

JK Lakshmipat University Jaipur
INSTITUTE OF ENGINEERING AND TECHNOLOGY

End Term Examination, December 2022

B. Tech. in Electrical and Electronic Engineering, Semester VII

Roll No.....

Course Code : EE1206 Industrial Drive and E-Vehicles

Time: 2.5 hours

Max. Marks: 20

Instructions to students:

1. Do not write anything other than your roll number on question paper.
2. Assume suitable data wherever required and mention it clearly.
3. Writing appropriate units, nomenclature, and drawing neat sketches/schematics/ flow chart wherever, required are an integral part of the answer.

Note: Open Book Exam

Answer all questions

Each question carry equal marks

1. A motor drives two loads. One load has rotational motion directly coupled with the motor shaft has moment of inertia of 20 kg-m^2 and the torque of 50 N-m . Other load has rotational motion, and it is coupled to the motor through a reduction gear with $a = 0.2$ and efficiency of 80% . Motor has an inertia of 0.4 kg-m^2 and run at speed of 1450 rpm . Determine
 - (i) Equivalent inertia referred to motor shaft
 - (ii) Equivalent power developed by the motor
 - (iii) Speed of the load(LO1 & LO5) (05)
2. Design a material handling drive mechanism for one floor to another floor in industry and analyses its quadrant conventions. (LO1) (04)
3. A 200-volt, 1000 rpm , 200 amp separately excited dc motor has an armature resistance of 0.02 ohm . It is fed from a single phase fully controlled rectifier with an AC source voltage of 230 V , 50 Hz . Calculate
 - (i) Firing angle for rated motor torque and 800 rpm .
 - (ii) Firing angle for rated motor torque and $(-500) \text{ rpm}$.(LO4) (04)
4. A 200-volt, 800 rpm and 150 Amp separately excited dc motor has an armature resistance of 0.04 ohm . The motor is fed from a chopper which provide both motoring and braking operations. The source has a voltage of 230 volt .
 - (i) Calculate the duty ratio of chopper for motoring operation at rated torque and 500 rpm .
 - (ii) Calculate the duty ratio of chopper for braking operation at double the rated torque and 400 rpm .(LO2 & LO3) (04)
5. A 10 kW , 400 V , 3-phase, 4-pole, 50 Hz slip ring induction motor develops rated output at rated voltage and frequency and with its slip ring short circuited. The maximum torque equal to the twice

the full load torque, occurs at a slip of 10% with zero external rotor resistance in the rotor circuit. Stator resistance and rotational loss are neglected. Determine:

- (i) Slip and rotor speed at full load torque.
- (ii) Air gap power
- (iii) Rotor omic-loss at full load torque.
- (iv) Starting torque at rated voltage and frequency.
- (v) Full load efficiency. (LO2 & LO3) (04)

6. An electric motor is required to drive the vehicle with a radius of wheel is 45 cm. The vehicle is traveled at a speed of 60 km/Hr. The tension on the wheel is 400 N when unloaded and 800 N with the rated load. The motor is coupled to the wheel though a 3:2 reduction gearing of 80% efficiency. Determine the power rating and the required speed range of the motor for this application. (LO4 & LO5) (04)

7. An E-vehicle has the following parameters:

Air density $\delta = 1.2 \text{ kg/m}^3$, Mass = 800 kg, aerodynamic coefficient $C_D = 0.1$, $A_F = 2 \text{ m}^2$, $g = 9.8 \text{ m/s}^2$ and rolling coefficient $C_{rr} = 0.02$.

Vehicle require to move in plane area with a velocity of 120 km/Hr. Calculate:

- (i) Rolling Force
- (ii) Gradient Force
- (iii) Aerodynamic Force
- (iv) Required power rating of motor (LO5) (05)