

N.B. : (1) Question No. 1 is compulsory.

(2) Attempt any four questions out of remaining six questions.

(3) Assume suitable data wherever required.

1. (a) Explain the following terms related to robot :- 10
DOF, Reach, stroke, tool orientation, precision, accuracy, repeatability, load carrying capacity, speed, work envelope.
- (b) How are robots classified? 5
- (c) Differentiate between soft and hard automation. 5
2. (a) Compute the joint variable vector $q = [q_1, q_2, q_3, q_4]^T$ for the following tool configuration vector of SCARA. $W(q) = [203.4, 662.7, 557, 0, 0, -1.649]^T$ 10
- (b) Explain the process of linear interpolation with parabolic blends. 10
3. (a) Using D-H Algorithm, perform direct kinematic analysis of 5 axis RHINO XR3 robot. 10
- (b) Explain the principle and applications of edge detection techniques using gray scale image. 10
4. (a) Explain bounded deviation algorithm for achieving straight line motion. 10
- (b) Describe the solution of inverse kinematic problem of a 2-axis planar robot. 10
5. (a) Explain work space analysis of 5-axis RHINO-XP3 robot by finding the maximum and minimum bounds. 10
- (b) Derive the general link co-ordinate transformation matrix T_{K-1}^K . 10
6. (a) Explain the PNP motion trajectory in details. 10
- (b) Explain the effect of Moment of Inertia on the dynamic performance of a robot. 10
7. Write short notes on :- 20
 - (a) Screw Transformation
 - (b) Robot Programming
 - (c) Shrink and Swell Operators
 - (d) Gross Motion Planning.

- N.B.** (1) Question No. 1 is **compulsory**.
 (2) Attempt any **four** questions from remaining.
 (3) Assume **suitable** data if **necessary**.
 (4) **Figures** to the **right** indicate **full** marks.

1. Explain in brief the following :— 20
- What are different performance parameters for controlled rectifiers ? Explain their significance.
 - State the conditions for getting inversion mode of operation in case of line commutated convertors.
 - Compare BJT, SCR and JGBT.
 - Explain the basic requirements for the successful triggering of thyristors in detail.
2. (a) A single phase fully controlled bridge convertors supplies an inductive load. Assuming that the output current is virtually constant and is end to I_d . Determine the following performance measures. If the supply voltage is 230 V and if the firing angle is maintained at 60° :— 10
- Average output voltage
 - Supply RMS current
 - Fundamental power factor
 - Supply power factor
 - Voltage ripple factor.
- (b) (i) Explain Latch up in JGBT. 5
 (ii) Explain need of Isolation in power electronics. 5
3. (a) Explain the operation of A.C. phase control circuit using Triac-Diac for lamp dimmer application. 10
 Draw the wave form across load.
- (b) A 3ϕ full wave converter bridge is connected to supply of 230 volt per phase and frequency of 50 Hz. The source inductance per phase i.e. L_s is 4 mH. The load current is 20 Amp. If the load consists of D.C. source of 400 volt with internal resistance of 1Ω . Calculate — 10
- Firing angle delay
 - Overlap angle.
4. (a) Why commutation failure may occur in case of Jones choppers ? How it can be avoided ? 10
- (b) In a basic step down D.C. chopper circuit Input voltage is 200 V. $R = 5 \Omega$ drop across chopper is 2 Volt. Duty cycle is 0.4. Determine — 10
- Average output voltage
 - RMS o/p voltage
 - Chopper efficiency.
5. (a) Draw and explain the simple SCR series Invertor circuit employing class A type commutation. Draw and discuss the important waveform, state the limitation of this series invertor. 10
- (b) Obtain an expression for circuit turn-off time Jones chopper $C = 40 \mu\text{f}$, $L_1 = 100 \mu\text{H}$, $L_2 = 30 \mu\text{H}$, $V_s = 100$ volt. Find out the highest turn-off time for main SCR T_1 and maximum load current that can be safety commutated. 10

6. (a) Explain the method of speed control of 3-phase slip ring induction motor using slip power bearing scheme. 10
- (b) Explain with block schematic the working of microcontroller based circuit of D.C. motor. 10
7. Write short notes on any **four** of the following :— 20
- (a) Ramp and Pedestal scheme for triggering SCR circuit
 - (b) Commutation circuits of SCR
 - (c) Cooling methods of power semiconductor devices
 - (d) V/F control for induction motor
 - (e) Modified Series Invertor
 - (f) Parallel Invertor.

Con. 3192-10. Data Communication & Network AN-3130

(3 Hours)

[Total Marks : 100

- N.B.** (1) Question No. 1 is compulsory.
 (2) Attempt any four questions out of remaining six questions.
 (3) Assume suitable data wherever required.

1. Answer any four questions :- 20
- (a) Does TCP provide connection oriented or connectionless service ? Differentiate between TCP and UDP.
 - (b) Is bit padding a technique for FDM or TDM ? Explain.
 - (c) Why packet switching preferred over circuit switching for data transmission ?
 - (d) How does fast Ethernet differ from 10 Base-T ?
 - (e) Explain the VCI/VPI structure used in ATM. State advantages.
2. (a) Distinguish between synchronous TDM and statistical TDM. Explain merits and demerits of statistical TDM with respect to synchronous TDM. 8
- (b) Design the switch for $N = 32$ and $n = 8$ for the following - 8
- (i) 3-stage space division switch
 - (ii) TST switch
- which is a better option ? Why ?
- (c) Define utilization efficiency of the line and obtain the expression for the same for sliding window flow control. 4
3. (a) Sketch HDLC frame structure. With respect to it, explain 10
- (i) Piggybacking
 - (ii) Bit-stuffing
 - (iii) Types of frames in HDLC.
- (b) Sketch the frame format of frame relay and explain address field. How it provides congestion control and quality of service ? 10
4. (a) For the following block of 16 bits is 10101001 00111001 6
- (i) Obtain checksum of 8 bits
 - (ii) If there is no error in reception, show that the receiver detects the same.
 - (iii) For the received data 10101111 11111001 0001 1101, obtain the receiver decision.
- (b) Explain point to point protocol in detail. 10
- (c) Compare Go-back-N ARQ and selective repeat ARQ. 4

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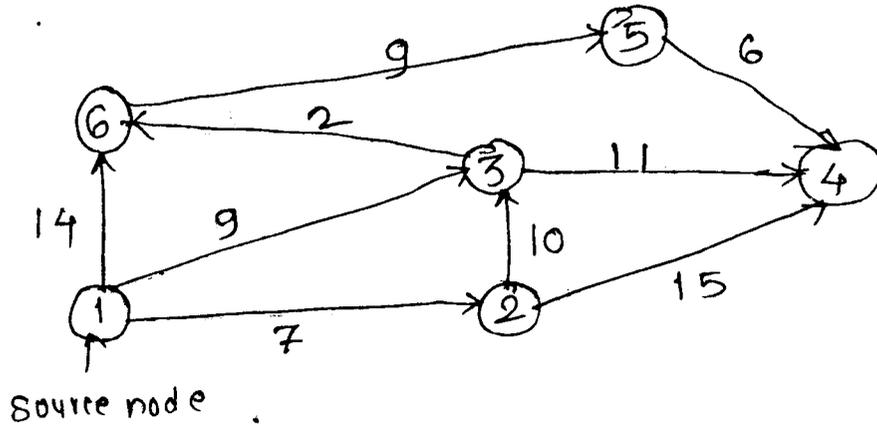
(Lab)

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11 Am to 2 Pm

5. (a) State Bellman Ford and Dijkstra's Algorithm. Apply any one algorithm to the given network and find the least cost path between the source node 1 to all other nodes. 12



- (b) How are congestion control and quality of service related? What are four general technique to improve quality of service? 8
6. (a) Explain ATM adaptation layer and ATM cell in detail. 10
 (b) Compare the IEEE 802 protocol layer with the OSI model. 5
 (c) Briefly explain the signaling structure supported by SS7. 5
7. (a) Draw block diagram of functional architecture of B-ISDN and explain B-ISDN channels and interface. 10
 (b) Write short notes on any two of the following :- 10
 (a) CSMA/CD
 (b) FDDI
 (c) ADSL.

Con. 3217-10.

(REVISED COURSE)

AN-3136

(3 Hours)

[Total Marks : 100

- N.B. :** (1) Question No. 1 is **compulsory**.
 (2) Solve any **four** from remaining **six** questions.

- Q.1 Design an embedded system to measure frequency of a power line. 12
 a) The system is expected to measure frequency correctly up to one decimal place and ring an alarm if it is less than 47 Hz or greater than 53 Hz. Suggest hardware components used with justification.
- b) Explain the use of following in Embedded C Programming 08
 # include directive and header files
 # define
 static and volatile modifiers
- Q.2 A simple battery operated toy is to be developed for alphabet learning. 20
 The specifications are as follows
- There are keys for alphabets and to choose level of learning.
 - For any alphabet key pressed a prerecorded message is played and a display indicates the alphabet.
 - For different levels different messages should be played. (Satisfying learner at different level)
 - If more than two keys are pressed error message is to be played.
- Design a system indicating components required.
 Explain the design with choice of processor.
 Show how audio message is generated.
- Q.3 a) A real time program has three tasks with following characteristics 10
- | | Period | execution time | Initial occurrence at |
|----|--------|----------------|-----------------------|
| T1 | 3 | 1 | 0 |
| T2 | 6 | 2 | 2 |
| T3 | 12 | 3 | 5 |
- In addition to that there is aperiodic task T4 which occurs at time = 11 and takes 5 units of time for execution.
 If the priorities are assigned according to their periods / deadlines dynamically and preemptive scheduling is done then evaluate whether all the tasks meet their deadlines. Also find waiting time for T4
- b) Explain reentrancy and disabling of interrupts method to avoid shared data problem with suitable example. 10
- Q.4 a) One task is generating data to be sent to another task and the second task is using this data for further processing. Explain which Inter task communication tools will be used to synchronize these tasks so that none has to wait for the data and no data should be overwritten or lost. 10
- b) Write a short note on Interrupt Latency and its role in design of embedded real time systems. 10

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- Q.5 a) Write an assembly language program for following code in C for 8 bit processor / microcontroller (Assume instruction set) 10

```
#define Input_A P0
#define Input_B P1
main( )
{
int m, n , total ;
while ( 1)
{
if (total = 0) break;
if (m<n)
{
total = m + n;
}
m = Input_A;
n= Input_B;
}
}
```

- Q. 5 b) Explain need of corrective protocols in case of unbounded priority inversions. 10
Explain with suitable examples when to use Priority inheritance protocol and when to use priority ceiling protocol.

- Q. 6 a) Discuss layered architecture of CAN node. Elaborate Transfer Layer with regards to message framing and arbitration. 06

- b) What is the role of processor reset and system reset? 06
Explain need of watchdog timer and reset after the watched time.

- c) Explain what Build Process of Embedded Software is. 08

- Q.7 Write short notes on any 3 20

- 1) RISC and CISC processors
 - 2) In Circuit Emulators
 - 3) Use of I²C Embedded Systems
 - 4) waterfall model of embedded software development
 - 5) Black Box Testing
-

Mechatronics.

Con. 3241-10.

AN-3127

(3 Hours)

[Total Marks : 100

N.B. (1) Question No. 1 is compulsory.

(2) Answer any four questions out of remaining six questions.

(3) Assume any suitable data wherever required but justify the same.

(4) Figures to the right indicate full marks.

(5) Illustrate answer with sketches wherever required.

1. Answer any four of the following :-

20

(a) What is mechatronics ? Explain key elements of mechatronics.

(b) Give different type of volume control valves and explain in brief.

(c) What is micro sensor ? Give the basis fabrication process steps of micro sensor.

(d) Draw PLC Ladder diagram of the following -

(i) AND logic

(ii) OR logic

(iii) As push button pb_1 pressed motor M_1 ON for 15 sec. and motor M_2 automatically switched ON after 10 sec. Motor M_1 and M_2 will be switched OFF after 15 sec.

(iv) Explain digital controller with neat block diagram.

2. (a) Explain in detail Mechatronics design process diagram, operation and importance. 10

(b) Explain the operation of various types of flow sensor. 10

3. (a) Compute the block diagram representation of the following electrical circuit shown in figure. 10

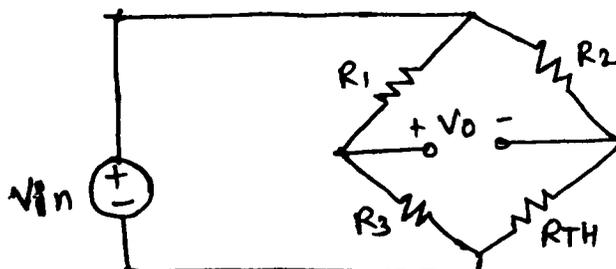


fig. 3(a)

(b) Explain basic principle of piezoelectric transducer. Derive expression for voltage. 10
Draw mechanical diagram of piezoelectric accelerometer.

4. (a) Explain construction and operation of brushless D.C. motor. 10

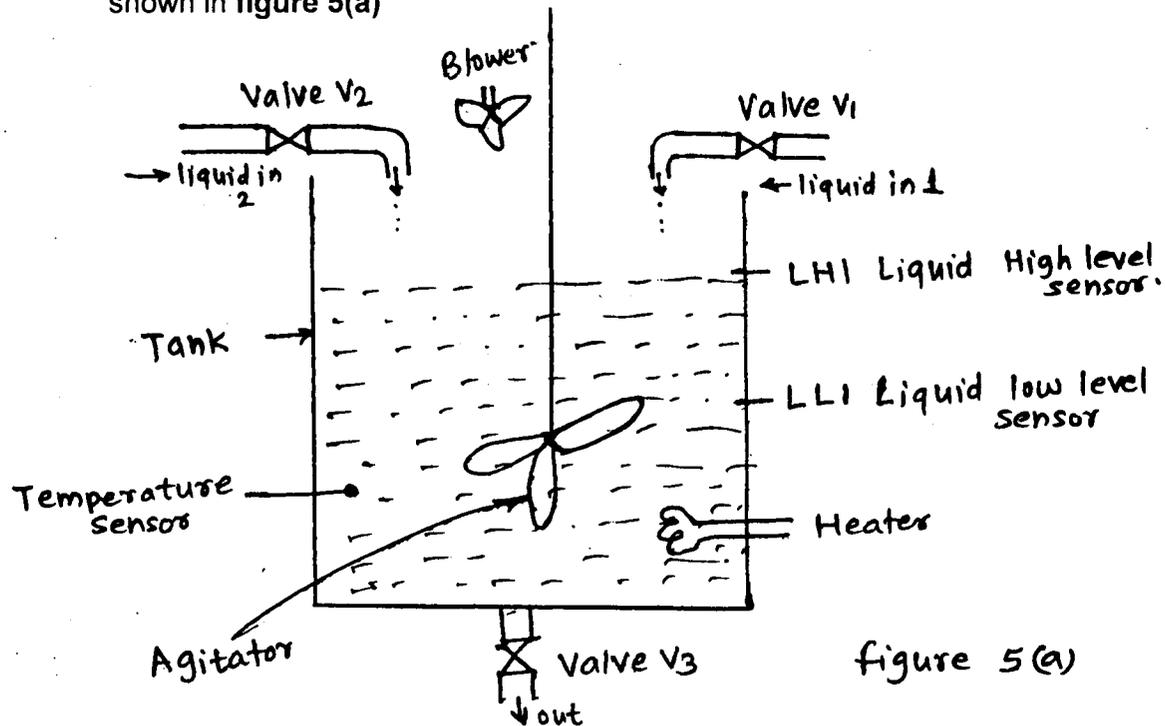
(b) Explain major components of data acquisition and control system. 10

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5. (a) Draw the PLC ladder diagram and plain logic for following chemical mixing plant as shown in figure 5(a) 12



As start push button pressed following process start

- (i) If liquid level below LLI, Valve V_1 open. When liquid level touches to LLI valve V_1 get closed after 5 sec. and valve V_2 open.
 - (ii) When liquid level touches to LHI sensor valve V_2 get closed after 10 sec. and agitator ON for 15 sec. then heater is ON.
 - (iii) When liquid temperature is more than 200°C then heater turn off and then agitator and blower ON for 20 sec.
 - (iv) Then V_3 valve open for 30 sec.
 - (v) Repeat this process five times and then stops.
- (b) Draw the block diagram of PLC and explain each block in detail. Also explain selection procedure and features of PLC. 8
6. (a) Explain P, PI, PD and PID controller with the help of circuit diagram. Also draw the waveform for step input and ramp input. 12
- (b) Explain mechatronics control in Automated manufacturing in detail with diagram. 8
7. Write a note on :- 20
- (a) Fuzzy logic
 - (b) Fiber optic sensors in mechatronics
 - (c) Stepper motor
 - (d) Adaptive control system.

Con. 3217-10.

(REVISED COURSE)

AN-3136

(3 Hours)

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Embedded Systems & Real-Time Programming

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