(3 hours) [Total Marks: 80]

**Note:**

1. Question-1 is compulsory.
2. Answer any three questions from remaining five.
3. Assume suitable data if necessary.
4. Numbers in the right indicate marks.

1. Answer the following questions. (Each question carry 5 marks) 20
   (a) Distinguish between linear valve and equal percentage valve.
   (b) Draw circuit diagram of a basic RC band-pass filter. Sketch its frequency response clearly showoing the expressions for cut-off frequencies.
   (c) Describe any two discontinuous controller modes.
   (d) What are two PLC operation modes? Describe both modes in brief.

2. (a) Draw basic pneumatic system and describe its components. 10
   (b) Illustrate the working of V-to-I and I-to-V converters with neat circuit diagrams. 10

3. (a) Consider the instrumentation amplifier shown in figure below. Derive the expression for $V_{out}$ and compute the resistors for the gain of 101. 10
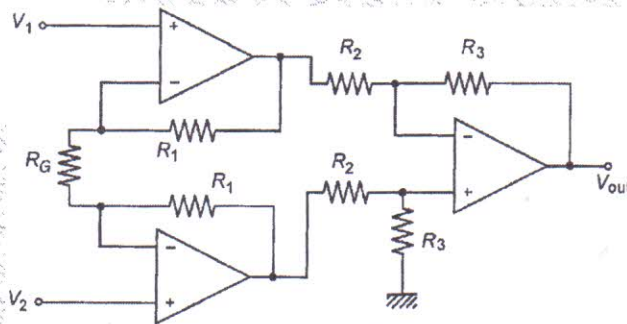


   (b) What are the criteria for selecting controller mode for a given process? Describe the ratio controller with clearly specifying the types of processes for which it is used. 10

4. (a) An integral controller is used for speed control with a setpoint of 12 rpm within a range of 10 to 15 rpm. The controller output is 22% initially. The integral gain $K_I = -0.15\%$ controller output per second per percentage error. If the speed jumps to 13.5 rpm, calculate the controller output after 2s for a constant $e_p$. 10
   (b) Draw the basic structure of PLC and describe its components in detail. 10

[TURN OVER]

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5. (a) Develop the physical ladder diagram for a motor with the following: NO start button, NC stop button, thermal overload limit switch opens on high temperature, green light turns on when running, red light turns on for thermal overload.    10

    (b) What is a Data Acquisition System (DAS)? Describe, with clear diagram, working of a typical DAS.    10

6. Answer any two of the following questions.    20

    (a) Write a short note on SCADA.

    (b) What is the scope of standard NEMA 250? Describe its features in brief.

    (c) List any five SAMA symbols. Draw clear symbol with brief description.

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**Time: 3 Hours**                                                                 **Total Marks: 80**

NB: (1) Question No. 1 is compulsory.
    (2) Attempt any three questions from remaining five questions.
    (3) Assume suitable data if required but justify the same.
    (4) Figures to the right indicate full marks

Q.1.        Attempt any four from following                                         20

    a    Describe different modes of operation of SCR with the help its static V-I characteristics and explain what is holding current and latching current.

    b    Explain single phase full-bridge inverter with R load.

    c    Explain with the help of neat circuit diagram and waveforms what the effect of freewheeling diode is on the performance of single phase half wave controlled rectifier with RL load.

    d    What are turn on methods of SCR? What are the basic requirements for successful turn on of SCR? Which is the best method of SCR triggering explain why?

    e    Describe the principle of on-off control and phase control.

Q.2.  a    Draw ramp and pedestal trigger circuit used for single phase semi converter.   10
            Describe its operation with appropriate waveforms

    b    What are turning off methods of SCR. Explain the Class D commutation   10
            method with the help of neat circuit diagram and waveforms, also give the design concepts of class D commutation.

Q.3.  a    Discuss the effect of source inductance on the performance of single phase   10
            fully controlled converter, indicating clearly the conduction of various thyristors during one cycle. Derive an expression for its output voltage in terms of

            (1) Maximum voltage $E_m$, Firing angle $\alpha$ and overlap angle $\mu$.

            (2) $E_m$, $\alpha$, $L_s$ (source inductance) and $I_d$ (load current).

    b    A single phase fully controlled bridge converter supplies an inductive load.   10
            Assuming that the output current is virtually constant and is equal to $I_d$, determine the following performance measures, if the supply voltage is equal to 230 V and if the firing angle is maintained at $(\pi/6)$ radians.

            (i) Average output voltage (ii) Supply RMS current (iii) Supply fundamental RMS current (iv) Fundamental power factor (v) Supply power factor
            (vi) Supply harmonic factor (vii) Voltage ripple factor

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Q.4.  a  Draw and explain the basic series inverter circuit employing class A type   **10**
commutation. Draw and discuss the important waveforms. State the
limitations of this series inverter.

    b  A single phase full bridge inverter is operated from a 48 V battery and is   **10**
supplying power to a pure resistive load of 10 Ω.
Determine
(i) Fundamental output voltage and the first five harmonics.
(ii) RMS value by direct integration method and harmonic summation
method.
(iii) Output RMS power and output fundamental power.
(iv) Transistor switches ratings.

Q.5.  a.  Draw the schematic of step-up and step-down choppers and derive an   **10**
expression for output voltage in terms of duty cycle for a step-up and step-
down chopper.

    b  The input voltage to the boost DC-DC switch mode regulator is 6 V. The   **10**
average output voltage is 18 V and the average load current is 0.4 A. The
switching frequency is 20 KHz of L = 250 µH and C = 420 µF.
Determine
i) The duty cycle α, ii) The ripple current of inductor, iii) The peak current
of inductor, and iv) The ripple voltage of filter capacitor

Q.6.    Write a short note on **any three** of the following.          **20**
(i) Single phase cyclo-converter
(ii) Battery charging systems
(iii) Static characteristics of IGBT
(iv) Protection of SCR against dv/dt, di/dt, over current and over voltage.

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(3 Hours)          [Total Marks: 80]

NOTE:-1) Question 1 is **compulsory**
2) Solve **any three** from the remaining five questions
3) Assume suitable data if necessary.
4) Figures to the right indicate full marks

Q.1. a. What is the need of multirate processing? Give some examples of multirate    20
digital systems.

   b. What is Digital Signal Processor and explain it's basic characteristics.

   c. What is the relation between digital and analog frequency in impulse invariant
transformation .What is aliasing ?

   d. What do you mean by overflow limit cycles ? How it can be avoided?

Q.2. a. Design a high pass filter using Hamming window with cut off frequency    10
of 1.2 rad/sec and number of coefficients =9.

   b. Explain Gibb's phenomenon in FIR filter design.    10

Q.3. a. Explain frequency warping effect in BLT in detail.    10

   b. The digital filter with system function $H(z) = \frac{0.5\,Z}{z-0.5}$ Find the output noise

power from digital filter when input is quantized to have 8- bits.    10

Q.4. a. Explain the application of DSP in speech.    10

   b. Explain how higher throughput is obtained in DSP using the VLIW architecture.    10

Q.5. a. Find DFT of x(n)=$2^n$ using the 8-point DIT-FFT algorithm.    10

   b. Develop a radix -2 DIF -FFT algorithm for computing 8 point DFT.    10

Q.6. a. Explain in detail polyphase decomposition.    10
   b. What is the need for multistage filter implementation. Explain it's drawbacks.    10

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( 3 Hours )                                                      [ Total Marks: 80 ]

**N.B.:**  1. Question No. 1 is **compulsory**.
  2. Answer **any three** from remaining questions.
  3. **All** questions carry **equal marks**.

Q. 1 Answer **any four**:                                                    20
  a)    What is need for Wireless Sensor Network (WSN)? Mention applications.
  b)    How cell switching is done in Asynchronous Transfer Mode (ATM).
  c)    Explain the steps for completing access layer design.
  d)    What is IEEE 802.15 3a Ultra Wide Band (UWB)?
  e)    Differentiate between unicast routing and multicast routing protocols.

Q.2 (a) With a neat diagram explain  Bluetooth protocol stack with neat diagram.      10
  (b) Explain network security threats and safeguards in detail.                 10

Q. 3 (a) What is Remote Monitoring (RMON)? Explain the benefits of RMON.           10
  (b) Bring out the advantages of optical networking with a neat diagram, explain    10
      SONET hardware components.

Q.4 (a) Enlist and explain various deployment models of cloud computing.            10
      What are key drivers to adoption of cloud?
  (b) Draw and explains Dense Wavelength Division multiplexing (DWDM) architecture in
      detail.                                                          10

Q.5 (a) Explain 802.11 Media Access Control (MAC) frame format.                  10
      Describe the services offered by MAC.
  (b) Explain Open Shortest Path First (OSPF) protocol in detail.                 10

Q.6 Write a short note on **any four** :                                      20
  a)    Compare Infrastructure networks and Ad-hoc networks.
  b)    Zigbee technology.
  c)    Impact of cloud on users.
  d)    Packet filtering.
  e)    Radio Frequency Identification (RFID).

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Time: - 3 Hours

Total Marks:- 80

Note:  1] Question No.1 is COMPULSORY.

2]Solve Any THREE questions from remaining.

2] All Questions carry equal marks.

Q1.    [a] How are robot classified?                                                    [04]

[b] Define Precision, Accuracy, repeatability, DOF                        [04]

[c]  Given $[p]^M=[0.6, 0.5, 1.4]^T$. Compute $[p]^F$ if                        [04]

$$A = \begin{bmatrix} 0 & -1 & 0 \\ 1 & 0 & 0 \\ 0 & 0 & 1 \end{bmatrix}$$

[d]Define kinematics parameters. What is soft home configuration?        [04]

[e] State and Explain Single Axis Robot.                                    [04]

Q 2. [a] What are Composite Rotation Matrices? How are they represented?        [10]

[b]A robot joint has to move from an initial angle of $\theta_0 = 30^0$ to the final value of $\theta_f = 150^0$ in 5 seconds. Find the cubic polynomial to generate smooth trajectory for the joint. Assume zero velocity at the starting and ending of the path. What is maximum velocity and acceleration for this trajectory?        [10]

Q.3.　[a] Explain Denavit-Hartenberg (D-H) Algorithm in detail　　　[10]

　　　[b] Derive Direct kinematics of 3-Link manipulator shown below.　　　[10]
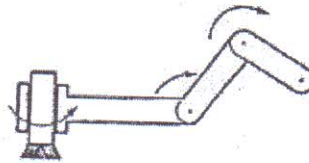


| joint | θ | d | a | α |
|-------|-----|---|----|-----|
| 1 | Θ1 | 0 | A1 | -90 |
| 2 | Θ2 | 0 | A2 | 0 |
| 3 | Θ3 | 0 | A3 | 0 |

Q.4　　[a] Obtain Tool Configuration Jacobian Matrix for Four Axis SCARA robot　　　[10]

[b]For the three axis planr articulated robot shown in the figure,Find the joint variables q when the first two links form a right angled triangle,given TCV as $W(q)=\{a2,a1,d3,0,0,1\}^T$.　　　[10]

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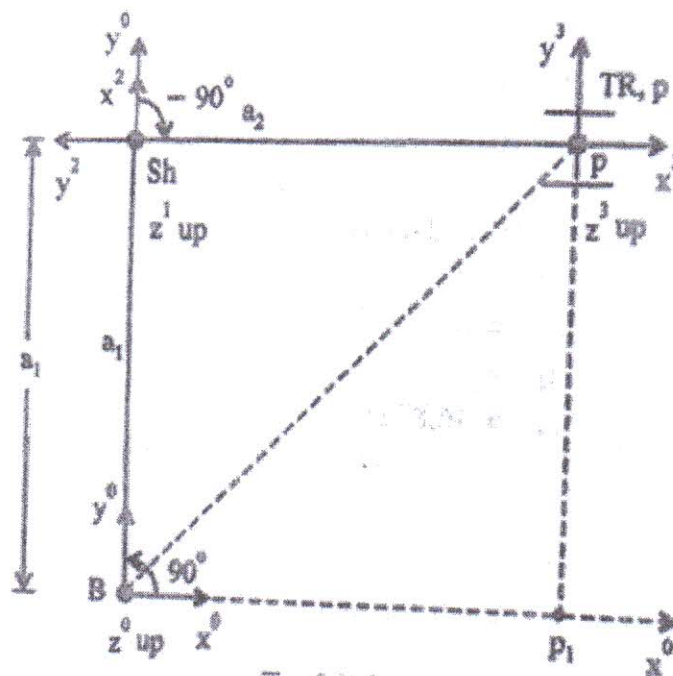
5 [a] Explain the edge detection algorithm. [10]

[b] What are the template matching techniques ? Explain Normalized Cross Correlation in detail for an image

| 2 | 1 | 0 | 0 | 3 |
|---|---|---|---|---|
| 0 | 0 | 5 | 0 | 0 |
| 0 | 4 | 0 | 6 | 0 |
| 1 | 0 | 5 | 0 | 0 |

For a mask/template

| 0 | 4 | 0 |
|---|---|---|
| 3 | 0 | 5 |
| 0 | 4 | 0 |

[10]

Q.6. [a]Explain any one of the technique in path planning algorithms . [10]

[b] Explain Shrink operators, their usage and comment on convergence for the image given below 10]

| 0 | 0 | 0 | 0 | 0 | 0 |
|---|---|---|---|---|---|
| 1 | 1 | 1 | 1 | 1 | 0 |
| 0 | 0 | 1 | 1 | 1 | 0 |
| 0 | 0 | 1 | 1 | 1 | 0 |
| 0 | 0 | 0 | 0 | 0 | 0 |

( 3 Hours )                                                    ( Total Marks : 80 )

N.B:   1) **Q.1** is **compulsory.**
       2) Attempt **any THREE** questions from the remaining questions.
       3) Assume suitable **data** if **necessary.**

Q.1 Attempt **any four** :

   a) Compare active attacks vs Passive attacks.                            [5]

   b) Explain various types of key-loggers in brief.                        [5]

   c) Classify the cybercrimes and explain any one briefly.                 [5]

   d) Explain how the appeals can be made under The IT ACT 2000.            [5]

   e) Write brief note on : Cyber-terrorism.                                [5]

Q.2 a) How criminals plan the attack? Discuss various steps involved       [10]

    b) Explain how Intellectual property laws protect the rights of the owner of the

       intellectual Property.                                              [10]

Q.3 a) Compare Vishing, Phishing and Smishing in cyber security.           [10]

    b) What is E-commerce? Explain different types of e-commerce with

       suitable examples.                                                  [10]

Q.4 a) What is Bluetooth hacking? Explain Bluetooth hacking tools in brief. [10]

    b) How the Indian penal code IPC 1860 addresses cybercrime?            [10]

Q.5 a) Discuss basic security precautions to be taken to safeguard Laptops and

       wireless devices.                                                   [10]

    b) What is E-contract? Discuss E-contract Act 1872.                     [10]

Q.6 Write short note on **(Any 2)** :                                       [20]

       1)    Computer Sabotage.

       2)    Indian Information Technology Act 2000

       3)    Write key IT requirements for SOX and HIPAA.

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