(3 Hours)   **[Total Marks: 80]**

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

              (2) Answer any **three** questions from Question Nos. 2 to 6.

              (3) Assume suitable data if necessary.

1   Answer any FIVE of the following questions:-   20
          (a) Discuss the process characteristics.   4
          (b) In the temperature measurement system, suppose the temperature   4
              range 20^0 *to* $120^0 C$ is linearly converted to the standard current
              range of 4 to 20 mA. What current will result from $60^0 C$? What
              temperature does 6.5 mA represent?
          (c) Discuss the need of controller tuning and explain any one method.   4
          (d) Draw and explain of cascade controller for CSTR.   4
          (e) Explain the use of RGA in multivariable control.   4
          (f) Discuss discrete state process control.   4

2   (a) Discuss dynamic behavior of first and second order systems.   10
          (b) For the error curve shown below, plot a graph of a PID controller   10
              output as a function of time.

$$K_P = 2.0, \quad K_I = 2.2 \ s^{-1}, K_D = 2 \ s, and \quad p_I(0) = 40\%$$
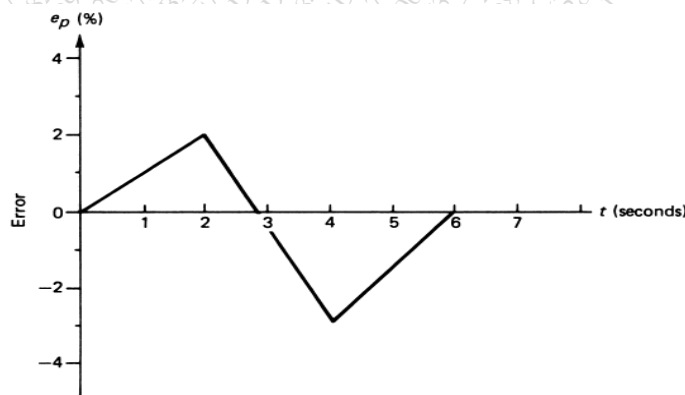
3   (a) Differentiate electronic and pneumatic controller.   10
          (b) With example explain selective control scheme.   10

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4   (a) Explain the advantages and disadvantages of F/B and F/F controller.   10

    (b) Discuss the need of adaptive controller and explain any one type adaptive controller.   10

5   (a) For the control problem shown in figure below, write the physical and programmed ladder diagram. The global objective is to heat a liquid to a specified temperature and keep it there with stirring for 30 min. The hardware has the following characteristics: 10
        1. START push button is NO, STOP is NC.
        2. NO and NC are available for the limit switches.
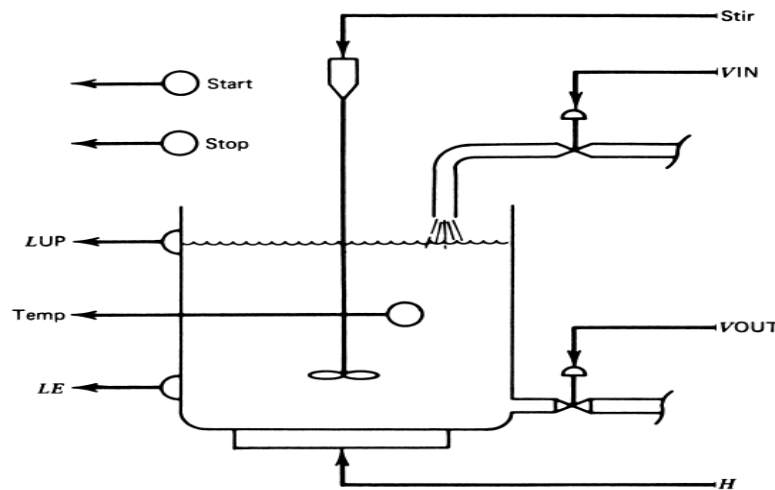
    The event sequence is
        1. Fill the tank.
        2. Heat and stir the liquid for 30 min.
        3. Empty the tank.
        4. Repeat from step 1.

    (b) Discuss with example the batch and continues process control.   10

6   Write short note on (any TWO):-   20
    (a) MRAC.
    (b) Elements of Process control.
    (c) Z-N method of PID tuning.
    (d) Ratio controller.

. . . .

[3 Hours] [Total Marks: 80]

NB. Q.1 is Compulsory.
Solve any three questions from the remaining
Assume suitable data if required and justify it.

Q.1 Solve the following 20
    a) Explain dynamic characteristics of SCR.
    b) Write advantages of IGBT and MOSFET
    c) Explain need of synchronizing circuit in converters
    d) Explain the effect of source inductance

Q.2   a) What is the difference between series and parallel inverter? Explain the   10
       working of series inverter.
    b) Explain the current fed ac drives & state its applications

Q.3   a) With the help of a neat diagram and associated waveforms discuss the   10
       operation of Buck-Boost converter. Also list the advantages and
       disadvantages of this type of converter.
    b) Explain variable frequency I.M. drive   10

Q.4   a) Describe the working of 1phase fully controlledbridge with RL load.   10
    b) What are the different PWM techniques. Explain with neat waveforms   10

Q.5   a) Explain the induction heating process with examples.   10
    b) Explain Step-up chopper with neat waveforms.   10

Q.6   a) Design a dc power control circuit for input of 250V, 50 Hz, ac supply using   20
       SCRs and UJT trigger circuits for following requirements.
       Dc output voltage variable= 75 to 110 V
       Load resistance =10Ω
       The minimum supply voltage used for trigger circuit with temperature
       compensation is

Cμf	0.07	0.1	0.2	0.3
V$_{BB}$	18	16	14	13

    UJT specifications are
    η_{min} =0.56 η_{max} =0.75 V_{BBmax}= 35V
    I_p= 5μA I_v = 4mA V_v= 2V

[Time: Three Hours]   **[Marks:80]**

Please check whether you have got the right question paper.

N.B: 1. Question 1 is compulsory.
         2. Attempt any three questions out of remaining five questions.
         3. Assume suitable data if necessary.

Q. 1   Answer the following (Any Four)   **(20)**
   a) State and prove convolution property of Z transform.
   b) Draw and explain block diagram of DSP processor.
   c) Convert the analog filter with system function $H(s) = \frac{(S+0.1)}{(s+0.1)^2 + 16}$ into a digital IIR filter using

   Bilinear transformation. The resonant frequency $w_r = \frac{\pi}{2}$
   d) $h(n) = \{3\ 1\ 2\ 8\}$
      $x(n) = \{4\ 9\ 2\ \}$
      Find $y\ (n)$ using convolution property of z Transform.
   e) Draw the pole zero plot and transfer function of following filter.
      i) comb filter   ii) Notch filter

Q. 2 a)
   i) $X(n) = \{3 + j6, 1 + j5, (7 + j2), 8 + j9\}$ **(10)**
      Find its DFT X [k]
   ii) Using result obtained in i) and not otherwise, find the DFT of the following sequences
      1) $x(n) = \{3\ 1\ 7\ 8\}$
      2) $x_2\ (n) = \{6\ 5\ 2\ 9\}$
   b) Find the circular convolution of the sequences using FFT and IFFT method.   **(10)**
      $x_1\ (n) = \{1 - 2\ 3\ 7\}$ $x_2\ (n) = \{7\ 4\ 5\ 1\}$

Q. 3 a) Obtain DFI, DF II, cascade and parallel realization of system function   **(10)**
   $H[z] = \frac{1+2Z^{-1}+Z^{-2}}{1-0.75Z^{-1}+0.125Z^{-2}}$
   b) Determine the output of a Linear filter whose impulse response h(n) is h(n) = {2 1 6 } and input   **(10)**
   x(n) is x(n) = {2 -3 1 2 -1 -2 3 4 1 -3 -1 2} using overlap save method.

Q. 4 a) Find the 8 point DFT using DITFFT algorithm   **(10)**
   x(n) = {3 6 1 -2 4 1 5 7}
   b)   **(10)**
   A low pass filter has the desired response as given below Hd (ejw) = $\begin{cases} e^{-j3w} & 0 \le w \le \pi \\ 0\ \frac{\pi}{2} & \le w \le \pi \end{cases}$

   Determine the filter coefficients h (n) for M = 7 using type 1 frequency sampling method.

Q. 5 a) A low pass filter has following specifications   **(10)**
   $0.8 \le |\ H\ (ej\omega)\ | \le 1$ for $0 \le \omega \le 0.2\pi$
   $|\ H\ (ej\omega)\ | \le 0.2$ for $0.6\ \pi \le \omega \le \pi$

   Find the filter order and analog cutoff frequency Ω c if
   i) Bilinear transformation technique is used for designing.
   ii) Impulse Invariance technique is used for designing.

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b) A low pass filter is to be designed with the following desired frequency response **(10)**

$$Hd\ (ej\omega) = e^{-j3\omega} \qquad \frac{-\pi}{4} \le \omega \le \frac{\pi}{4}$$

$$= 0 \qquad \frac{\pi}{4} \le |\omega| \le \pi$$

Determine the filter coefficients, if the window used is hamming window.

Q. 6 a) Develop DITFFT algorithm for decomposing the DFT for N = 6 and draw the flow diagram for **(10)**
N = 2.3.

b) Explain engineering applications of DSP processors. **(10)**

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Q. P. Code : 37755

(3 Hours)   [Total Marks: 80]

N.B 1) Question number 1 is compulsory

2) Attempt any three questions out of remaining questions

3) Make suitable assumptions wherever necessary.

1   Solve Following   [20]

    a. How many ports are there in PIC18F452? What is the role of TRIS, LATCH and PORT registers in ports functioning?

    b. What is embedded system? List any four applications of it.

    c. Explain the following instructions of PIC18F with example

        a. SWAPF   b. CPFSLT   c. RLNCF   d. BTFSS

    d. Write a program to add two 8-bit numbers for PIC 18F.

    e. Write any eight important features of PIC18F452 microcontroller.

2   a   What are design challenges of embedded system? Explain each in brief.   [10]

    b   Write a program to convert BCD number to ASCII with flowchart.   [10]

3   a   Describe ADC module of PIC18. Write a program to read channel 1 and display   [10]
        result on PORTC and   PORTD

    b   Define task and explain different task scheduling algorithms.   [10]

4   a   Draw an interfacing diagram of 4 seven segment LEDs to PIC18F. Write   [10]
        a program to display 1234 on it.

    b   Assuming crystal frequency is 10MHz, write a program to generate a square wave   [10]
        on Port C.0 with period of 10ms.

5   a   What are the registers used in serial communication of PIC18F? Write a program to   [10]
        transfer 'W' continuously with baud rate of 9600 and crystal frequency of 10MHz.

    b   Write a program to add two 16 bit numbers with flowchart.   [10]

TURN OVER

6 a Explain the working of CCP module of PIC18F [10]

b Describe working of I2C serial communication bus. [10]

Reg. Name	Bit7	Bit6	Bit5	Bit4	Bit3	Bit2	Bit1	Bit0
INTCON	GIE/GIH	PEIE/GIEL	TMR0IE	INT0IE	PBIE	TMR0IF	INT0IF	RBIF
INTCON2	RBPU	INTEDG0	INTEDG1	INTEDG2	____	TMR0IP	--------	RBIP
INTCON3	INT2IP	INT1IP	--------	INT2IE	INT1IE	------	INT2IF	INT1IF
T0CON	TMR0ON	T08BIT	T0CS	T0SE	PSA	T0PS2	T0PS1	T0PS0
T1CON	RD16	T1RUN	T1CKPS1	T1CKPS0	T1OSCEN	T1SYNC	TMR1CS	TMR1ON
T2CON	—	T2OUTPS3	T2OUTPS2	T2OUTPS1	T2OUTPS0	TMR2ON	T2CKPS1	T2CKPS0
ADCON0	— —	---	CHS3	CHS2	CHS1	CHS0	GO/DONE	ADON
ADCON1	_____	_____	VCFG1	VCFG0	PCFG3	PCFG2	PCFG1	PCFG0
ADCON2	ADFM	_____	ACQT2	ACQT1	ACQT0	ADCS2	ADCS1	ADCS0
TXSTA	CSRC	TX9	TXEN	SYNC	SENDB	BRGH	TRMT	TX9D
RCSTA	SPEN	RX9	SREN	CREN	ADDEN	FERR	OERR	RX9D
IPR1	PSPIF	ADIF	RCIF	TXIF	SSPIF	CCP1IF	TMR2IF	TMR1IF
IPR2	OSCFIF	CMIF	___	EEIF	BCLIF	HLVDIF	TMR3IF	CCP2IF
PIE1	PSPIE	ADIE	RCIE	TXIE	SSPIE	CCP1IE	TMR2IE	TMR1IE
PIE2	OSCFIE	CMIE	_____	EEIE	BCLIE	HLVDIE	TMR3IE	CCP2IE
PIR1	PSPIP(1)	ADIP	RCIP	TXIP	SSPIP	CCP1IP	TMR2IP	TMR1IP
PIR2	OSCFIP	CMIP	_____	EEIP	BCLIP	HLVDIP	TMR3IP	CCP2IP

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[Time: Three Hours]   **[Marks:80]**

N.B:
1. Question.No.1 is compulsory.
2. Attempt any three questions from remaining five questions.
3. Assume suitable data wherever necessary

1	a	Explain importance of session layer in OSI model.	4×5=20
	b	Describe Bust Mode of HART protocol.	
	c	Compare H1 and HSE segment of foundation Field bus.	
	d	What are different types of network topologies	
	e	Which standard is used for	

   i.   Wireless LAN   ii   GPRS   iii   Bluetooth   iv ZigBee

2	a	Draw and explain the TCP/IP model in detail.	10
	b	Explain the following network components and state in which layer of OSI model each of them work	10

   I.   Bridge
   II.   Hub
   III.   Router
   IV.   Gateway
   V.   Switch

3	a	What is MODBUS and MODBUS Plus.	10
	b	Describe PROFI BUS-DP in detail	10

4	a	Discuss the OPC architecture with suitable diagrams.	10
	b	Explain different types of cables used in communication network along with its advantages and disadvantages.	10

5	a	Illustrate and explain the layered architecture of HART.	10
	b	What is satellite communication? Define uplink and downlink frequency?	10

6		Write short notes on:-	20

   I.   GPIB
   II.   Data Highway Plus
   III.   CAN protocol
   IV.   Advantages and Disadvantages of Field Bus

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Paper / Subject Code: 37406 / ANYLYTICAL INSTRUMENTATION

Duration: 03 Hours **Total Marks: 80**

Note: 1) Question **No. 1** is **compulsory**.
2) Answer any **three questions** from the remaining **five questions.**
3) Assume **suitable data** wherever **necessary.**

Q1. Answer any **4** from the given **5** questions: **20**

a) Give 4 differences between classical and instrumental methods of analysis.
b) Justify that Beer-Lambert's law is a limiting law.
c) Define chemical shift and give its significance in NMR.
d) Explain any 4 factors influencing Fluorescence or Phosphorescence.
e) List the units of Radioactivity and define half-life period.

Q2. a) With a neat diagram, explain working of Double beam filter photometer. **10**

b) Describe Raman Effect. Explain working of Raman Spectrometer. **10**

Q3. a) Explain working and application of Gieger Muller counter with neat diagram. **10**

b) Explain working of Atomic Absorption Spectrometer with neat diagram. **10**

Q4. a) Explain the principle and concept of Nuclear Magnetic Resonance (NMR) **10**

Spectroscopy with applications.

b) Explain the working of any two detectors used in Gas Chromatography system. **10**

Q5. a) Explain principle and working of Time-of-flight type mass spectrometer **10**

with a neat diagram.

b) Explain with a neat diagram the working of oxygen analyzer. **10**

Q6. Write short notes on: **(any two)** **20**

a) GC-MS

b) Monochromators

c) X-ray absorption meter

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