

**Gandhi Institute of Engineering and Technology University, Odisha, Gunupur
(GIET University)**



B. Tech (Sixth Semester – Regular/Supplementary) Examinations, April 2025

21BELPC36003/22BELPC36003 – ELECTRIC DRIVES

(EE)

Time: 3 hrs

Maximum: 70 Marks

**Answer ALL questions
(The figures in the right hand margin indicate marks)**

PART – A

(2 x 5 = 10 Marks)

Q.1. Answer **ALL** questions

	CO #	Blooms Level
a. Mention the different types of classes of duty .	CO1	K1
b. What is meant by plugging in DC Motors?	CO2	K1
c. Why stator voltage control is more suitable for speed control of Induction motor in fan type load than constant type load.	CO3	K1
d. Which motor is usually preferred for the elevator nowadays?	CO4	K1
e. Define cooling time constant?	CO1	K1

PART – B

(15 x 4 = 60 Marks)

Answer **All** the questions

	Marks	CO #	Blooms Level
2. a. Derive the fundamental Torque Equation and Explain the four quadrants operation of Electric Drive	8	CO1	K3
b. A motor is used to drive the hoist. Motor characteristics are given by Quadrants I , II , IV: $T = 200 - 0.2N$ N -m . Quadrants II , III , IV : $t = -200 - 0.2N$, N-m where 'N' is speed in rpm . When hoist is loaded , the net load torque= 100 N -m and when unloaded , net load torque is -80 N-m . Obtain the equilibrium speeds for operation in all four quadrants.	7	CO1	K3
(OR)			
c. Derive an expression for equivalent values of drive Parameters for loads with Rotational and Translational motion	8	CO1	K3
d. 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 90%. The load has a moment of inertia of 10kg m^2 and torque of 10 Nm . Other load has translational motion and consists of 1000kg weight to be lifted up at an uniform speed of 1.5m/s. Coupling between this load and the motor has an efficiency of 85% . Motor has an inertia of 0.2kg/m^2 and runs at a constant speed of 1420rpm. Determine equivalent inertia referred to the motor shaft and power developed by the motor .	7	CO1	K3
3.a. Discuss the Ward – Leonard speed control system and Dual Converter with a neat circuit diagram. Also mention the advantages and disadvantages of Ward Leonard speed control system .	8	CO2	K2
b. A 220V , 1500rpm , 50 A separately excited motor with armature resistance of 0.5Ω is fed from a circulating current dual converter with ac source voltage (line) = 165V . Determine converter firing angle for following operating points. (i) Motoring operation at rated motor torque and 1000rpm.	7	CO2	K3

- (ii) Braking operation at rated motor torque and 1000rpm
- (iii) Motoring operation at rated motor torque and -1000rpm.
- (iv) Braking operation at rated motor torque and -1000rpm

(OR)

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| c. Explain with neat diagram the methods of speed control of dc drives using rectifiers . | 8 | CO2 | K2 |
| d. A 200 V , 875rpm , 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 220 V, 50Hz. Calculate: | 7 | CO2 | K3 |
| (i) Firing angle for rated motor torque and 750rpm | | | |
| (ii) Firing angle for rated motor torque and -500 rpm. | | | |
| (iii) Motor speed for $\alpha = 160^\circ$ and rated torque . | | | |
| 4.a. With the neat diagram describe the static Kramer's method for slip recovery power for three phase Induction motor. What are the drawbacks seen | 8 | CO3 | K2 |
| b. A 440 V , 50Hz , 6 pole , Y connected wound rotor motor has following parameters $R_s = 0.5\Omega$, $R_r' = 0.4\Omega$, $X_s = X_r' = 1.2\Omega$, $X_m = 50\Omega$ stator to rotor turns ratio is 3.5 . Motor is controlled by static motor resistance control. External resistance is chosen such that breakdown torque is produced at stand still for a duty ratio of zero. Calculate the value of external resistance. How duty ratio should be varied with speed so that the motor accelerates at maximum torque? | 7 | CO3 | K3 |

(OR)

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| c. With a neat diagram describe Voltage source Inverter for three phase Induction motor | 8 | CO3 | K2 |
| d. A Y – connected squirrel cage Induction motor has following ratings and Parameters : 400V , 50Hz , 4 Pole , 1370 rpm and $R_s = 2\Omega$, $R_r' = 3\Omega$, $X_s = X_r' = 3.5\Omega$. Motor is controlled by a VSI at constant V/F ratio. Inverter allows frequency variation from 10 to 50 Hz. | 7 | CO3 | K3 |
| (i) Obtain a plot between the breakdown torque and frequency | | | |
| (ii) Calculate starting torque and current of this as a ration of their values when motor started at rated voltage and frequency . | | | |
| 5.a. Explain the key aspects and digital technique in speed control of electric drive system | 8 | CO4 | K2 |
| b. Discuss the implementation, advantages and limitations of digital speed control in electric drives | 7 | CO4 | K2 |

(OR)

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| c. Write short notes on drives used in steel mills , Cement Mills and Textile mills | 8 | CO4 | K1 |
| d. Draw the basic structures of microcontroller based traction drives | 7 | CO4 | K1 |

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