MECHATRONICS AND MODERN CONTROL (SEMESTER - 6)

CS/B.TECH(ME/PE)/SEM-6/ME-602/09

1. .....
Signature of Invigilator

2. .....
Signature of the Officer-in-Charge

Reg. No. | | | | | | | | | | | | | | |

Roll No. of the Candidate | | | | | | | | | | | | | | |

CS/B.TECH(ME/PE)/SEM-6/ME-602/09

ENGINEERING & MANAGEMENT EXAMINATIONS, JUNE – 2009

MECHATRONICS AND MODERN CONTROL (SEMESTER - 6)

Time : 3 Hours] [Full Marks : 70

INSTRUCTIONS TO THE CANDIDATES :

1. This Booklet is a Question-cum-Answer Booklet. The Booklet consists of **32 pages**. The questions of this concerned subject commence from Page No. 3.
2. a) In **Group – A**, Questions are of Mul iple Choice type. You have to write the correct choice in the box provided **against each question**.
   b) For **Groups – B** & **C** you have t answer the questions in the space provided marked 'Answer Sheet'. Questions of **Group – B** are Short answer type. Questions of **Group – C** are Long answer type. Write on both sides of the paper.
3. **Fill in your Roll No. in the box** p ovided as in your Admit Card before answering the questions.
4. Read the instructions given inside carefully before answering.
5. You should not forget to write the corresponding question numbers while answering.
6. Do not write your name or put any special mark in the booklet that may disclose your identity, which will render you liable to disqualification. Any candidate found copying will be subject to Disciplinary Action under the relevant rules.
7. **Use of Mobile Phone and Programmable Calculator is totally prohibited in the examination hall.**
8. You should return the booklet to the invigilator at the end of the examination and should not take any page of this booklet with you outside the examination hall, **which will lead to disqualification**.
9. Rough work, if necessary is to be done in this booklet only and cross it through.

No additional sheets are to be used and no loose paper will be provided

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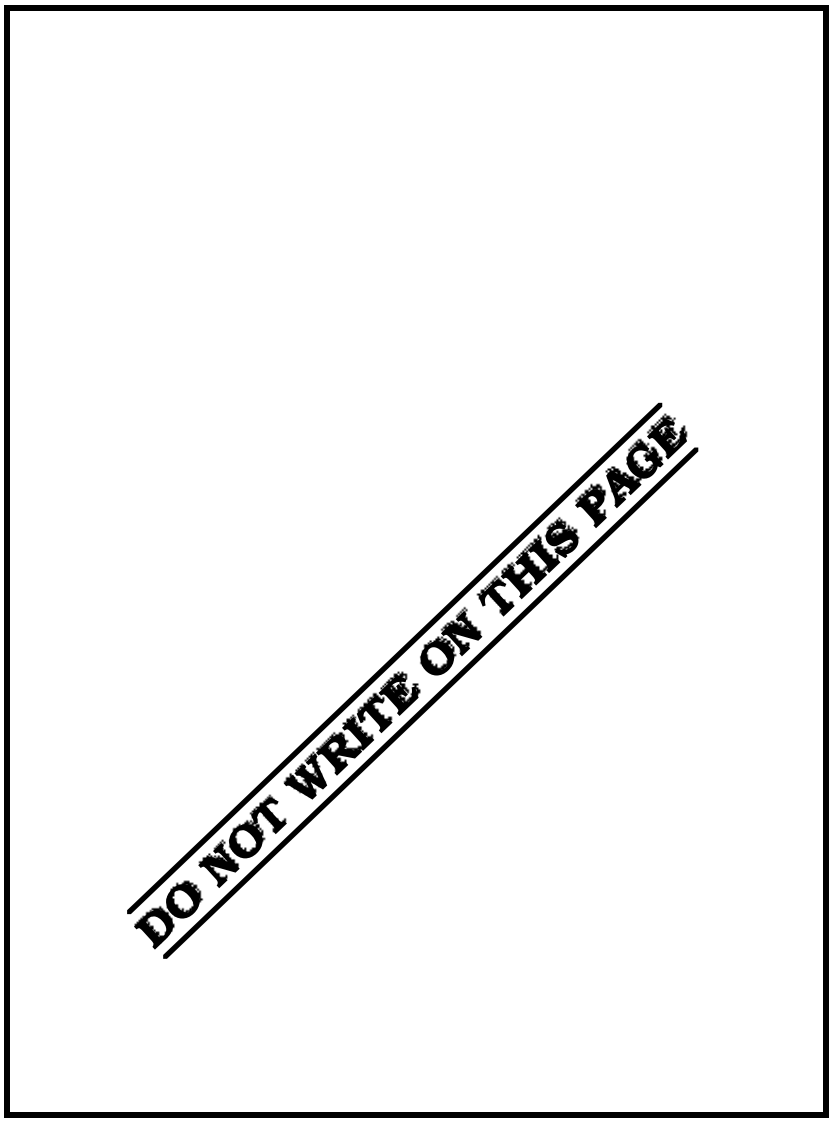
FOR OFFICE USE / EVALUATION ONLY

Marks Obtained

	Group – A										Group – B			Group – C				
Question Number																	***Total Marks***	***Examiner's Signature***
Marks Obtained																		

.....
Head-Examiner/Co-Ordinator/Scrutineer

6674 (05/06)



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GROUP – A

(Multiple Choice Type Questions)

1. Choose the correct alternatives for any *ten* of the following : 10 × 1 = 10

i) Inductive type Transducer is

a) Potentiometer b) Strain Gauge

c) Tachometer d) LVDT. ☐

ii) Laplace Transform of Unit Step Function is

a) s b) $1/s$

c) S^2 d) $1/s^2$. ☐

iii) 8085 Microprocessor is .... bit processor.

a) 4 b) 8

c) 16 d) 32. ☐

iv) The Boolean equation for the NAND gates is

a) $A.B = Q$

b) $\bar{A} = Q$

c) $A + B = Q$ when A, B are inputs and Q is the output

d) None of these. ☐

v) The resistance-temp. relationship for a resistance-temp. detectors (RTD's) is given by

a) $R_t = R_0 (1 + \alpha t)$ b) $R_t = Ke^{\beta / t}$

c) $R_t = \alpha t + bt^2$ d) none of these. ☐

where R_t = resistance at room temp. (°C), K, β,b = constants

α = temp. co-efficient of resistance, a constant.

vi) Each flag register is a register of ..... bit in 8085 microprocessor

a) 5 b) 01

c) 8 d) 16. ☐

vii) 1 : n de-multiplexer should have m select line such that

a) $2^n = m$ b) $2^m = n$

c) $m = n$ d) none of these. ☐

viii) Proximity switches are used to detect

a) nearness of an object

b) distance of an object

c) whether the object comes in contact

d) all of these. ☐

ix) The ability of a transducer to give same output when used to measure a constant input over a period of time, is kn wn as

a) sensitivity b) stability

c) accuracy d) repeatability. ☐

x) Stepper motor s efficiently used in

a) closed loop control systems b) open loop control systems

c) both (a) and (b) d) none of these. ☐

xi) 5/3 position control valve means

a) 5 positions and 3 ports b) 3 ports and 5 positions

c) 8 ports and 3 positions d) 3 ports and 8 positions. ☐

xii) Fipflops are

a) Asynchronous tristate device b) Synchronous tristate device

c) Synchronous bistable device d) None of these. ☐

GROUP – B

(Short Answer Type Questions)

Answer any *three* of the following. 3 × 5 = 15

2. What is Mechatronics ? How does it help in designing and manufacturing products ?

2 + 3

3. With schematic diagram, make the comparative features between vane pump and gear pump.

4. Construct the simplest logic circuit with 3 inputs using different types of logic gate which will give the output as

$Q = A\,B^{I}\,C + A^{I}\,B\,C + ABC^{I} + ABC$.

5. Write down the theory of State-Space analysis.

6. Draw the block diagram of a closed loop control system briefly describing the various component elements.

7. Write a short note on *Z*-transformation.

8. What is the principle of a Thermocouple ? What are the types of thermocouple ? State with neat sketches. $2\frac{1}{2} + 2\frac{1}{2}$

GROUP – C

(Long Answer Type Questions)

Answer any *three* questions. 3 × 15 = 45

9. a) What is the purpose of a pressure relief valve ? Describe its operation with the help of a schematic diagram and also discuss the differences between pressure relief valve and pressure reducing valve. 1 + 3 + 2

   b) Design a hydraulic circuit which is to be utilized for a drill work. The system utilizes two linear actuators-one for clamping the job and another for drilling :

      i) Clamp the job

      ii) Drill the job

      iii) Retract the drill spindle

      iv) Unclamp the job. 6

   c) Discuss the Principle of working of a solenoid control value. 3

10 a) Sketch a recirculating ball-screw nut assembly and explain how the backlash can be eliminated. 5

b) Explain the working principle of a stepper motor. 5

c) Write short note on either Hall-effect sensor or tactile sensor. 5

11. a) State the role of sensors and transducers in feedback control systems. 3

b) By using wheatstone full bridge circuit, construct a schematic representation of strain gauge type 2D turning dynamometer to measure the cutting force and feed force in machining. 6

c) State the advantages of piezo electric type transducers over strain gauge type transducers. 3

d) Describe the use of optical encoders in a m chatronic system. 3

12. a) Write a note on adaptive control systems and types of different adaptive control circuits. 4

b) What is Transfer Function ? Pro e that $C(S) / G(S) = G(S) / [1 + G(S) H(S)]$, where $C(S)$ = Output, $R(S)$ = Input, $G(S)$ = Open Loop Transfer Function, $H(S)$ = Feedback Transfer Function. 2 + 4

c) What is PID Con roller ? Explain *P, I, PID* controller with related equations. 5

13. a) Draw the schematic diagram of the programmable registers of the 8085 microprocessors. State the operations done by the constituent register. 3 + 4

b) Write the codes for an 8085 microprocessor that will add two numbers placed in two consecutive memory locations 2501 H and 2502 H. Store the result in another memory location 2503 H. 4

c) With an example, discuss the importance of clock pulses in performing different operations of a 8085 microprocessor. 4

14. a) Consider the following mechanical translational system. F denotes force, x denotes displacement, M denote Mass, B denote friction coefficient and K denote spring constant.

Dia.

i) Write down the differential equations governing the above system.

ii) Draw the corresponding electrical equivalent circuit using force-voltage analogy scheme. 4 + 2

b) W ite short notes on any *three* of the following :

i) Servo motor

ii) LVDT.

iii) Concurrent engineering promoted by mechatronics

iv) RS Flip Flop

v) Programming on a PLC

vi) Field effect transistors.

END