

(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:-
- |   |    |
|---|----|
| (a) Draw and explain the block diagram of process control.  | 4  |
| (b) Explain Dead Time. Why dead time systems are difficult to control?  | 4  |
| (c) Discuss types of variables associated with process control.   | 4  |
| (d) State significance of continuous control actions.   | 4  |
| (e) Justify the need of Adaptive control?   | 4  |
| (f) Explain in brief relative gain analysis (RGA).  | 4  |
| 2 (a) Compare pneumatic and electronic PID controller.  | 10 |
| (b) What is inverse response behavior? Explain how to compensate inverse response behavior of a chemical processes. | 10 |
| 3 (a) Discuss various controller modes and explain working of ON/OFF controller.                                    | 10 |
| (b) Explain block diagram analysis for MIMO system.   | 10 |
| 4 (a) Explain advantages and disadvantages of feedback/feed forward control strategy.                               | 10 |
| (b) Explain dynamic behavior of Second order systems with suitable sketches.  | 10 |
| 5 (a) Why tuning of controller is required? Explain process reaction curve method for tuning.                       | 10 |
| (b) Explain with a neat sketch cascade control scheme for CSTR.   | 10 |
| 6 Write Short Notes on :  |    |
| (a) PLC.  | 05 |
| (b) Proportional Band and Offset.   | 05 |
| (c) Ratio control scheme.   | 05 |
| (d) Interacting System & Non Interacting system.  | 05 |

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NB. Q.1 is Compulsory.  
Solve any four questions from the remaining.

- Q1** 20
- Explain SCR ratings
  - compare IGBT & MOSFET
  - Explain Commutation in Thyristor circuit
  - Differentiate between series & parallel inverter
- Q2.** 20
- Design a converter to give output voltage 120 V at 1A load current. The input is 230 V 50 Hz ac supply. Use UJT 2N2646.  
 $V_{BBmax} = 35 \text{ V}$  for  $V_{bb} = 16 \text{ V}$ ,  $C = 0.1 \mu\text{F}$ ,  $\eta_{min} = 0.56$ ,  $\eta_{max} = 0.75$ ,  $\eta_{type} = 0.63$   
 $I_v = 4 \text{ mA}$ ,  $I_p = 25 \mu\text{A}$  Consider temperature compensation.
- Q3**
- with the help of a neat diagram and associated waveforms discuss the operation of Buck converter. Also list the advantages and disadvantages of this type of converter. 10
  - Explain variable frequency I.M. drive. 10
- Q4**
- Describe the working of 1phase fully controlled bridge converter in the following two modes. 10
    - Rectifying mode
    - Inversion mode.
 Also sketch the following waveforms for  $\alpha = 45^\circ$ , &  $\alpha = 120^\circ$
  - Write a note on control strategies used in chopper. 10
- Q5**
- Explain the application of power electronics in industrial heating process. 10
  - Explain application of triac as an ac regulator. Draw relevant waveforms. 10
- Q6**
- Explain PWM inverter with appropriate waveforms 10
  - Explain full bridge inverter with R-L load. Also explain purpose of feedback diodes in these inverters. 10

[Time: 3 Hrs ]

[ Marks: 80 ]

Please check whether you have got the right question paper.

- N.B:
1. Questions No 1 is compulsory.
  2. Solve any three questions of the remaining five questions.
  3. Assume any suitable data if required.

- Q. 1** Answer the following (any four) (20)
- a) Find the energy of the signal  $x(n) = 0.2^n u(n) + 5^n u(-n-1)$
  - b) Find the value of  $x(n) = \cos(0.25\pi n)$  for  $n = 0, 1, 2, 3$  Compute the DFT of  $x(n)$  using FFT flow graph.
  - c) Compare FIR and IIR filter.
  - d) State and prove the circular time shift property of DFT.
  - e) Write a short note on Decimation by a integer factor.
- Q. 2** a) Determine the output of a Linear FIR filter whose impulse response  $h(n) = \{3, 7, 1\}$  (10)  
For input  $x(n) = \{5, 0, -2, 1, -3, -1, 0, 2, -3, 1, 4, 2\}$   
Using overlap save method.
- b) Derive and draw the FFT flow graph for  $N=6=2 \times 3$  using DITFFT algorithm. (10)
- Q. 3** a) Perform circular convolution using DFT and IDFT. (10)  
 $x(n) = \{1, -5, 3, 2\}$   $h(n) = \{2, 7, 4, 1\}$
- b) Obtain DF-I, DF-II and cascade form of realization for the system (10)  
 $Y(n) = -0.1 y(n-1) + 0.2 y(n-2) + 3x(n) + 3.6 x(n-1) + 0.6 x(n-2)$
- Q. 4** a) A LPF has the desired response as given below:- (10)
- $$H_d(e^{j\omega}) = \begin{cases} e^{-j3\omega} & 0 \leq \omega \leq \frac{\pi}{2} \\ 0 & \frac{\pi}{2} \leq \omega \leq \pi \end{cases}$$
- Determine filter coefficients  $h(n)$  for  $N = 7$ , using frequency sampling technique.
- b) A Low pass filter has the following specifications (10)
- $$0.8 \leq |H(e^{j\omega})| \leq 1 \quad 0 \leq \omega \leq 0.2\pi$$
- $$|H(e^{j\omega})| \leq 0.2 \quad 0.7\pi \leq \omega \leq \pi$$
- Find filter order and cutoff frequency.
- i) By BLT method
  - ii) By IIT method used for design
- Q. 5** a) Frequency response of a filter is given by an expression. (05)  
 $h(e^{j\omega}) = e^{-j3\omega} [2 + 1.8 \cos 3\omega + 1.2 \cos 2\omega + 0.5 \cos \omega]$   
Find impulse response of filter.
- b) The Transfer function of analog filter is  $h(s) = \frac{1}{(s+1)(s+3)}$  (05)  
Find  $H[z]$  using Impulse Invariance method.

- c) Let  $\{20, 0, -4+4j, 0, -4\}$  be the first 5 points of 8 point DFT  $X[K]$  of a real value sequence  $x(n)$ . (05)
  - i) Find  $X[K]$  for  $K = 5, 6, 7$
  - ii) Find the 8 point DFT  $P[k]$  such that  $p(n) = (-1)^n x(n)$  using DFT property.

- Q. 6**
- a) Explain the architecture of any DSP processor with major blocks. (10)
  - b) Explain any one application of DSP (05)
  - c) Explain relationship between ZT, DTFT and DFT (05)

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3 HOURS

[TOTAL MARKS: 80]

- N.B.** (1) Question **No. 1** is compulsory.  
 (2) Attempt any **Three** questions out of remaining **five** questions.  
 (3) Assume any suitable data if necessary.  
 (4) Figure to the right indicates full marks.

1. Attempt **any four**. **20**
  - a) States important features of PIC18F microcontroller.
  - b) Draw and explain ADC modules of PIC18F microcontroller.
  - c) Explain SPI module of PIC18F microcontroller.
  - d) Explain basic concept of RTOS.
  - e) Explain following instructions with example:
    - i. DECFSZ
    - ii. BTFSS
    - iii. RETFIE.
  
2. a) Define embedded system. States various characteristics and design challenges of embedded system. **10**
  - b) What is task? Explain various task scheduling algorithms for RTOS. **10**
  
3. a) Draw and explain block diagram of PIC18F microcontroller. **10**
  - b) Explain CCP module of PIC18F microcontroller in capture and compare modes. **10**
  
4. a) Write a program to load number 7FH in WREG and subtract it from the number 28H and display the result at PORTC and also save it in registers 30H. Identify the status of all the flags after the subtraction. **10**
  - b) Write a program to copy the value 55H into RAM locations 40H to 45H using Direct and Register Indirect Addressing (without loop) Modes for PIC18F microcontroller. **10**
  
5. a) Write a program to toggle RB1 a total of 200 times. Use file register of RAM Location 32H to hold counter value. **10**
  - b) Interface 4x4 matrix key with PIC18F and explain its operation in detail. **10**
  
6. a) Interface a Stepper Motor to PIC18F microcontroller and write a program to control the angle and direction of Stepper Motor rotation. **10**
  - b) Write a short note on Inter-integrated Circuit (I<sup>2</sup>C) Protocol. **10**

( 3 Hours )

( Total Marks : 80 )

**Note:**

1. Question No.1 is compulsory
2. Solve any THREE questions out of remaining FIVE questions.
3. Figure to the right indicate full marks.

1. Answer any five :

(20)

- a) Explain the importance of Hubs, routers, switches and bridges.
- b) What are the components of a field bus?
- c) Compare H1 and HSE segments of foundation field bus.
- d) Explain the difference between physical address, network address and domain name.
- e) Explain ethernet.
- f) Mention the ISO-OSI layers along with their functions.

2. Answer the following :

- a) What is meant by sensor level network? Explain two such networks in detail. (10)
- b) Compare WiFi, GSM, GPRS wireless communication technologies. (10)

3. Answer the following :

- a) Explain the OPC-OLE and list its importance. (10)
- b) Explain PROFIBUS in detail. (10)

4. Answer the following :

- a) Explain the methods employed for protection of field bus in hazardous area. (10)
- b) Explain MODBUS in detail. (10)

5. Answer the following :

- a) Explain the architecture of HART and its importance in industrial communication. (10)
- b) Explain the circuit switching, packet switching and message switching. (10)

6. Write short notes on any (2) :

(20)

- a) CAN Bus
- b) Transmission impairments in communication
- c) IEEE standards and Token bus.

Duration: 03 Hours

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- 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

- Give 4 differences between Fluorescence and Phosphorescence.
- Justify that Beer-Lambert's law is a limiting law.
- Differentiate filters and monochromators.
- Explain any 4 characteristics of Raman lines.
- What is chemical shift and give its significance in NMR.

Q2. a) With a neat diagram, explain working of Single beam spectrophotometer. 10

b) Describe with a neat diagram phosphoroscope. 10

Q3. a) Explain working and application of Scintillation counter with neat diagram. 10

b) Explain working of Atomic Emission Spectrometer with application. 10

Q4. a) Explain the working of Nuclear Magnetic Resonance (NMR) Spectrometer. 10

b) Explain the working GC-MS with a neat diagram. 10

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

b) Explain with a neat diagram the working of gas density analyzer. 10

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

a) HPLC

b) X-ray absorption meter

c) Double beam Fluorimeter