



Kafrelsheikh University
Faculty of Engineering

Subject: **Selective Course 2 (Electrical Drives)**

Year: Fourth Electrical Power (R.2007)

Exam Date: 10 /1/2017



Final Exam of september-2016-2017

Department of Electrical Engineering

course code: EPM4120 Full Mark: 90 Marks

Number of pages: 2 Time allowed: 3 hours

Attempt all question

Q1:

(20 Mark)

- a) Explain the types of electric drives?
- b) A tramway car having a total weight of 140 k N is accelerated at 1.2 m/s^2 on a gradient having a horizontal motion. The drive motor has a moment of inertia of 5 kg.m^2 and is geared to the drive wheel at a reduction ratio of 3:1. Gear efficiency can be assumed equal to unity. The wheel diameter is 45 cm and total moment of inertia of the wheel is 60 kg.m^2 . The wheel coefficient of friction is assumed to be constant at 0.025. The vertical frontal area of the car is 3.5 m^2 and the air resistance coefficient is 0.05. If the maximum speed of the car is 80 km/h. determine:
- (i) The motor rated speed
- (ii) The resisting load torque at the motor shaft
- (iii) The total moment of inertia at the motor shaft

Q2:

(20 Mark)

- (a) Explain the Ward Leonard method of separately excited dc motor?
- (b) The following data were taken on a series motor when running at constant speed of 300 r.p.m.

$I_f \text{ A}$	20	30	40	50
$V_a \text{ V}$	162	215	250	274

The armature resistance and series field resistance are 0.3 and 0.1, respectively. Neglecting brush drop, determine and draw the speed-torque curve when connected to 250 V supply.

- (a) Without any external resistance
- With an external resistance of 2Ω .

Q3:

(25 Mark)

- (a) Explain the four quadrant operation of dc chopper drive; support your answer with needed wave forms?
- (b) A 220 V, 1500 rpm, 50 A, separately excited dc motor with armature resistance of 0.5Ω , is fed from a 3-phase fully-controlled rectifier. Available ac source has a line voltage of 440 V, 50Hz. A star-delta connected transformer is used to feed the armature so that motor terminal voltage equals rated voltage when converter firing angle is zero. Assume continuous conduction.
- (i) Calculate transformer turns ration.
- (ii) Determine the value of firing angle when: (a) motor is running at 1200 rpm and rated torque, (b) when motor is running at 800 rpm and twice the rated torque.



(25 Mark)

Q4:

(a) Explain the voltage, frequency control of induction motor, sketch and explain the closed loop control of this method.

(b) A three phase, 460 V, 50 Hz, 4-pole, 1420 rpm, Y-connected induction motor has the following parameters per phase referred to stator:

$$R_1 = 0.66, R_2 = 0.38, X_1 = X_2 = 1.14, X_m = 32.$$

The motor is controlled by a variable frequency control at constant flux of rated value. Determine the following:

- (i) The motor speed and the stator current at half the rated torque and 25 Hz.
- (ii) By assuming the speed- torque curves to be straight lines, solve for part (i) for $s < s_m$.
- (iii) The frequency, the stator current, and voltage at a rated braking torque and 1200 rpm.

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With my best wishes

Dr. Eng./ Mohamed I. Abd EL_Wanis