Registration No.: | | | | | | | | | | |

Total Number of Pages: 02 **Course: IDD (B.Tech and M.Tech)**
Sub_Code: REL5D004

5th Semester Regular/Back Examination: 2024-25
SUBJECT: ELECTRIC DRIVES
BRANCH(S): ELECTRICAL & C.E., EEE, EE
Time: 3 Hours
Max Marks: 100
Q.Code: R229

Answer Question No.1 (Part-1) which is compulsory, any eight from Part-II and any two from Part-III.
The figures in the right-hand margin indicate marks.

Part-I

Q1 **Answer the following questions:** **(2 x 10)**

a) What is Electrical Drives? Draw its Block Diagram.
b) What are the advantages of Electrical Drives?
c) Why PWM inverter preferred over stepped wave inverter?
d) What are the disadvantages of rotor resistance control?
e) What do you mean by intermittent periodic duty? Explain briefly with wave forms.
f) Why series motor should not be used in those drives where there is a possibility of the load being dropped to the extent that the speed may exceed twice rated value?
g) How induction motor phase sequence can be reversed?
h) What are the limitations of stator voltage control of 3-phase induction motor?
i) What do you mean by regenerating braking of DC motor?
j) Draw the duty cycle of traction drives.

Part-II

Q2 **Only Focused-Short Answer Type Questions- (Answer Any Eight out of Twelve)** **(6 x 8)**

a) A drive has the following parameters: J =10 kg-m^2, T = 100-0.1N, N-m, Passive Load Torque T_L = 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.
b) What are the various classes of motor duty? Explain with suitable waveforms.
c) Explain the various dc motor speed - torque characteristics and their performance with suitable mathematical expression and diagrams.
d) A 200 V, 10.5 A, 2000 rpm shunt motor has the armature and field resistance of 0.5 Ω and 400 Ω respectively. It drives a load whose torque is constant at rated motor torque. Calculate motor speed if the source voltage drops to 175 V.
e) Explain the Plugging operation of dc motors.

f) Explain the variable frequency control of an induction motor drive with neat sketch diagram.

g) Explain the VSI control of induction motor drive with suitable diagrams.

h) Explain the CSI control of induction motor drive with suitable diagrams. What are the advantages of CSI over VSI.

i) Explain four quadrant operation of a motor driving a hoist load with suitable diagram.

j) Explain torque and power limitations in combined armature voltage and field control of separately excited dc motor with suitable diagram.

k) Explain various modes of variable frequency control of synchronous motor drives.

l) Explain the operation of 25 kV, 50 Hz ac traction using on-load transformer tap changer.

Part-III

Only Long Answer Type Questions (Answer Any Two out of Four)

Q3 **a)** Explain the various methods of speed control of dc motor. **(8)**

b) A 220V, 970 rpm, 100 A DC separately excited motor has an armature resistance of 0.05 Ω. It is braked by plugging from an initial speed of 1000 rpm. Calculate (a) resistance to be placed in armature circuit to limit braking current to twice the full load value (b) braking torque (c) torque when the speed has fallen to zero. **(8)**

Q4 **a)** What are slip power recovery schemes? Explain. **(4)**

b) Explain the various slip power recovery schemes of three phase induction motor with suitable diagram. **(12)**

Q5 **a)** Derive the expression for Tractive Effort and torque per motor of an electric train. **(8)**

b) A 100 tonne motor coach is driven by 4 motors, each developing a torque of 5000 Nm during acceleration. If up-gradient is 50 in 1000, gear ratio a = 0.25, gear transmission efficiency 98 %, wheel radius 0.54 m, train resistance 25 N/tonne, effective mass on account of rotational inertia is 10% higher, calculate the time taken to attain a speed of 100 kmph. **(8)**

Q6 **a)** Write short notes on Steel Rolling Mill. **(6)**

b) Explain the different operations carried out in a textile mill. What are the electrical drives used for these operations? **(10)**