

CBCS SCHEME

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18ME744

Seventh Semester B.E. Degree Examination, Feb./Mar. 2022 Mechatronics

Time: 3 hrs.

Max. Marks: 100

Note: Answer any FIVE full questions, choosing ONE full question from each module.

Module-1

- 1 a. Define mechatronics. Briefly explain various evolution stages of mechatronics. (10 Marks)
b. Explain with block diagram the working of engine management system. (10 Marks)

OR

- 2 a. Define transducer. Explain primary and secondary transducers with examples. (10 Marks)
b. What is hall effect? Explain the working of hall effect sensors with neat sketch and mention their applications. (10 Marks)

Module-2

- 3 a. Define signal conditioning. Explain any four methods adopted for signal conditioning. (10 Marks)
b. What is the significance of operational amplifiers? How it is used as non-inverting amplifier? (10 Marks)

OR

- 4 a. Define Solenoids. Explain two types of solenoids and mention their applications. (10 Marks)
b. With neat sketch, explain the construction and working principle of permanent magnet DC motor. (10 Marks)

Module-3

- 5 a. Explain with neat block diagram, the general form of microprocessor system. (10 Marks)
b. What is microcontroller? Explain the classification of micro controllers. (10 Marks)

OR

- 6 a. What are the different types of registers used in 8085 microprocessor? Explain with block diagram. (10 Marks)
b. What are buses? Explain different types of buses. (10 Marks)

Module-4

- 7 a. Define PLC (Programmable Logic Controller). Explain with a neat diagram working of a PLC. (10 Marks)
b. Briefly explain the basic structure of ladder logic diagram. (10 Marks)

OR

- 8 a. Explain various requirements for selecting a PLC. (10 Marks)
b. List the applications of PLC's in:
(i) Industries (ii) Power Stations (iii) Education sector
(iv) Domestic (v) Commercial sectors (10 Marks)

Modified

Module-5

- 9 a. Write notes on:
- (i) Hydrostatic bearings
 - (ii) Linear motion guide ways (linear bearing with balls) (10 Marks)
- b. Briefly explain the elements of open and closed loop control systems with neat block diagram. (10 Marks)

OR

- 10 a. Explain the different stages of mechatronic design process. (10 Marks)
- b. List the differences between traditional and mechatronic design process. (10 Marks)

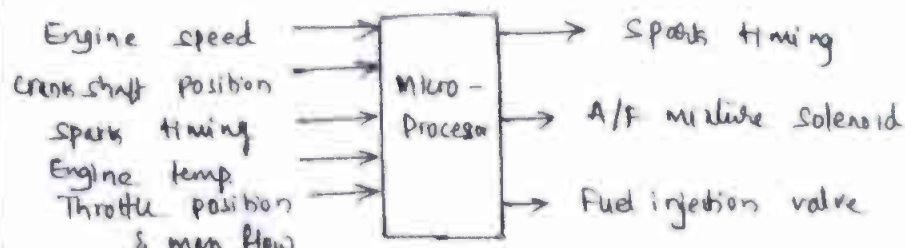
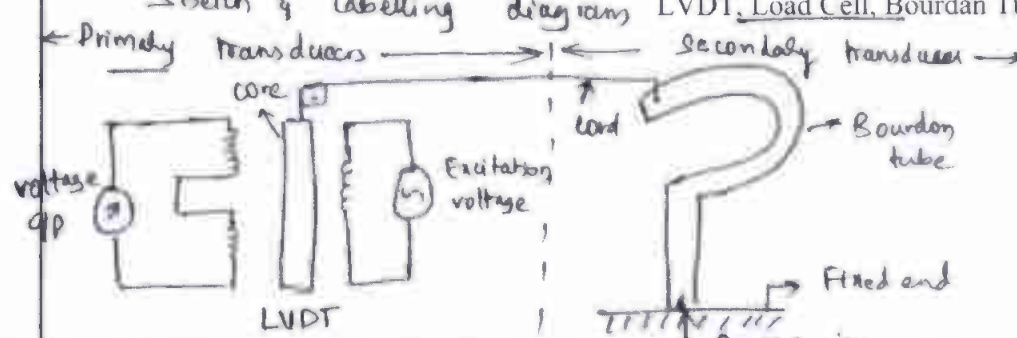


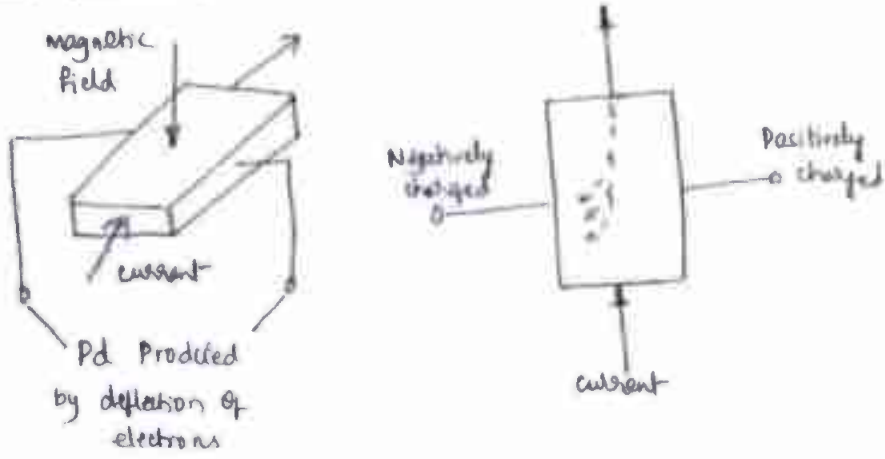
Scheme & Solutions

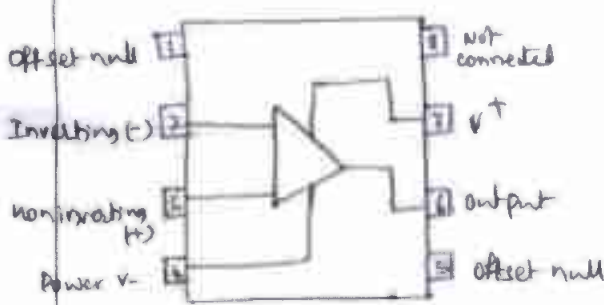
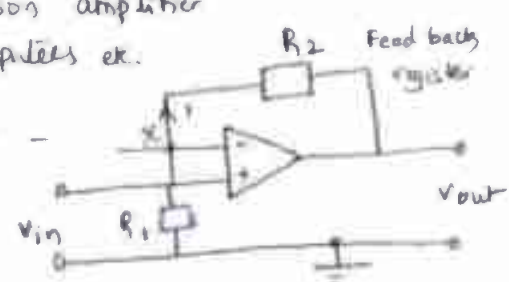
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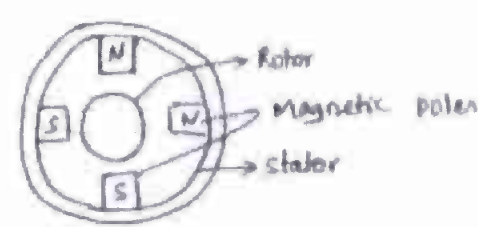
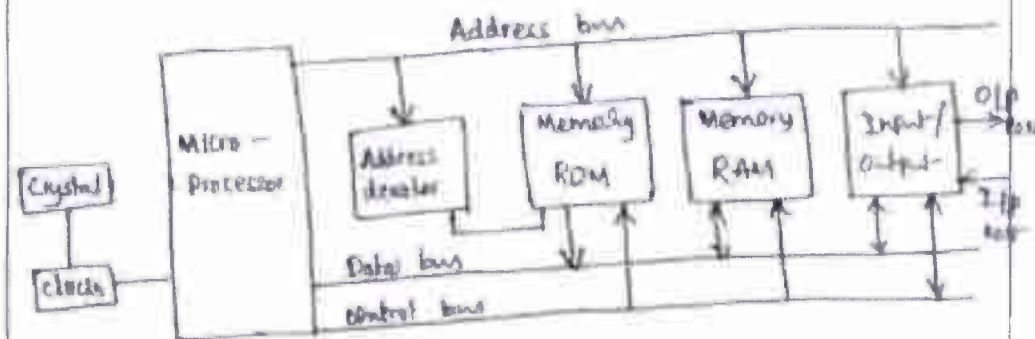
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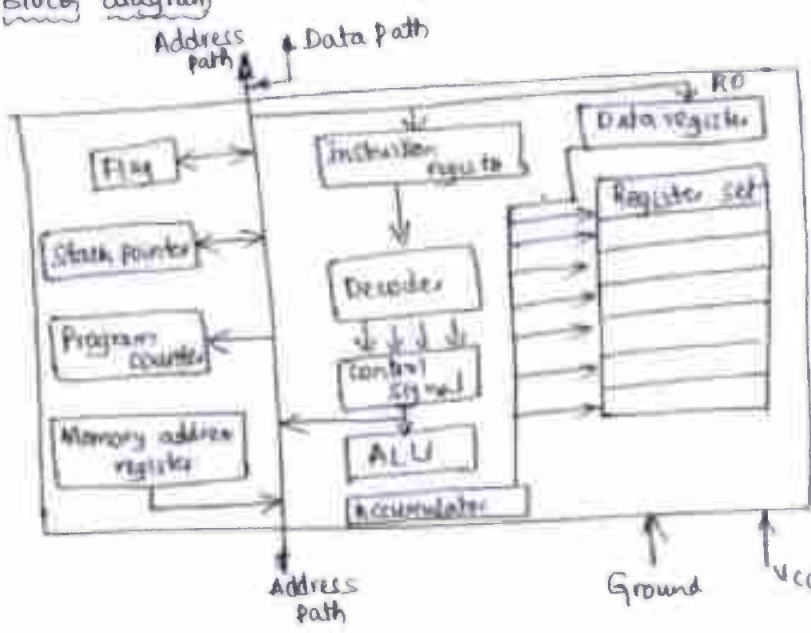
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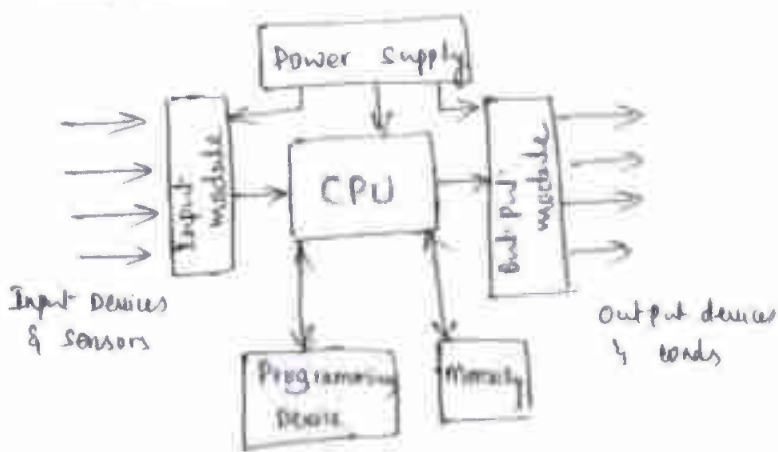
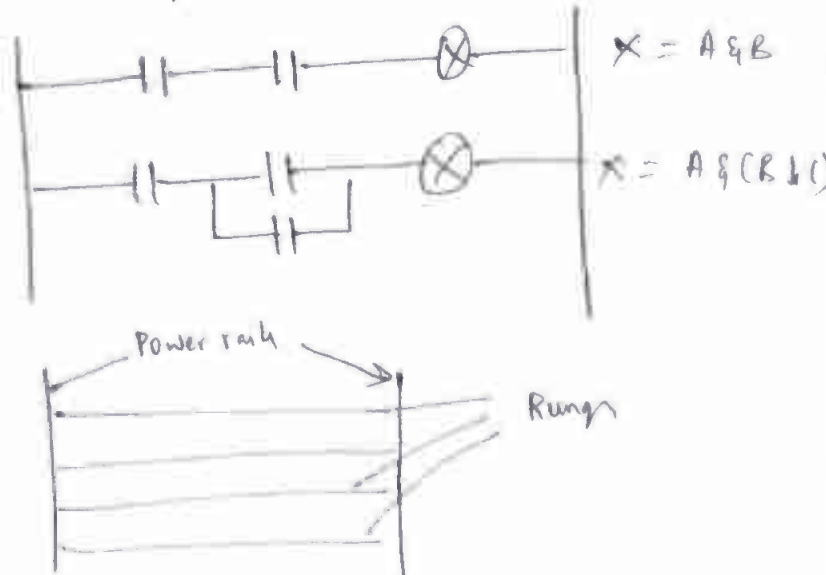

Question Number	Solution	Marks Allocated
1]	<p>a) Definition _____</p> <p>Explanation - 4 stages (i) primary level (ii) secondary level (iii) tertiary level (iv) gateway level</p> <p>b) Explanation - Any 6 points _____</p> <p>Diagram & labelling of block diagram</p> 	<p>(02M)</p> <p>(08M)</p> <p>(06M)</p> <p>(04M)</p>
2]	<p>a) Definition of Transducers</p> <p>Explanation - any 4 points</p> <p>Sketch & labelling diagrams</p> 	<p>(02M)</p> <p>(04M)</p> <p>(04M)</p>

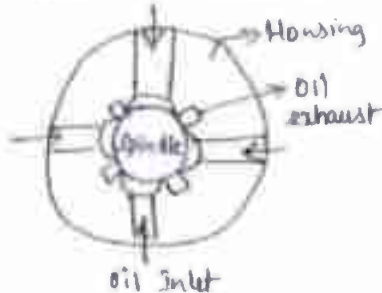
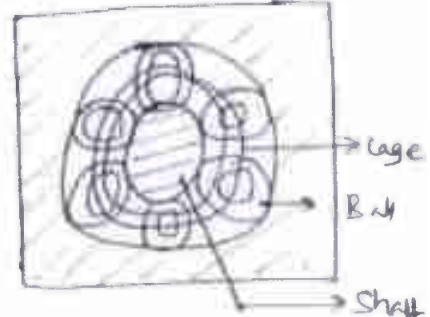
Question Number	Solution	Marks Allocated
<p>2) b)</p>	<p><u>Definition</u> → Deflection in the path of electron beams on addition of magnetic field</p> <p><u>Figure & Labelling</u></p>  <p><u>Explanation</u> - Working principle with equation as —</p> $V = k_H \frac{BI}{L}$ <p>where</p> <ul style="list-style-type: none"> V = Potential difference B = magnetic flux density I = current t = plate thickness k_H = Hall coefficient <p>Applications —</p>	<p>02M</p> <p>02+02M</p> <p>02M</p> <p>02M</p>
<p>3) a)</p>	<p><u>Definition</u> - Process of modifying output signals from transducers into usable & satisfactory level of signals using amplification, attenuation, filtration etc</p> <p><u>Methods adopted for signal conditioning are :-</u></p> <ul style="list-style-type: none"> → Amplification → Attenuation → Isolation → Multiplexing → Filtering → Excitation <p style="text-align: right;">for any 4 Explanation</p>	<p>02M</p> <p>02M x 4 = 08M</p>

Question Number	Solution	Marks Allocated
<p>3] b).</p>	<p>(i) Describe - 5 parameters</p> <p>(i) Input resistance (ii) Output resistance (iii) voltage gain (iv) Band width (v) Slew rate</p> <p><u>Symbol & uses -</u></p>  <p><u>Uses :-</u></p> <ul style="list-style-type: none"> (i) comparator (ii) Adder [summer] (iii) instrumentation amplifier (iv) Analog computers etc. <p>non-inverting amplifier -</p> 	<p>(01x5) (05M)</p> <p>(03M)</p> <p>(02M)</p>
<p>4] a).</p>	<p><u>Definition :-</u> These are actuators capable of linear motion -</p> <p><u>Two types of Solenoids</u></p> <ul style="list-style-type: none"> (i) Push type (ii) pull type <p>Figure + Explanation</p> <p><u>Applications :-</u></p> <ul style="list-style-type: none"> → Pushing buttons → Robots → Vending machines → Domestic appliances → valve operations → Factory automation → office equipments etc 	<p>(02M)</p> <p>03+03 = (06M)</p> <p>(02M)</p>

Question Number	Solution	Marks Allocated
4] b)	<p>Permanent magnet DC motor</p> <p>Sketch - & Labelling</p>  <p>Explanation - Construction _____ Working _____</p> <p>$F = I_a L B$</p> <p>Where I_a - Armature current L - length of conductor B - magnetic field.</p>	<p>04M</p> <p>03M</p> <p>03M</p>
5] a)	<p>General form of micro processor [Block diagram]</p>  <p>Explanation - 3 main parts (i) CPU, (ii) Input & Output ports, (iii) Memory</p> <p>Explanation - Bus: (i) Data bus (ii) control bus (iii) Address bus</p>	<p>03M</p> <p>01M</p> <p>02 x 03M = 06M</p>

Question Number	Solution	Marks Allocated
5] b)	<p>Microcontroller is a micro computer on a single chip i.e. it is the integration of CPU with memory & I/p, o/p interfaces</p> <p><u>Classification + Explanation</u></p> <ol style="list-style-type: none"> Semiconductor technology width & data format Instruction set Data type they can handle. 	<p>02M</p> <p>04 x 02 M = 08M</p>
6] a)	<p><u>Block diagram</u></p>  <p><u>Explanation on registers</u> :-</p> <ol style="list-style-type: none"> Temporary registers Accumulator Flag Instruction register <p>b) Buses carry electrical signals from one section to another section of the computer. They can be tracks on a printed circuit boards (PCBs)</p> <p><u>Explanation of</u> (i) Data bus, (ii) Address bus & (iii) control bus</p>	<p>02M</p> <p>02M x 04 = 08M</p> <p>01M</p> <p>03 x 03 M = 09M</p>

Question Number	Solution	Marks Allocated
<p>7] a)</p>	<p>PLC is a specialized digital controller that can control machines & processes by monitoring inputs, making decisions & controlling outputs in order to automate machines & processes</p> <p><u>Block diagram</u></p>  <p><u>Explanation</u></p>	<p>02M</p> <p>04M</p> <p>04M</p>
<p>b)</p>	<p>Basic structure of ladder logic diagram</p>  <p>Each rungs or a network, on a logic program represents a logic operation as shown</p>  <p><u>Explanation</u></p>	<p>06M</p> <p>04M</p>

Question Number	Solution	Marks Allocated
<p>8] a)</p>	<p>Requirements for selecting a PLC</p> <ul style="list-style-type: none"> * System requirements * Application requirements * Electrical requirements * Speed of operation * Communication <p>Explanation for above 5 points</p>	<p>05x02M = 10M</p>
<p>b)</p>	<p>Applications of PLC's in</p> <ol style="list-style-type: none"> (i) Industry (ii) Power stations (iii) Education sector (iv) Domestic & (v) commercial sectors <p>→ any 3 or 4 points on each sector</p>	<p>02M x 05 = 10M</p>
<p>9] a)</p>	<p>(i) <u>Hydrostatic bearings</u></p>  <p>(ii) <u>linear motion guideways</u></p> <p>(iii) <u>linear bearing with balls</u></p>  <p>Sketches →</p> <p>Explanations →</p>	<p>03+03 02+02 = 10M</p>
<p>b)</p>	<p>Block diagram of open loop control system - 02M</p> <p>closed loop control system - 02M</p> <p>Explanation of elements of each system - 03+03</p>	<p>04M 06M = 10M</p>

Question Number	Solution	Marks Allocated
10] a)	<p>Explanation on following stages of mechatronic design process</p> <ol style="list-style-type: none"> ① Need for design ② Analysis of Problems ③ Preparation of specifications ④ Generation of possible solution ⑤ Evaluation ⑥ Production of detailed design ⑦ Production of working drawing ⑧ Implementation of design 	(10M)
b)	<p>Differences between traditional & mechatronic design process</p> <p>Any 5 points in each category 02Mx05 →</p>	(10M)

Approved by



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"APPROVED"

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