
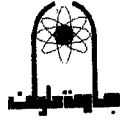


| | | | |
|-------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------|
|  Faculty of Engineering | Dept.: Mechanical Engineering Courses Code: POW7413 Instructors: Assoc. Prof. Mohamed EL-Korfally, Assis. Prof. Fathy M. M. Bassiouny, Assis. Prof. Abdalla Abdelmouty Sayed | Group: Mechatronic Title: Electric Drive Final Exam Total mark: 60 mark Time allowed: 3 hrs. Jan. 2016 |  |
| | | | |

Answer the following problems

PROBLEM 1

A 5KW, 380v, 50Hz, 6-pole, 3-phase induction motor has $T_{max}=2.5T_N$, $s_{cr}=0.2$. The machine operates a fan. The fan characteristic crosses the normal operating point of motor. The fan torque proportional with the square of speed. After that, the sequence of voltage is changed by interchanging two terminals.

Calculate:

- The nominal slip and nominal speed.
- The slip, speed, and torque just after the sequence is changed.
- Draw power flow diagram of b).
- The slip, speed, and torque at final condition.

PROBLEM 2

a) Explain the speed control method of IM using R_{add} in rotor circuit with rectifier & GTO. State also advantages and disadvantages

b) A three-phase IM, 380 V, 50Hz, 4-pole, Y connected, wound rotor that speed is controlled by $R_{add}=8\Omega$ in rotor through 3-phase rectifier & GTO with duty ratio=0.6, the turn ratio of the rotor to stator winding is $N_r/N_s=0.8$ the load torque is 30N.m. Neglect friction torque and neglect rotor resistance with respect to R_{add} . Calculate:

- DC link current
- The operating speed of the motor

PROBLEM 3

An electric motor drives a load that requires a torque of 200 N.m. through a series of reduction gears having the radius ratios of 1:3 and 1:2, the efficiency of gears are 80% and 90% respectively. The speed of the motor is 1000 rpm. Draw the drive system and Determine:

- The speed of the load in rpm.
- The power required to the load.
- The load torque referred to the motor shaft.
- The input power to the motor if its efficiency is 85%.

PROBLEM 4



- What is meant by stability in electric drive systems? Suggest the suitable solutions for an unstable system.
- Explain how to select the suitable transmission system in electric drives (gears, belts, pulleys).
- Explain how counter-current braking is applied in dc shunt motors?
- 10hp, 250V, 800 rpm, dc shunt motor has a full load efficiency of 90%. The armature and the field resistances are 1.0 Ω and 125 Ω respectively. If the motor is loaded by a constant load torque equal to its rated value. Compute the resistance to be added to the armature circuit to reduce the speed by 20 %.



PROBLEM 5

- A. Using the speed torque characteristics, explain how the speed of a dc shunt motor is controlled by varying the armature voltage? What are its advantages and disadvantages?
- B. 220V, 1400 rpm, 32A, dc shunt motor has an armature resistance of 0.4Ω and a field resistance of 110Ω . While the motor was running at its rated speed, flux, and current, dynamic braking is applied to stop the motor;
- i- Compute the braking resistance to limit the initial braking current to twice its rated value.
 - ii- What is the reduction in the braking resistance to give a braking torque of twice the rated value when the speed is reduced to 400 rpm.

Best Wishes and Good Luck

| | | |
|----------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------|
|  كلية الهندسة بخولان | Dept.: Mechatronics Academic level: Fourth Year Semester: Jan , 2016 Course code & title: (POW 7416) Automated control techniques Instructor: A.samahy , Y. Shankeer, H. El-Zoghby Total mark: 90 Exam : two pages Time allowed: 3hrs |  |
|----------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------|

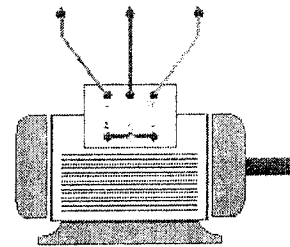
Answer the following questions

Question No. (1) [Mark 15]

- a) Mention the different classifications of sensors and give one example on each classification.
- b) Explain the different types of sensors that used to measure motor speed.
- c) An encoder of 100 counts/rev fixed on a motor shaft;
 - i) How does the shaft angle for 1 encoder count .
 - ii) How many counts are there for 10000 degree of rotation?
 - iii) If the encoder counts 100000 counts in 2 minutes, calculate the motor speed in R.P.M.

Question No. (2) [Mark 20]

- a) List the criteria of selecting a PLC for a certain application.
- b) It is required to automatically operate a three-phase induction motor in forward direction for 10 minutes , 0.5 minute rest, and 10 minutes in reverse direction . The complete operation is started by the operator and still continues until the operator stop the operation. Three indication lamps must be used (red lamp for stop , green lamp for forward, and yellow lamp for reverse).
 - i- Draw the power circuit and classical control circuit.
 - ii- Write a PLC ladder diagram.
 - iii- Draw the connection of inputs and outputs to Siemens PLC.

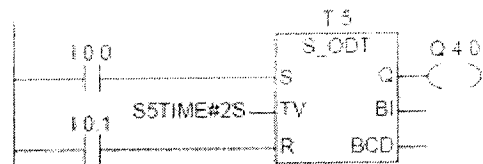


Question No. (3) [Mark 20]

- a) Explain the operation of the conventional on and off delay timers.
- b) Draw the timing diagram the following two ladder diagrams.



(a)



(b)

- c) Show by using control and power circuits how to automatically operate three-phase induction motor using:
 - i- temperature switch
 - ii - pressure switch
 - iii- and level switch.



Question No. (4)

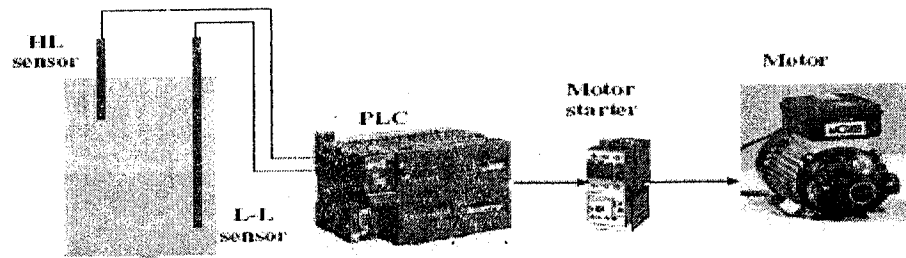
[Mark 15]

a) Show with simple diagrams the different types of PLC input switches, and output devices.

b) In order to Control the level of oil in a tank between low and high levels using oil pump driven by a motor, a Siemens PLC is used:

i-Draw the ladder diagram of the controlling program

ii-Draw the connection diagram of the PLC to the input and output devices at each stage of the operation.



Question No. (5)

[Mark 20]

a) It is required to build an automatic water sprinkler system of a garden. A water pump delivers water to grass for 3 minutes then flowers for 5 minutes and finally for trees for 10 minutes respectively. Watering of whole garden depends upon humidity, and temperature. Either temperature sensor or humidity can turn on the sprinkler system. In case of fire in any part of garden, a fire alarm is used depending on a fire sensor, the sprinkler is forced to operate at the fired zone.

i- Define the inputs and outputs labels.


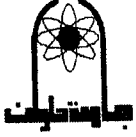
ii- Draw the controlling ladder diagram.

iii- Draw the connection of inputs and outputs to PLC.

b) Show in details how to control a stepper motor speed using Labview program assuming two coils excitation.

With best wishes ...

٢٠١٦ / ١٨ / ١٨ / ١٨
١٨ / ١٨ / ١٨ / ١٨
١٨ / ١٨ / ١٨ / ١٨

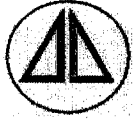
| | | |
|----------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------|
|  كلية الهندسة بحلوان | Dept/Division : Mechanical Engineering Academic level: Fourth Year. Semester: Winter Term.2015 Course code & title: Vehicular Electronics – Code:7415 Instructor: Prof.Dr. Mohamed Fikry Hussein. Total mark: 100 marks |  جامعة أسيوط |
|----------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------|

Instructions: Answer the following questions ;

- Q1 a) Illustrate by block- diagram the microcomputer structure of motor vehicle.
b) Explain (briefly) the function of the microcontroller in microcomputer for electronic management of motor vehicle. (20 Marks)
- Q2 a) State the purpose of Electronic Management System for Spark Ignition Engine.
b) Describe the fuel supply system for Spark Ignition Engine with manifold injection with return fuel supply. (20 Marks)
- Q3 a) Explain the basic ignition process of mixture (fuel-air) in SI engine;(coil ignition)
b) Describe Electronic Map-Controlled thermostat for engine cooling system of Spark Ignition Engine. (20 Marks)
- Q4 a) Define the function of the (ABS) system for motor vehicle.
b) Illustrate by a scheme the design of the (ABS) system for motor vehicle. (20 Marks)
- Q5 a) Explain the function of the Traction Control System (TCS) for motor vehicle.
b) Name the new components added to the (ABS) of motor vehicle in order to have the advantage of (TCS) system. (20 Marks)

Prof. A. Halim Bassiuny

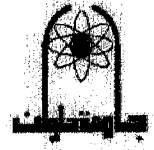
7411 Mechatronics Engineering 1
C. 12/1/15



كلية الهندسة بحلوان

Mechanical Engineering Department
Mechatronics Division
Academic level: Four
Prof. A. Halim Bassiuny

7411 Mechatronics Engineering 1
Semester: First 2015/16
Time allowed: 3 hrs
Total mark: 90 marks



Question 1: (30 M)

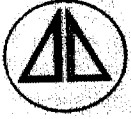
- Define Mechatronics and describe how friction and inertia affects on mechatronic systems
- Explain with a simple sketch the functions and operation of the basic components required for a hydraulic system.
- Describe with sketch the operation principles of a stepper motor.
- List some of the advantages of using pneumatics in industry.
- A hydraulic cylinder has bore of 50 mm and moves a mass of 10 kg. It is controlled with a valve with a constant $k_v = 80 \text{ Pa/m}$. The damping coefficient is 2 N.s/m.
 - Calculate the time constant T, critical damping coefficient Cc and the damping ratio δ
 - Given that x_i and x_o are zero when $t = 0$, calculate the initial acceleration of the mass when the input is changed suddenly to 10 mm.
 - Calculate the acceleration when the velocity reaches 0.1 mm/s.
 - Calculate the velocity when the acceleration is zero.

Question 2: (30 M)

- List the static characteristics of sensors and actuators.
- Describe with sketch the operation of Analog to Digital Conversion
- A strain gauge with a gauge factor of (2) is subjected to a stress of 1000 kg/cm^2 . The Young's modulus of the metal is $2 \times 10^6 \text{ kg/cm}^2$. Find the percentage change in the resistance of the gauge.
- Changing overlap area capacitive sensing element has the following dimensions: $L=5\text{cm}$, $W=5\text{cm}$ and separation distance is 1 mm. It is used in air with relative permittivity of (1). Find the capacitance at $x=3\text{mm}$.
- A sensor whose open loop transfer function is $G(s) = \frac{1}{1+s}$ and is subjected to a sinusoidal input. Sketch the frequency response curves and the polar plot.

Question 3 (30 M)

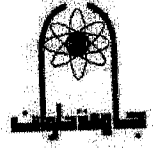
- A continuous voltage signal is to be converted into its digital counterpart by an analog-to-digital converter (ADC). The maximum voltage range is $\pm 5\text{V}$. The ADC has a 6-bit



كلية الهندسة بحلوان

Mechanical Engineering Department
Mechatronics Division
Academic level: Four
Prof. A. Halim Bassiuny

7411Mechatronics Engineering 1
Semester: First 2015/16
Time allowed: 3 hrs
Total mark: 90 marks



- capacity. *Determine* the number of quantization levels, the resolution, the spacing of each quantization level, and the quantization error for this ADC.
- b- Use the successive approximation method to encode an input signal of 9.0 V for a 6-bit register of an ADC with a full range of ± 10 V.
- c- A DAC uses a reference voltage of 100 V and has 6-bit precision. In three successive 1 s sampling periods, the binary data contained in the output register were 100000, 011111 and 011101. *Determine* the equation for the voltage as a function of time between sampling instants 2 and 3 using a zero – order hold.
- d- The piston rod of a double-acting cylinder is to advance when the 3/2-way roller lever valve (1S2) is actuated and the push button of the 3/2-way valve (1S1) is actuated. If either of these is released, then the cylinder is to return to the initial position. *Draw* the circuit