[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 Attempt **any four** : **20**

a Explain the importance of freewheeling diode.

b Draw and explain characteristics of TRIAC.

c List the applications of DC shunt motor and DC series motor.

d Explain dv/dt and di/dt ratings.

e Explain the significance of Drives.

2 a What is an inverter? Explain its significance. Explain any one type of Inverter. **10**

b Explain the three-phase induction motor. Also explain its torque slip characteristics. **10**

3 a Describe the various speed control strategies of AC motor using drives. **10**

b Explain power stages in induction motor also mention about the losses taking place in motors. **10**

4 a Explain characteristics of DC shunt motor. Write the motor equation, explain the significance of back emf. **10**

b Draw and explain symmetric semi converter inductive load along with waveforms. **10**

5 a Explain construction and working of Shaded pole induction motor. **10**

b Differentiate between powerBJT, powerMOSFET,powerdiodes. **10**

6 Write a short note on any two **20**

a DC-DC converters

b Ac power control with TRIAC-DIAC

c Single phase Induction motor

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[3 Hours] [Total Marks : 80]

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

1 Attempt the following: 20

a. State Sampling Theorem. Determine the minimum sampling rate required to convert the following analog signal into discrete-time signal? 5

$$x(t) = 5\sin(250\pi t) + 7\cos(800\pi t)$$

b. Compare FIR and IIR filters. 5

c. Sketch the block diagram of Digital Signal Processing (DSP) system. State the advantages of DSP over analog signal processing. 5

d. Convert the analog filter with following transfer function into a digital filter using approximation of derivative method: 5

$$H_a(s) = \frac{2}{(s+2)^2 + 16}$$

2 a. Compute circular convolution of following sequences using DFT-IDFT method: 10

$x_1(n) = \{5, 4, 3, 2\}$, $x_2(n) = \{2, 2, 1, 1\}$

b. Realize the discrete-time system having following transfer function using direct-form I structure: 10

$$H(z) = \frac{-10(0.5 + z^{-1} + 1.25\,z^{-2} - 1.5\,z^{-3})}{15 + 25\,z^{-1} - 6.5\,z^{-2} + 8.5\,z^{-3}}$$

3 a. Design a FIR high-pass filter with following desired frequency response: 10

$$H_d(\omega) = \begin{cases} e^{j5\omega}, & 0.6\pi \le \omega \le \pi \\ 0, & otherwise \end{cases}$$

Use length of filter, $M = 11$ and Bartlet and Hamming window functions.

b. Determine 8-point DFT of following sequence using decimation-in-time (DIT) FFT algorithm and sketch the signal flow graph: 10

$x(n) = \{1, 2, 3, 4, 5, 6, 7, 8\}$

4 a. Design a digital Butterworth low-pass filter with following specifications:
Passband attenuation, $\delta_p = 0.89$
Stopband attenuation, $\delta_s = 0.25$
Passband frequency, $\omega_p = 0.3\pi\ rad/sample$
Stopband frequency, $\omega_s = 0.6\pi\ rad/sample$
Use Bilinear transformation method with sampling time, *T = 1 sec.*

b. Explain the architecture of TMS 320C54XX DSP processor with the help of neat diagram.

5 a. What are the applications of adaptive filters? Describe the Least Mean Square (LMS) adaptive filter algorithm.

b. Determine 4-point DFT of following sequence using decimation-in-frequency (DIF) FFT algorithm and draw the signal flow graph:

$x(n) = \{1, 0, 2, 4\}$

c. State any two properties of DFT.

6 a. Design a digital type-I Chebyshev low-pass filter with following specifications:
Passband attenuation, $\delta_p = 0.9$
Stopband attenuation, $\delta_s = 0.2$
Passband frequency, $\omega_p = 0.25\pi\ rad/sam$
Stopband frequency, $\omega_s = 0.6\pi\ rad/sample$
Use Impulse Invariance method. Assume sampling time, *T = 0.5 sec.*

b. Design a FIR low-pass filter with cut-off frequency $0.6\pi\ rad/sample$ and length of filter, M = 11
Use Blackman and Hanning window functions.

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Duration: 3 Hours **Total Marks: 80**

Note:

1. **Question one is compulsory.**
2. **Solve any three from remaining and assume suitable data**

Q1. Solve any four **20**

a. Explain in details Jump resonance for nonlinear system.

b. Explain types of stability in details.

c. Differentiate linear and nonlinear system in detail

d. Explain Lyapnov theorem in details

e. Derive classical control "c" from the IMC controller 'q'

Q2. a Determine stability of system described by the following equation. Use Lyapunov direct method **10**

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

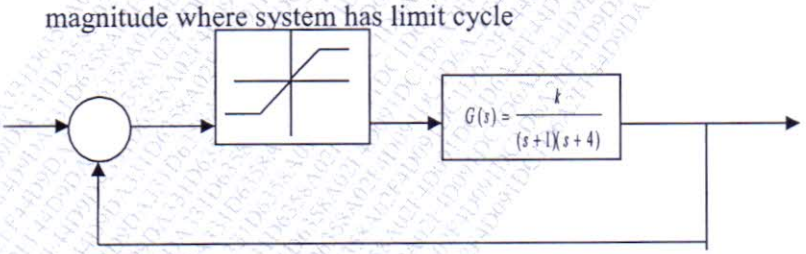
Q2. b Formulate the describing function for relay. **10**

Q3.a Derive the Lyapunov function using Variable Gradient method for the system given , $\dot{x}_1 = -9x_2, \dot{x}_2 = -x_1^2 - x_2$ **10**

Q3.b. Design IMC- PI controller for the following plant model in order to achieve the response with time constant of 1.5 Sec. **10**

$$G(s) = \frac{(-s+1)}{(2s+1)}$$

Q4.a. Investigate Stability using Describing function of following system which has unity saturation signal as a nonlinearity and find out frequency and magnitude where system has limit cycle **10**



Q4.b. Investigate stability using singular point and its type **10**

$$\ddot{Y} - (0.1 - \frac{10}{3}y)\dot{y} + y + y^2 = 0$$

Q5.a. Explain in details IMC based PID controller Design/tuning. **10**

Q5.b. Investigate stability using variable gradient method so that system becomes stable at equilibrium point **10**

$$\dot{x}_1 = -2x_1, \dot{x}_2 = -2x_2 + 2x_1x_2$$

Q6a. How would you classify the following physical nonlinearities and sketch their input-output characteristics? **04**

a. Saturation b. Dead-zone c. Relay d. Friction

Q6b Demonstrate the following: **06**

1. Phase plane
2. Phase portrait
3. Singular point
4. Phase trajectories

Q6c What is limit cycle? Explain in details contrast between stable and unstable limit cycles using Van der Pol equation **10**

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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 Attempt the following. 20

a. Why digital signal processing is required in biosensor measurement?

b. Explain elements of biosensor with a neat diagram.

c. Explain with diagram electrode tissue interface..

d. How biosensor is used for agriculture applications?

2 a. Explain working of nervous system in detail. 10

b. Explain wavelet signal processing technique used for biosensor measurement.. 10

3 a. Explain with block diagram biomedical instrumentation system. 10

b. Explain working of any one resistive type biosensor. 10

4 a. Elaborate working principle of Clark electrode with suitable diagram. 10

b. How the biosensor can be used for clinical applications? 10

5 a. Explain working of any one fiber optic biosensor. 10

b. What are the different types of pressure biosensors explain any one of them. 10

6 Write a short note on :- 20

a. Photoelectric transducer.

b. Flow biosensor.

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ntice based / INST.

(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 indicate full marks.

1. Attempt **any four**. 20
   a) Describe instruction cycle state diagram.
   b) State Overflow and Subtraction rule with suitable example.
   c) Define Microinstruction and and its sequencing technique.
   d) State Temporal locality and Spatial locality.
   e) Explain flynn's Taxonomy.

2. a) Describe the block diagram of Unsigned Binary Multiplication with suitable example. 10
   b) Describe the memory hierarchy. 10

3. a) Describe IEEE 754 single format floating point representation. 10
   b) Explain in brief the levels of RAID. 10

4. a) Describe the effect of conditional branch on instruction pipeline operation using six stage instruction pipeline. 10
   b) State the drawbacks of Programmed and Interrupt driven I/O. Explain a more efficient technique for the large data transfer implemented in computer. 10

5. a) Classify Semiconductor RAM and ROM with respect to Type, Erasure, Write mechanism and volatility and explain in detail. 10
   b) Describe the Fetch, Indirect and Interrupt micro operations in detail. 10

6. a) Write short note on 10
      1.Computer Architecture and Computer Organization.
      2. Pentium's Branch prediction
   b) Describe block diagram of Pentium and its Cache. 10

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