CMR INSTITUTE OF TECHNOLOGY	USN										

Improvement Test

Sub:	Mechatronics & Microprocessors							Code:	10ME65
Date:	26/05/2017	Duration:	90 mins	Max Marks:	50	Sem:	6	Branch:	ME

Note: Answer Any FIVE Questions

		Marks	OBE	
			CO	RBT
1.	With the help of symbol and truth table, explain NOT, NAND, NOR and XOR gates.	10	CO5	L1
2.	Write the Boolean algebra expressions for the following: i. Associative law. ii. Distributive law.	10	CO5	L1
3.	Explain with neat circuit diagrams, various types of DC rotors with respect to field coils.	10	CO3	L3
4.	What is a control system? Explain open loop and closed loop control system with suitable example.	10	CO1	L2
5.	Illustrate the following proximity sensors: (Any 2) i. Capacitive type ii. Pneumatic type iii. Eddy current type	10	CO2	L3
6.	Write a short notes on any two of the following: i. Electrical relay ii. Solenoids iii. PLC	10	CO3	L2
7.	Explain the working principle of Hall Effect sensor, How can this sensor be used to measure the fuel level in automobile fuel tank.	10	CO2	L2

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Course Outcomes		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1:	To identify and illustrate mechanical and electrical systems and their interconnection.	3											1
CO2:	To analyze mechanical, electronics, control and computer engineering in the design of mechatronics systems.	3											
CO3:	Be able to do the complete design, building, interfacing and actuation of a mechatronics system for a set of specifications.	2		1		1							
CO4:	Explain working principles and drive techniques for DC Brush, DC brushless, AC, and stepper motors	2											
CO5:	Describe architecture and understand the basic functioning of Intel 8085 Microprocessor	3											1

Cognitive level	KEYWORDS
L1	List, define, tell, describe, identify, show, label, collect, examine, tabulate, quote, name, who, when, where, etc.
L2	summarize, describe, interpret, contrast, predict, associate, distinguish, estimate, differentiate, discuss, extend
L3	Apply, demonstrate, calculate, complete, illustrate, show, solve, examine, modify, relate, change, classify, experiment, discover.
L4	Analyze, separate, order, explain, connect, classify, arrange, divide, compare, select, explain, infer.
L5	Assess, decide, rank, grade, test, measure, recommend, convince, select, judge, explain, discriminate, support, conclude, compare, summarize.

PO1 - *Engineering knowledge*; PO2 - *Problem analysis*; PO3 - *Design/development of solutions*; PO4 - *Conduct investigations of complex problems*; PO5 - *Modern tool usage*; PO6 - *The Engineer and society*; PO7- *Environment and sustainability*; PO8 – *Ethics*; PO9 - *Individual and team work*; PO10 - *Communication*; PO11 - *Project management and finance*; PO12 - *Life-long learning*

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26/05/2017

Mechatronics & Microprocessors - 10ME65

Scheme of Evaluation & Solutions

SOE

1. Explanation of NOT, NAND, NOR and XOR gates with suitable circuit diagram and Truth table

   2.5 X 4 = 10 Marks

2. To write the boolean algebra expression & suitable circuit diagram and truth table

   a. Associative law — 5 Marks

   b. Distributive law — 5 Marks

3. 4 types of DC motors with respect to field coils & suitable graphs to show speed-torque characteristics.

   2.5 X 4 = 10 Marks

4. Definition of control System — 02 Marks

   Two types of control systems

   a. Open loop — 4 Marks

   b. closed loop — 4 marks.

   (with examples)

5. Illustration of any two Proximity Sensors

a. Capacitive 05 Marks

b. pneumatic 05 Marks } 10 Marks

c. Eddy current 05 Marks

6. To write short on any two with suitable diagrams.

a. Electrical relay

b. Solenoids 5 Marks each

c. PLC (5 x 2 = 10 Marks)

7. working principle of Hall effect sensor – 04 Marks

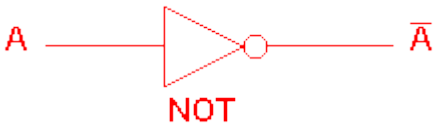
Diagram and Expression for Hall voltage – 04 Marks

Example / application – 02 Marks.

Solutions of Improvement test May 2017

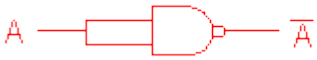
1

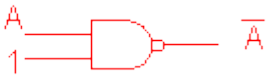
NOT gate



NOT gate	
A	$\overline{A}$
0	1
1	0

The NOT gate is an electronic circuit that produces an inverted version of the input at its output. It is also known as an *inverter*. If the input variable is A, the inverted output is known as NOT A. This is also shown as A', or A with a bar over the top, as shown at the outputs. The diagrams below show two ways that the NAND logic gate can be configured to produce a NOT gate. It can also be done using NOR logic gates in the same way.



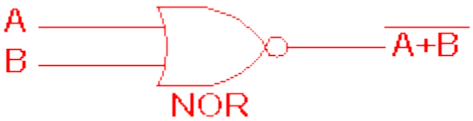


NAND gate

2 Input NAND gate		
A	B	$\overline{A.B}$
0	0	1
0	1	1
1	0	1
1	1	0

This is a NOT-AND gate which is equal to an AND gate followed by a NOT gate. The outputs of all NAND gates are high if **any** of the inputs are low. The symbol is an AND gate with a small circle on the output. The small circle represents inversion.

NOR gate



2 Input NOR gate		
A	B	$\overline{A+B}$
0	0	1
0	1	0
1	0	0
1	1	0

This is a NOT-OR gate which is equal to an OR gate followed by a NOT gate. The outputs of all NOR gates are low if **any** of the inputs are high.
The symbol is an OR gate with a small circle on the output. The small circle represents inversion.

EXOR gate

2 Input EXOR gate		
A	B	A⊕B
0	0	0
0	1	1
1	0	1
1	1	0

The '**Exclusive-OR**' gate is a circuit which will give a high output if **either, but not both**, of its two inputs are high. An encircled plus sign (⊕) is used to show the EOR operation.

2

a. Associative Laws for Boolean Algebra

Associative law of addition states that OR ing more than two variables i.e. mathematical addition operation performed on variables will return the same value irrespective of the grouping of variables in an equation.

It involves in swapping of variables in groups.

The Associative law using OR operator can be written as

A+(B+C) = (A+B)+C

Associative law of multiplication states that ANDing more than two variables i.e. mathematical multiplication operation performed on variables will return the same value irrespective of the grouping of variables in an equation.

The Associative law using AND operator can be written as

A * (B * C) = (A * B) * C

b. Distributive Laws for Boolean Algebra

The multiplication of two variables and adding the result with a variable will result in same value as multiplication of addition of the variable with individual variables.

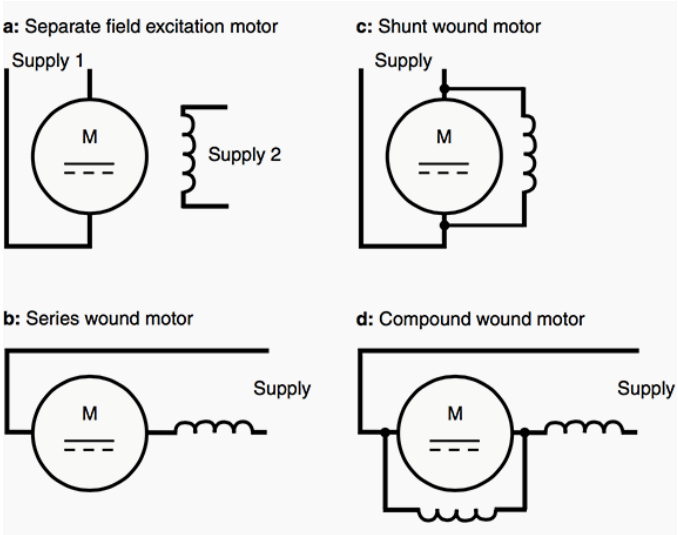
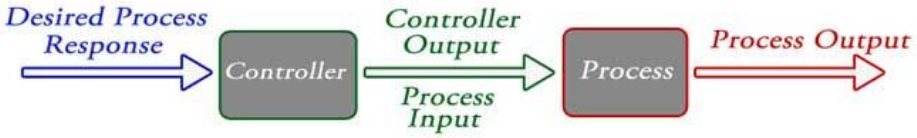
In other words, ANDing two variables and ORing the result with another variable is equal to AND of ORing of the variable with the two individual variables.

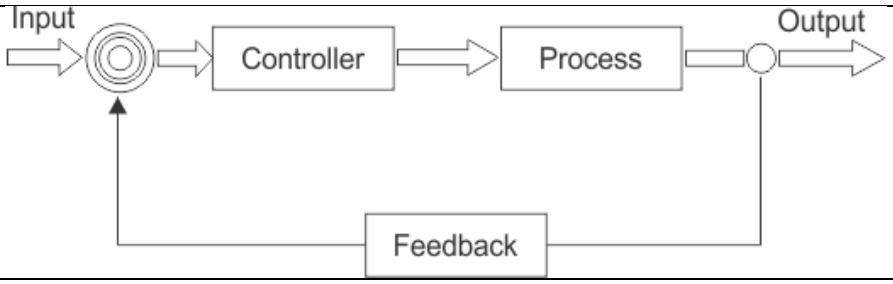
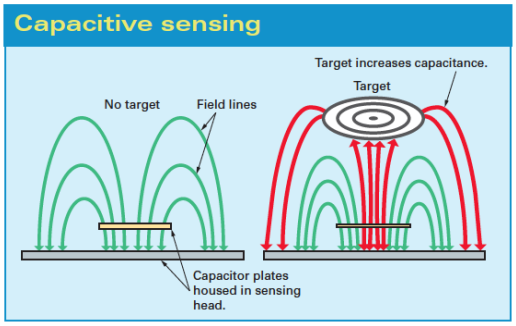
Distributive law can be written as

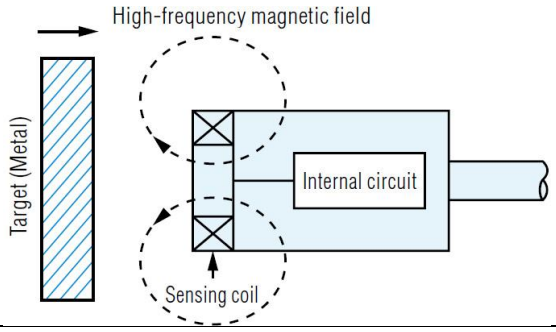
A + BC = (A + B)(A + C)

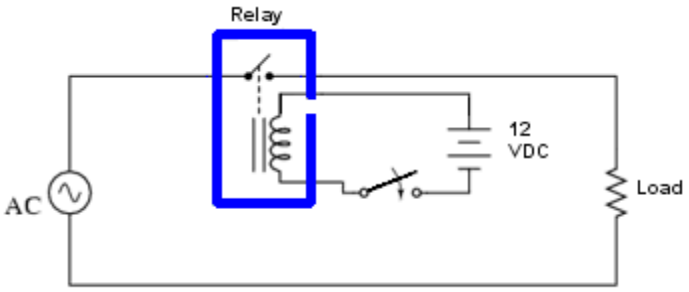
The addition of two variables and multiplying the result with a variable will result in same value as addition of multiplication of the variable with individual variables.

In other words, ORing two variables and ANDing the result with another variable is

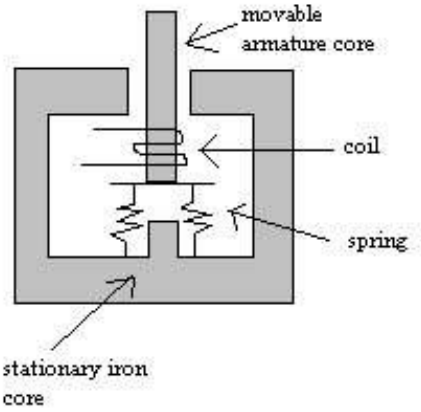
	equal to OR of ANDing of the variable with the two individual variables. Distributive law can be written as A (B+C) = (A B) + (A C)
3	The four types of DC motor can be listed as follows- 1. Separately Excited DC Motor 2. Shunt Wound DC Motor 3. Series Wound DC Motor 4. Compound Wound DC Motor 
4	A control system is a system of devices or set of devices, that manages commands, directs or regulates the behavior of other device(s) or system(s) to achieve desire results. There are two main types of control system. 1. Open loop control system 2. Closed loop control system **Open Loop Control System** A control system in which the control action is totally independent of output of the system then it is called open loop control system.  **Closed Loop Control System** Control system in which the output has an effect on the input quantity in such a manner that the input quantity will adjust itself based on the output generated is called **closed loop control system**.

<table>
<tr><td></td><td> 
</td></tr>
<tr><td>5</td><td>1. Capacitive sensors
Capacitive proximity sensors can detect both metallic and non-metallic targets in powder, granulate, liquid, and solid form. This, along with their ability to sense through nonferrous materials, makes them ideal for sight glass monitoring, tank liquid level detection, and hopper powder level recognition.
 

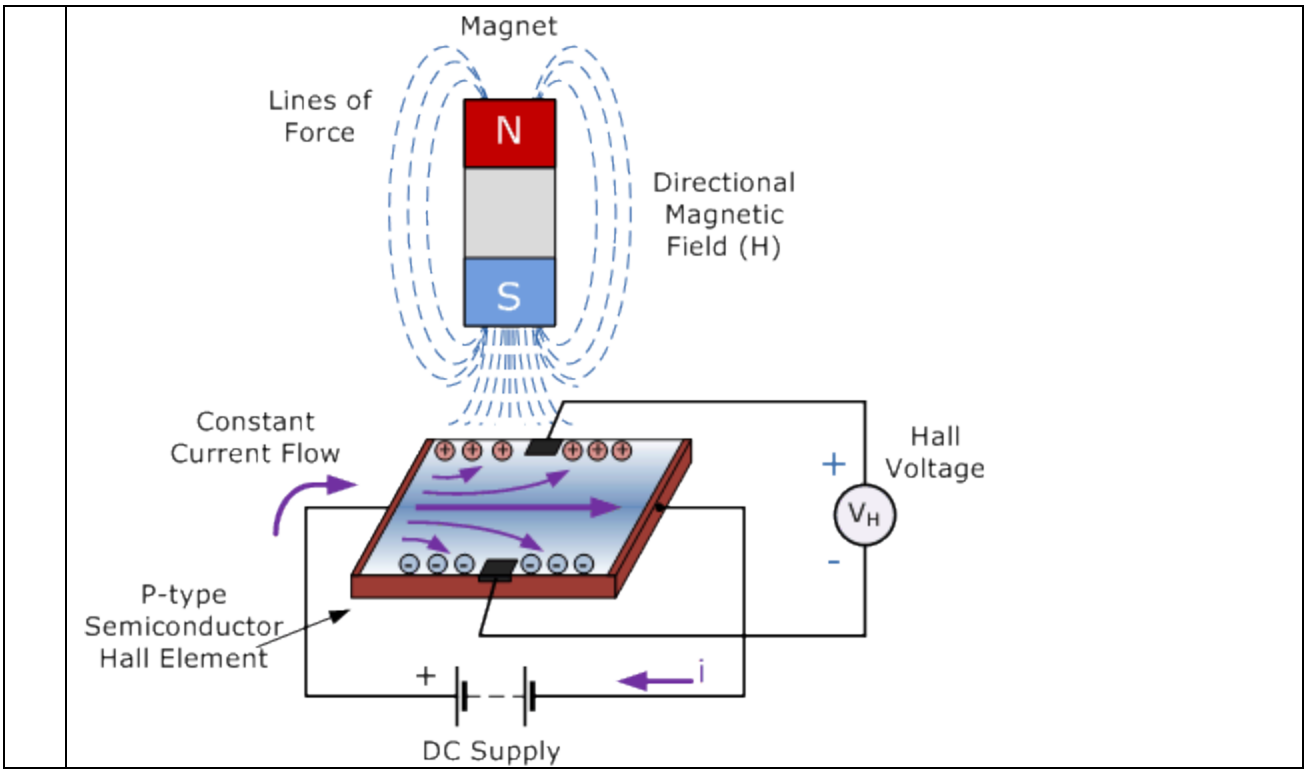
2. Eddy current proximity sensors
Eddy current proximity and switches detect the proximity or presence of a target by sensing fluctuations in a magnetic field generated by a reference coil. The variations in this field are due to the presence of nearby conductive objects. Field generation and detection information is provided in the kHz to MHz range. They can be used as proximity sensors to detect the presence of a target, or can be configured to measure the position or displacement of a target.
 
</td></tr>
<tr><td>6</td><td>1. A relay is an electromagnetic switch operated by a relatively small electric current that can turn on or off a much larger electric current. A relay is usually an electromechanical device that is actuated by an electrical current. The current flowing in one circuit causes the opening or closing of another circuit. Relays are like remote control switches and are used in many applications because of their relative simplicity.</td></tr>
</table>



2. A solenoid is a coil of insulated or enameled wire wound on a rod-shaped form made of solid iron, solid steel, or powdered iron. In a solenoid, the core material is ferromagnetic, meaning that it concentrates magnetic lines of flux. This increases the inductance of the coil far beyond the inductance obtainable with an air-core coil of the same dimensions and the same number of turns. When current flows in the coil, most of the resulting magnetic flux exists within the core material. Some flux appears outside the coil near the ends of the core; a small amount of flux also appears outside the coil and off to the side



7	**Hall Effect Sensors** are devices which are activated by an external magnetic field. The output signal from a Hall effect sensor is the function of magnetic field density around the device. When the magnetic flux density around the sensor exceeds a certain pre-set threshold, the sensor detects it and generates an output voltage called the **Hall Voltage, V_H**.


Magnet
Lines of Force
N
S
Directional Magnetic Field (H)
Constant Current Flow
Hall Voltage
+
V_H
-
P-type Semiconductor Hall Element
+
i
DC Supply