain the speed control of induction motor by using static rotor resistance control. **10** (2 :5 : 1.4.1)

**(OR)**

8. a. With a neat circuit diagram, explain the current source inverter control for an induction motor. **10** (2 :5 : 1.4.1)
- b. With a neat circuit diagram, explain any three starting methods of single phase induction motor. **10** (2 :5 : 1.4.1)

### **Module-5**

9. a. With a neat block diagram, explain the working of a steel rolling mill. **10** (2 :3 : 1.4.1)
- b. Explain the brushless DC motor for servo application with the relevant waveforms. **10** (2 :5 : 1.4.1)

**(OR)**

10. a. With a neat block diagram, explain the working of a paper mill. **10** (2 :3 : 1.4.1)
- b. With a neat circuit diagram, explain the self-controlled synchronous motor drive employing load commutated inverter. **10** (2 :5 : 1.4.1)

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