Roll No.													

PRESIDENCY UNIVERSITY
BENGALURU

SCHOOL OF ENGINEERING

TEST 1

Sem & AY: Odd Sem. 2019-20
Course Code: MEC 218
Course Name: MECHATRONICS
Program & SEM: B.Tech. (MEC) & VII.

Date: 1.10.2019
Time: 1:00PM to 2:00PM
Max Marks: 40
Weightage: 20%

Instructions:

i. Answer all Questions and Use Pencil to draw sketches/diagrams.

Part A [Memory Recall Questions]

Answer both the Questions. Each Question carries four marks. (2Qx4M=8M)

1. Explain any 2 differences between open & closed loop system. (C.O.NO.1) [Comprehension]
2. State any four applications of Mechatronics systems. (C.O.NO.1) [Knowledge]

Part B [Thought Provoking Questions]

Answer both the Questions. Each Question carries six marks. (2Qx6M=12M)

3. Identify the sensor, signal conditioner and display elements in the measurement systems of (C.O.NO.1) [Comprehension]
   a). Mercury in Glass thermometer
   b). Automatic control of water level using floating ball.
4. Describe the advantages & disadvantages in a Mechatronics enabled control system for the domestic heating system involving a bimetallic thermostat and that involving a microprocessor. (C.O.NO.1) [Knowledge]

Part C [Problem Solving Questions]

Answer both the Questions. Each Question carries ten marks. (2Qx10M=20M)

5. Explain the following terms, Accuracy, Repeatability, Sensitivity, Hysteresis, and Stability. (C.O.NO.2) [Comprehension]
6. State the steps that might be present in the sequential control of an automated washing machine with a neat diagram. (C.O NO.1) [Knowledge]

SCHOOL OF ENGINEERING

Semester: VII

Course Code: MEC 218

Course Name: Mechatronics

Date: 1-10-2019

Time: 1 PM to 2 PM

Max Marks: 40

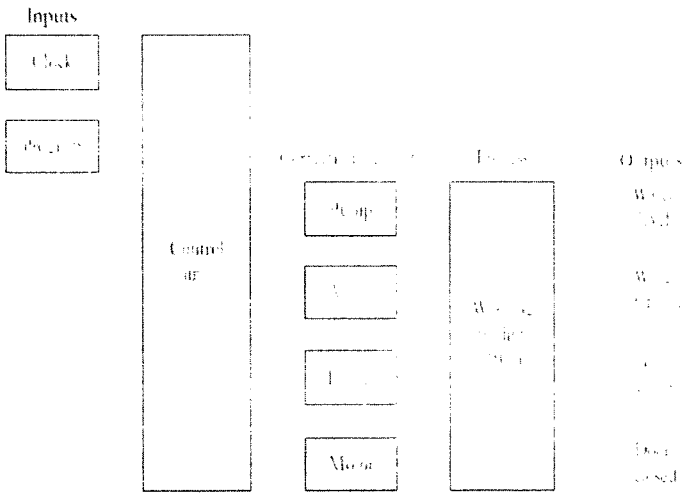
Weightage: 20%

Extract of question distribution [outcome wise & level wise]

Q.NO	C.O.NO	Unit/Module Number/Unit /Module Title	Memory recall type [Marks allotted] Bloom's Levels			Thought provoking type [Marks allotted] Bloom's Levels			Problem Solving type [Marks allotted]			Total Marks
			K			C			A			
1	1	Module-1				4						
2	1	Module-1	4									
3	1	Module-1				6						
4	1	Module-1	6									
5	2	Module-2				10						
6	1	Module-1	10									
	Total Marks		20			20						

K =Knowledge Level C = Comprehension Level, A = Application Level

Part C (Q x M = Marks)

Q No	Solution	Scheme of Marking	Max. Time required for each Question
5	• **Accuracy :** It is a measure of difference between the measured value and actual value. Generally defined as % of actual value. Or *Accuracy is the extent to which the value indicated by a measured system might be wrong OR the accuracy of a measurement means conformity to truth.* Or Accuracy is the closeness with which an instrument reading approaches the true value of the quantity being measured • **Repeatability :** It is the ability to reproduce the output signal exactly when the same measured quantity is applied repeatedly under the same environmental conditions • **Sensitivity**: It is the ability of the measuring instrument to respond to changes in measured quantity. It is ratio of change of output to change of input. • **Hysteresis**: is defined as condition of obtaining different output for increasing and decreasing value of input. • **Stability (drift)** - It is the ability to give same output when a constant input is measured over a period of time. Drift is expressed as % of full range output.	Each definition=2M	15 Min
6		Diagram=4 M Explanation=6 M	15 Min

Annexure- II: Format of Answer Scheme

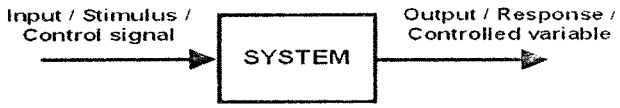
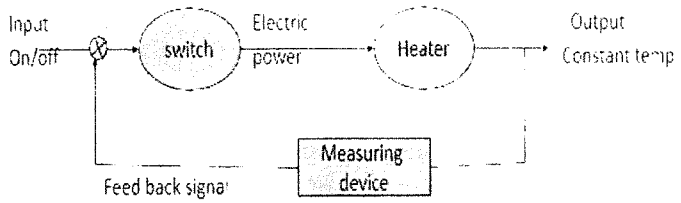
SCHOOL OF ENGINEERING

SOLUTION

Semester: VII
Course Code: MEC 218
Course Name: MECHATRONICS

Date: 1-10-2019
Time: 1 PM to 2 PM
Max Marks: 40
Weightage: 20%

Part A (2Q x 4M = 8Marks)

Q No	Solution	Scheme of Marking	Max. Time required for each Question
1	**OPEN LOOP:** An open-loop controller, also called a non-feedback controller, is a type of controller that computes its input into a system using only the current state and its model of the system.  Fig.14 Open loop control system **CLOSED LOOP:** Here the output is dependent on the input and also the output decides the further input. It is characterized by a feedback system, which permits the output to be compared against the input and make necessary changes. 	**EACH DIFFERENCE =1M**	**5 MIN**
2	**APPLICATIONS:** 1.Contact-free magnetic bearings, digitally controlled combustion engines, robots, automated guided vehicles or other machine tools, mechatronics is present everywhere. 1.It is used in home appliances such as dish washer and washing machines.	**EACH APPLICATIO N=1M**	**5 MIN**

	2.It is used in laser optical systems. It is part of the image and sound processing devices such as sound operators and automatic focusing device. 3.Mechatronic is also used in intelligent measuring devices like calibration devices, measuring and testing of sensors. 4.Mechatronic is used in the medical field as well. Many medical applications such as magnetic resonance, ultrasonic probes, arthroscopic devices use mechatronics. 5.It is used in automation like automatic air conditioning systems, security system, automatic door systems. It is also used in pressure, heat and position control systems. 6.It is widely used in aeronautics engineering for unmanned aerial vehicles and automatic pilots. In the defense industry it is used for automatically guided vehicles and mine detection robots		

Part B (Q x M = Marks)

Q No	Solution	Scheme of Marking	Max. Time required for each Question
3	A). MERCURY IN GLASS THERMOMETER SENSOR: Mercury, SIGNAL CONDITIONER: Capillary tube, DISPLAY ELEMENTS: Marking on the tube. B). AUTOMATIC CONTROL OF WATER LEVEL SENSOR: Floating ball & Lever, SIGNAL CONDITIONER: The Pivoted lever, DISPLAY ELEMENTS: Water level.	Mercury=3 M Water level=3 M	10 MIN
4	Advantages: 1. The products are of high quality 2. It possesses a good performance characteristics 3. High degree of flexibility 4. Machine utilization is high 5. Capital expenses are reduced as a mechatronic parts are better than sum of its parts 6. They are user friendly and are highly reliable. 7. Mechatronic engineers have excellent employment prospects as the demand for qualified professionals with multidisciplinary skills. Disadvantages: 1. The existing system has to be replaced by the new system which is a very expensive process 2. The initial cost will be high 3. Electronic parts are more susceptible to damage when the machine is working in difficult environment, so when it spoil, whole mechatronic system will not fulfill its tasks. 4. Specific problems have to be dealt by specific people only	Advantage:3M Disadvantage:3M	10 MIN

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PRESIDENCY UNIVERSITY
BENGALURU

SCHOOL OF ENGINEERING

TEST – 2

Sem & AY: Odd Sem 2019-20
Course Code: MEC 218
Course Name: MECHATRONICS
Program & Sem: B.Tech.(MECH) & VII Sem

Date: 19.11.2019
Time: 1:00 PM to 2:00 PM
Max Marks: 40
Weightage: 20%

Instructions:
(i) Read the question properly and answer accordingly.
(ii) Question paper consists of 3 parts.

Part A [Memory Recall Questions]

Answer all the Questions. Each question carries four marks. (3Qx4M=12M)

1. Name any four advantages of using mechanical transducer. (C.O.NO.2)[Knowledge]
2. With neat sketch explain photo emission effect. (C.O.NO.2)[Knowledge]
3. What are the functions of signal conditioning process? (C.O.NO.2)[Knowledge]

Part B [Thought Provoking Questions]

Answer both the Questions. Each question carries seven marks. (2Qx7M=14M)

4. With necessary sketches explain the working of Inductive Transducers. (C.O.NO.2)[Comprehension]
5. Draw a neat sketch of basic components of Pneumatic system and mention its functions. (C.O.NO.3)[Comprehension]

Part C [Problem Solving Questions]

Answer the Question. The question carries fourteen marks. (1Qx14M=14M)

6. With necessary circuit explain the working of Single cycle automation of multiple cylinders using cascading method Sequence of motion: A+B+B-A (C.O.NO.3)[Comprehension]

SCHOOL OF ENGINEERING

GAIN MORE KNOWLEDGE
REACH GREATER HEIGHTS

Semester: 7TH

Course Code: MEC218

Course Name: MECHATRONICS

Date: 01-11-19

Time: 1:00 PM to 2:00 PM

Max Marks: 40

Weightage: 20%

Extract of question distribution [outcome wise & level wise]

Q.NO.	C.O.NO	Unit/Module Number/Unit /Module Title	Memory recall type [04] Bloom's Levels			Thought provoking type [06] Bloom's Levels			Problem Solving type [08]			Total Marks 40
			K			C			U C			
1.	2	2		4								
2	2	2		4								
3	2	2		4								
4	2	2					7					
5	3	3					7					
6	3	3								14		
	Total Marks			12			14			14		**40**

K =Knowledge Level C = Comprehension Level, A = Application Level

Annexure- II: Format of Answer Scheme

SCHOOL OF ENGINEERING

SOLUTION

Semester: 7

Course Code: MEC218

Course Name: MECHATRONICS

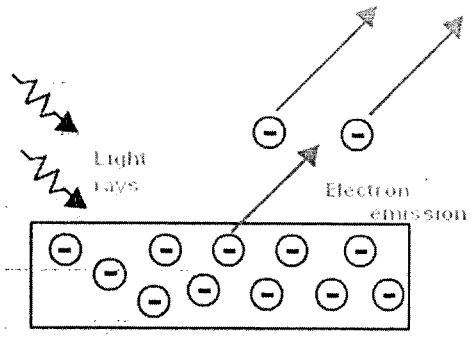
Date: 19-11-19

Time: 1-2PM

Max Marks: 40

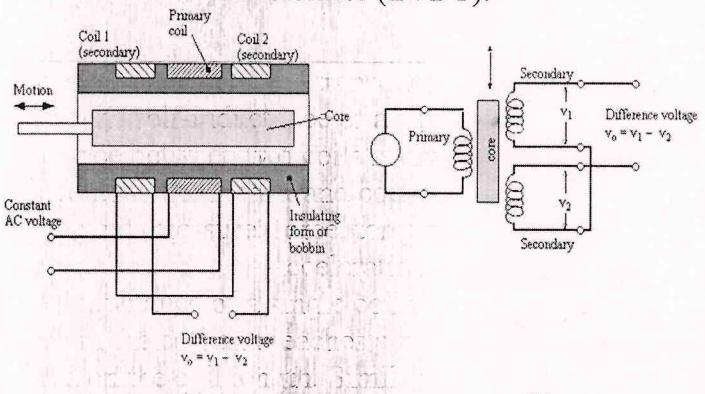
Weightage:20%

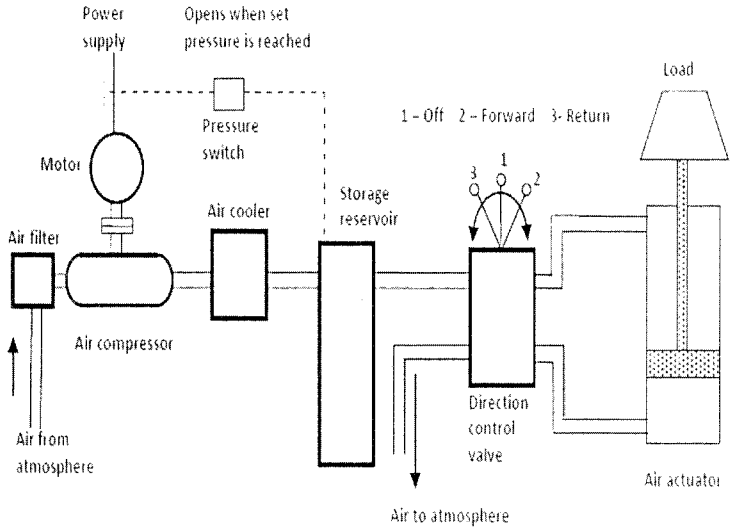
Part A (3 x 4 = 12Marks)

Q No	Solution	Scheme of Marking	Max. Time required for each Question
1.	1. They posses high accuracy. 2. Rugged (rough handling) 3. Relatively low cost. 4. Operate without any external source (Active transducers)	Each advantage with clear description carries -1M	5Min
2	Whenever light fall on a cathode the free valence electrons on the cathode absorbs the light energy, resulting in increase in kinetic energy. These electrons ejected from the cathode are attracted towards the anode constituting anode current which is proportional to the intensity of light. 	Definition -2 mark Justification-2 Marks	5Min
3	1. ***Protection*** to prevent damage to the next element. 2. Getting the signal into the ***right type of signal***. This can mean making the signal into a DC voltage or current. 3. Getting the **level of the signal** right. 4. Eliminating or reducing ***noise*** 5. **Signal *manipulation***	Each function with clear description carries-1M	5Min

Part B

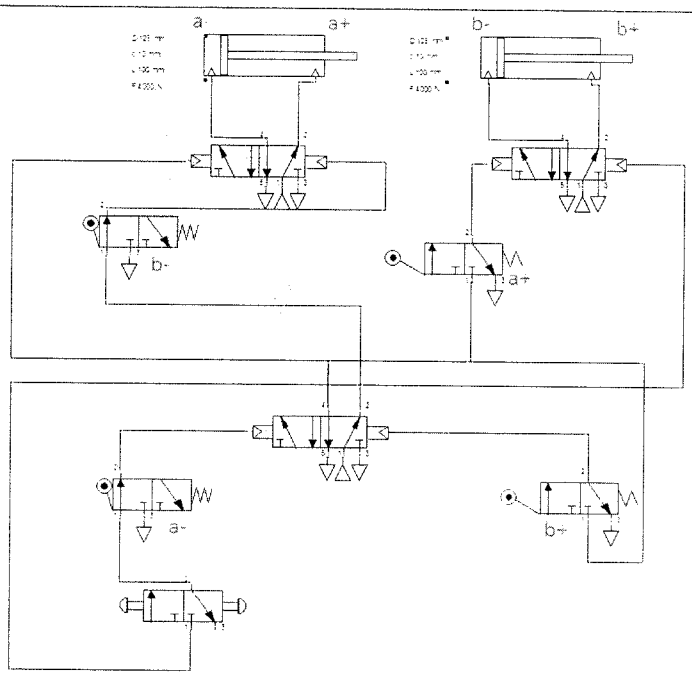
(2 x 7=14 Marks)

Q No	Solution	Scheme of Marking	Max. Time required for each Question
4.	In these transducers, the transduction mechanism is one where the self-inductance of a single coil or the mutual inductance between two coils is changed by a measurand. In general, the measurand could be a linear or rotary displacement, pressure, force, torque, vibration velocity, and acceleration. The inductance of a single coil increases as the core is inserted in the coil and reaches a maximum value when it is centered on the coil length. Similarly, two separate coils L1 and L2 wound on the same bobbin can also be used as a displacement transducer. A variation of the inductive transducer, shown schematically in Fig, is known as the linear variable differential transformer (LVDT).  (a) (b)	Sketch carries 4Marks ~~each~~ Explanation -3marks ~~each~~	7.5 Min

5	 1. The pneumatic actuator converts the fluid power into mechanical power to perform useful work. 2. The compressor is used to compress the fresh air drawn from the atmosphere. 3. The storage reservoir is used to store a given volume of compressed air. 4. The valves are used to control the direction, flow rate and pressure of compressed air. 5. External power supply (motor) is used to drive the compressor. 6. The piping system carries the pressurized air from one location to another. Air is drawn from the atmosphere through an air filter and raised to required pressure by an air compressor. As the pressure rises, the temperature also rises; hence, an air cooler is provided to cool the air with some preliminary treatment to remove the moisture. The treated pressurized air then needs to get stored to maintain the pressure. With the storage reservoir, a pressure switch is fitted to start and stop the electric motor when pressure falls and reaches the required level, respectively. The three-position change over the valve delivering air to the cylinder operates in a way similar to its hydraulic circuit	4M Sketch+3M for explanation	7.5 Min

Part C

(2 x 8 =16 Marks)

Q No	Solution	Scheme of Marking	Max. Time required for each Question
6		7M Explanation+7M for Sketch	30Min

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PRESIDENCY UNIVERSITY
BENGALURU

SCHOOL OF ENGINEERING

END TERM FINAL EXAMINATION

Semester: Odd Semester: 2019 - 2020 | **Date**: 28 December 2019

Course Code: MEC 218 | **Time**: 9:30 AM to 12:30 PM

Course Name: MECHATRONICS | **Max Marks**: 80

Program & Sem: B.Tech (MEC) & VII | **Weightage**: 40%

Instructions:

(i) Read the all questions carefully and answer accordingly.

(ii) Write all sketches using pencil only.

Part A [Memory Recall Questions]

Answer all the Questions. Each Question carries 2 marks. **(10Qx2M=20M)**

1. In a 5/2 Direction control valve, "5" indicates number of _____ and "2" indicates number of _____ (C.O.No.3) [Knowledge]
2. The control system is classified into __ & __ loops system. (C.O.No.1) [Knowledge]
3. _____ & _____ are 2 examples for contact type of transducers. (C.O.No.2) [Knowledge]
4. NOT gate has _____number of input & _____ number of outputs (C.O.No.4) [Knowledge]
5. AC motors are classified as _____ & _____ types (C.O.No.3) [Knowledge]
6. Stability is defined as _____ (C.O.No.2) [Knowledge]
7. Hysteresis is defined as _____ (C.O.No.2) [Knowledge]
8. _____ mechanism is used to rotational motion into linear/translational motion; and _____ are used to transfer and transform rotational motion (C.O.No.3) [Knowledge]
9. De-Morgan's law states that $\overline{XY}$=_____ and $\overline{X+Y}$ =_____ (C.O.No.4) [Knowledge]
10. _____ bus is used to transport a word to or from the CPU and the memory or the input/output interfaces carrying of processing function of the CPU, and _____ bus carries signals which indicate where data is to be found and so the selection of certain memory locations or input or output ports. (C.O.No.4) [Knowledge]

Part B [Thought Provoking Questions]

Answer all the Questions. Each Question carries 6 marks. **(5Qx6M=30M)**

11. Explain the process of controlling room temperature manually with a neat block diagram and identify controlled variable, reference value, comparison element, error signal, control unit, correction unit, process and measuring device. (C.O.No.1) [Comprehension]

12. Describe Hall Effect sensor with a neat labelled diagram. (C.O.No.2) [Knowledge]

13. Explain the principles of operation of electrically operated relay. (C.O.No.3) [Comprehension]

14. Identify a motor which uses a direct current to operate and has a magnetic stator with coil/windings as rotor. (C.O.No.3) [Comprehension]

15. Explain NAND & NOR gates with truth table and its symbols. (C.O.No.4) [Comprehension]

Part C [Problem Solving Questions]

Answer both the Questions. Each Question carries 15 marks. **(2Qx15M=30M)**

16. Minimize the following expressions by use of Boolean functions.

    a. $X = A\,B\,C + \overline{A}\,B + A\,B\,\overline{C}$

    b. $X = \overline{A}\,B\,\overline{C} + A\,\overline{B}\,\overline{C} + \overline{A}\,\overline{B}\,\overline{C} + \overline{A}\,\overline{B}\,\overline{C}$

    c. Prove, $AB + \overline{A}\,C + BC = AB + A\,\overline{C}$ (C.O.No.4) [Comprehension]

17. Describe the architecture of Intel 8051 Micro controller architecture with a neat block diagram. (C.O.No.4) [Comprehension]

GAIN MORE KNOWLEDGE
REACH GREATER HEIGHTS

SCHOOL OF ENGINEERING

END TERM FINAL EXAMINATION

Extract of question distribution [outcome wise & level wise]

Q.NO.	C.O.NO (% age of CO)	Unit/Module Number/Unit /Module Title	Memory recall type [Marks allotted] Bloom's Levels	Thought provoking type [Marks allotted] Bloom's Levels	Problem Solving type [Marks allotted]	Total Marks
			K	C	A	
1	3	3	K			2
2	1	1	K			2
3	2	2	K			2
4	4	4	K			2
5	3	3	K			2
6	2	2	K			2
7	2	2	K			2
8	3	3	K			2
9	4	4	K			2
10	4	4	K			2
11	1	1		C		6
12	2	2	K			6
13	3	3		C		6
14	3	3		C		6
15	4	4		C		6
16	4	4		C		15
17	4	4	K			15
	Total Marks		41	39		80

K =Knowledge Level C = Comprehension Level, A = Application Level

Note: While setting all types of questions the general guideline is that about 60%

Of the questions must be such that even a below average students must be able to attempt, About 20% of the questions must be such that only above average students must be able to attempt and finally 20% of the questions must be such that only the bright students must be able to attempt.

I hereby certify that all the questions are set as per the above guidelines.

Faculty Signature:

Reviewer Comment:

Format of Answer Scheme

GAIN MORE KNOWLEDGE
REACH GREATER HEIGHTS

SCHOOL OF ENGINEERING

SOLUTION

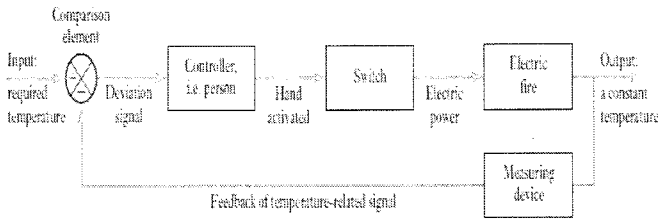
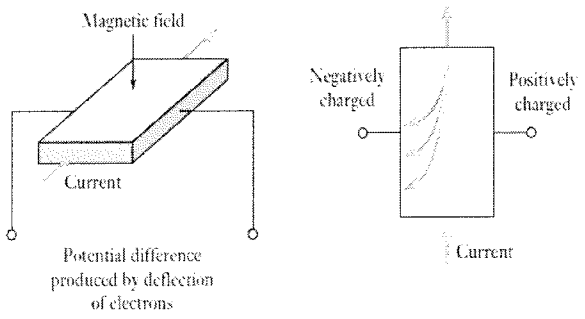
Semester: Odd Sem. 2019-20
Course Code: MEC 218
Course Name: MECHATRONICS
Program & Sem: B.Tech (MEC) & VII

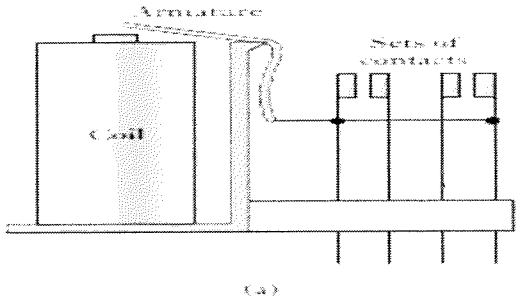
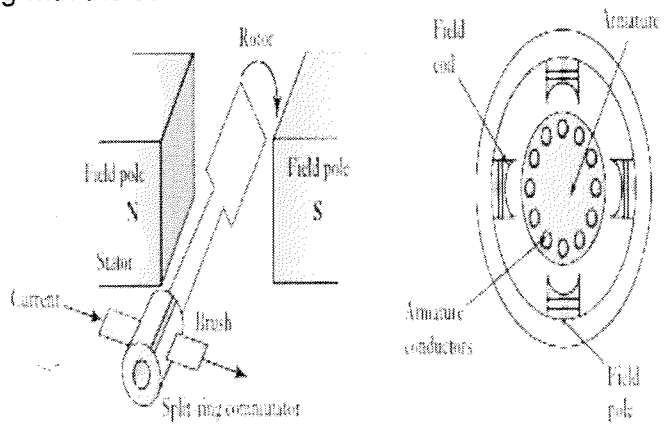
Date: 28 December 2019
Time: 9:30 AM to 12:30 PM
Max Marks: 80
Weightage: 40%

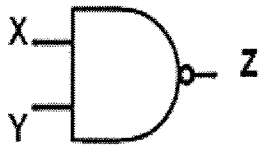
Part A (10Q x 2M = 20Marks)

Q No	Solution	Scheme of Marking	Max. Time required for each Question
1	Ports, Positions	Each ans=1M	2 min
2	Open, Closed	Each ans=1M	2 min
3	Strain guage, potentiometer	Each ans=1M	2 min
4	1 and 1	Each ans=1M	2 min
5	Single & polyphase (or) Induction & synchronous	Each ans=1M	2 min
6	**Stability (drift)** - It is the ability to give same output when a constant input is measured over a period of time.	Each ans=2M	2 min
7	**Hysteresis**: is defined as condition of obtaining different output for increasing and decreasing value of input.	Each ans=2M	2 min
8	Rack & Pinion Gear/Gear trains	Each ans=1M	2 min
9	$\overline{XY} = \overline{X}+\overline{Y}$ and $\overline{X+Y} = \overline{X}.\overline{Y}$	Each ans=1M	2 min
10	Data and address bus	Each ans=1M	2 min

Part B (6Q x 5M = 30 Marks)

Q No	Solution	Scheme of Marking	Max. Time required for each Question
11	 **Controlled variable** – the room temperature, **Reference value** – the required room temperature, **Comparison element** – the person comparing the measured value with the required value of temperature, **Error signal** – the difference between the measured and required temperatures, **Control unit** – the person, **Correction unit** – the switch on the fire, **Process** – the heating by the fire, **Measuring device** – a thermometer.	Block Diagram=2 M Each correct variables=0.5 M	15 Min
12	When a beam of charged particles passes through a magnetic field, forces act on the particles and the beam is deflected from its straight line path. A current flowing in a conductor is like a beam of moving charges and thus can be deflected by a magnetic field. Consider electrons moving in a conductive plate with a magnetic field applied at right angles to the plane of the plate (Fig). As a consequence of the magnetic field, the moving electrons are deflected to one side of the plate and thus that side becomes negatively charged, while the opposite side becomes positively charged since the electrons are directed away from it. This charge separation produces an electric field in the material. The charge separation continues until the forces on the charged particles from the electric field just balance the forces produced by the magnetic field. The result is a transverse potential difference V given by, $$V = K_H \frac{BI}{t}$$ where B is the magnetic flux density at right angles to the plate, I the current through it, t the plate thickness and K_H a constant called the **Hall coefficient**. Thus if a constant current source is used with a particular sensor, the Hall voltage is a measure of the magnetic flux density. 	Diagram=2 M Explanation =3 M Potential difference expression= 1M	15 Min

13	**Relays** Relays are electrically operated switches in which changing a current in one electric circuit switches a current on or off in another circuit. For the relay shown in Figure (a), when there is a current through the solenoid of the relay, a magnetic field is produced which attracts the iron armature, moves the push rod, and so closes the normally open (NO) switch contacts and opens the normally closed (NC) switch contacts. Relays are often used in control systems. The output from a controller is a relatively small current and so it is often used in conjunction with a transistor to switch on the current through the relay solenoid and hence use the relay to switch on the much larger current needed to switch on or off a final correction element such as an electric heater in a temperature control system or a motor. 	Correct Explanation =3 M Sketch=2 M Labelling=1 M	15 Min
14	A brush-type d.c. motor is essentially a coil of wire which is free to rotate, and so termed the rotor, in the field of a permanent magnet or an electromagnet, the magnet being termed the stator since it is stationary (Figure a). When a current is passed through the coil, the resulting forces acting on its sides at right angles to the field cause forces to act on those sides to give rotation. However, for the rotation to continue, when the coil passes through the vertical position the current direction through the coil has to be reversed and this is achieved by the use of brushes making contact with a split-ring commutator, the commutator rotating with the coil. 	Brush type DC motor=1M Explanation =3M Diagram=2 M	15 Min
15	**NAND Gate** The NAND gate has the ability to perform 3 operations such as AND, OR and NOT. This gate is a combination of NOT & AND gates. The NAND gate output is equal to the inverse of the AND gate.	NAND Gate symbol=1M Explanation =1M Truth Table=3M	15 Min

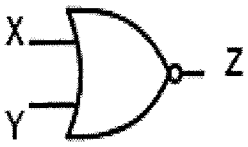


Inputs		Outputs
X	Y	Z
0	0	1
0	1	1
1	0	1
1	1	0

1 mark for labelling with **bubble**.

NOR GATE

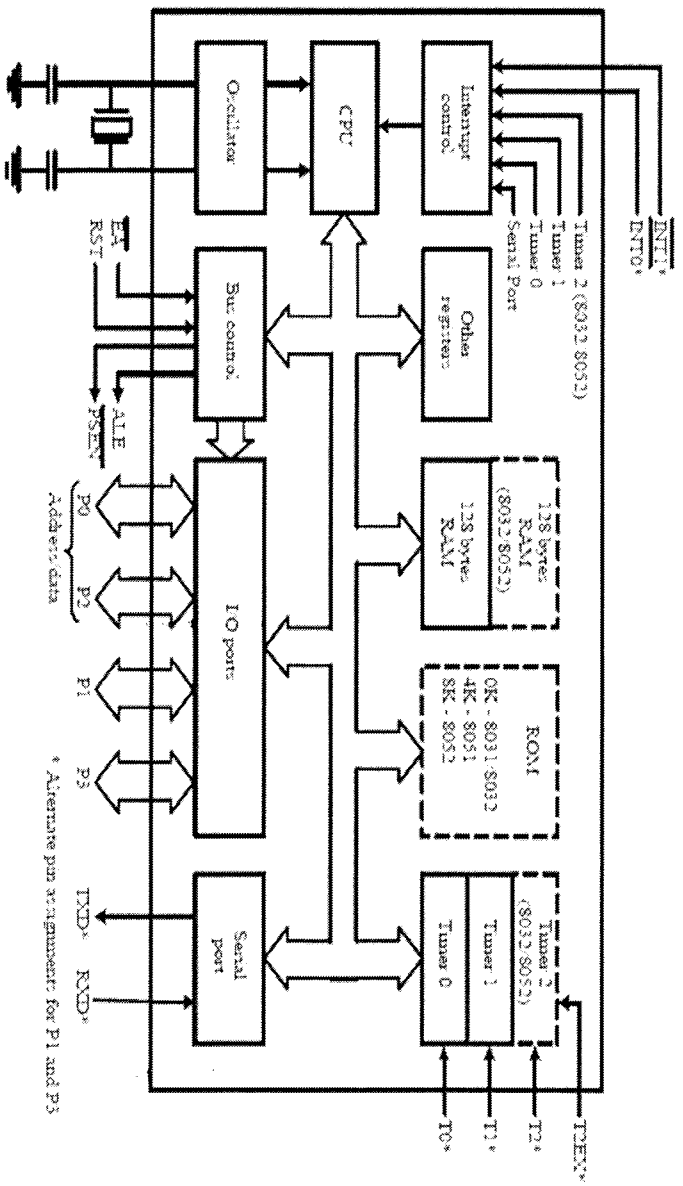
NOR gate is the combination of NOT gate and OR gate.
The NOR gate output is equal to the inverse of the OR gate.
The NOR gate has two inputs X and Y, and a single output Z.
Mathematically NOR gate is represented as $Z = \overline{(X+Y)}$.



Inputs		Outputs
X	Y	Z
0	0	1
0	1	0
1	0	0
1	1	0

Part C (2Q x 15M = 30Marks)

Q No	Solution	Scheme of Marking	Max. Time required for each Question
16	(a) $X = ABC + \overline{A}B + AB\overline{C}$ $= ABC + AB\overline{C} + \overline{A}B$ $= AB(C + \overline{C}) + \overline{A}B$ $= AB + \overline{A}B$ as $C + \overline{C} = 1$ $= (A + \overline{A})B.$ $= 1.B$ $= B$	Each correct ans=5 M	30 Min
	(b) $X = \overline{A}B\overline{C} + A\overline{B}\overline{C} + \overline{A}\overline{B}\overline{C} + \overline{A}\overline{B}\overline{C}$ $= \overline{A}B\overline{C} + A\overline{B}\overline{C} + \overline{A}\overline{B}\overline{C} + \overline{A}\overline{B}\overline{C}$ as $\overline{A} + \overline{A} = \overline{A}$ $= \overline{A}B\overline{C} + (A + \overline{A})\overline{B}\overline{C}$ $= \overline{A}B\overline{C} + 1.B\overline{C}$ $= (\overline{A}B + \overline{B})\overline{C}$ $= [(\overline{A} + \overline{B}).(\overline{B} + \overline{B})]\overline{C}$ by the dual of distribution. rules 15 $= (\overline{A} + \overline{B}).1]\overline{C}$ $= (\overline{A} + \overline{B})\overline{C}$		

	(c) L.H.S. $= AB - \overline{A}C - BC$ $= AB - \overline{A}C - BC$ $= AB - \overline{A}C - 1.BC$ as $1 = A - \overline{A}$ $= AB - \overline{A}C - (A - \overline{A})BC$ $= AB - \overline{A}C + ABC + \overline{A}BC$, by distributive law $= AB + ABC + \overline{A}C + \overline{A}BC$, by commutative law $= AB(1 + C) + \overline{A}C(1 + B)$, AS $1 + X = 1$ $= AB + \overline{A}C$ L.H.S. =R.H.S.		
17	 • Input/output ports Port 0 is at address 80H Port 1 at address 90H Port 2 at address A0H Port 3 at address B0H. Note:Hexadecimal **Input/output ports.** • When a port is to be used as an output port, the data is put into the corresponding special function register.	Skecth=7 M Explaination=8 M	30 Min

	• When a port is to be used as an input port, the value FFH must first be written to it. • All the ports are bit addressable. **ALE** • The address latch enable (ALE) pin provides an output pulse for latching the low-order byte of the address during access to external memory. This allows 16-bit addresses to be used. **PSEN** The program store enable pin is the read signal pin for external program memory and is active when low. It is connected to the output enable pin of external ROM or EPROM. **EA:** The external access pin is taken low for the microprocessor to access only external program code, when it automatically accesses internal or external code depending on the address. **XTAL1, XTAL2** These are the connecting pins for a crystal or external oscillator. **RESET** A high signal on this pin resets the microcontroller. Serial Input/output Writing to the serial data buffer SBUF at address 99H loads data for transmission; redaing SBUF accesses received data. Timing The timer mode register TMOD at address 89H is used to set the operating mode for timer 0 to timer 1. **INTERRUPTS** Interrupts force the program to call a subroutine located at a specified address in memory; they are enabled by writing to interrupt enable register at IE address A8H.		