Time: 3 Hours **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.

Q.1 Answers the following questions:- **(Attempt any Four)** (20)

(a) Draw and explain physical diagram and block diagram of basic Level control loop.

(b) Why pneumatic instrumentation is preferred and used in plants?

(c) Compare Feedback and Feed-forward control system.

(d) Incorporation of P-I action may lead to instability in the closed loop performance- Justify.

(e) Draw symbol and explain function of following elements are used in physical ladder diagram .
i) Relays, ii) Motor, iii) Solenoid, iv) Lights, v) Switch.

Q.2 (a) Explain P, I, D Control Actions. Discuss their advantages, disadvantages and applications. (10)

(b) Explain Cascade and Ratio Control Schemes with suitable example. (10)

Q.3 (a) Explain inverse response behavior of the process with example and also explain inverse response compensator. (10)

(b) For a proportional controller, the controlled variable is a process temperature with a range of 50 to 130° C and a setpoint of 73.5° C. Under nominal conditions, the set point is maintained with an output of 50%. Find the proportional offset resulting from a load change that requires a 55% output if the proportional gain is (a) 0.1 (b) 0.7 (c) 2.0 and (d) 5.0. (10)

Q.4 (a) With suitable example explain Split Range and Adaptive Control Schemes. (10)

(b) Explain with a neat sketch the working of Pneumatic PID Controller. (10)

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Q.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 when running, red light for thermal overload. (10)

(b) Explain Relative Gain Array method for multivariable control system and compute RGA and recommended controller pairs of following system. (10)

$$K = \begin{bmatrix} -2 & 1.5 \\ 1.5 & 2 \end{bmatrix}$$

Q.6 (a) Explain the procedure for tuning PID controller using zielger Nicholas method. In an application while tuning by Z-N method process begins oscillations with 30% proportional band in 11.5 minutes. Find nominal PID control settings. (10)

(b) Explain features of PID controller. (10)

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INST / Paper / Subject Code: 89002 / Industrial Data Communcation / May - 2019

T - VI / choice based.

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

N.B: 1. Question No. 1 is Compulsory.
2. Attempt any Three from the remaining questions.
3. Assume suitable data wherever necessary.

Q.1	a)	Explain the term IOT.	(05)
	b)	Compare RS232 and EIA485.	(05)
	c)	With neat block diagram explain operation of basic communication system.	(05)
	d)	Explain CAN protocol.	(05)
Q.2	a)	Compare Wi-Fi, GPRS, GPS, Zigbee.	(10)
	b)	Explain TCP/IP protocol in details.	(10)
Q.3	a)	i) Define Modulation. Explain need of amplitude Modulation in communication system.	(05)
		ii) The signal power and noise power measured at the input of amplifier are 150 μW and 1.5 μW respectively. If the signal power at the output 1.5 W and noise power is 40 mW. Calculate the amplifier noise factor and noise figure.	(05)
	b)	Explain Foundation fieldbus along with its advantages & disadvantages.	(10)
Q.4	a)	Explain open control network Modbus and proprietary Control network Modbus plus?	(10)
	b)	Explain the architecture of HART protocol in detail.	(10)
Q.5	a)	Explain OPC architecture with suitable diagram.	(10)
	b)	Compare PPM, PWM and PPM.	(10)
Q.6		Write short notes on:	(20)
	a)	RFID	
	b)	Repeaters, bridge and router	
	c)	LON device network	
	d)	Data Highway Plus	

Sem- VI / Paper / Subject Code: 89003 / Electrical machinesa and Drives / May-2019

ET / choice based.

(3 Hours) Total Marks: 80

N.B: (1) Question No 1 is compulsory
(2) Attempt any three questions from the remaining five questions.
(3) Answers to the questions should be grouped and written together.
(4) Assume suitable data wherever necessary and justify it.
(5) Draw neat circuit diagram and waveforms wherever applicable.

1. **Answer any five of the following:** **(20)**
   a) Differentiate between power BJT and power MOSFET.
   b) State true or false- Single phase Induction motors are not self-starting. Justify
   c) Describe any six ratings of SCR.
   d) Explain servo motors in detail.
   e) What is an inverter? Explain its classification
   f) Explain the power stages in Induction motor.

2. a) Explain 180 degree mode for 3 phase inverter. **(10)**
   b) Explain the construction and working of shaded pole induction motor **(10)**

3 a) Explain the characteristics of DC shunt motor and DC series motor. **(10)**
   b) Explain latching of IGBT. **(10)**

4. a) Explain the working of 3phase induction motor. Also explain the torque slip characteristics of the motor. **(10)**
   b) Explain full controlled bridge rectifier using RL load. **(10)**

5. a) Explain relaxation Oscillator using UJT. **(10)**
   b) A 4 pole ,3 phase induction motor operates from a supply whose frequency is 50Hz.Calculate: **(05)**
      i) the speed at which the magnetic field of the stator is rotating.
      ii) the speed of the rotor when the slip is 0.04.
      iii) the frequency of the rotor current when the slip is 0.03.
      iv) the frequency of the rotor current at standstill.
   c) Determine the developed torque and the shaft torque of 220V,4 pole series motor with 800 conductors wave connected supplying a load of 8.2KW by taking 45A from the mains. The flux per pole is 25m Wb and its armature circuit resistance is 0.6 ohms. **(05)**

6. Write short notes on any two of the following **(20)**
   a) Chopper and explain any one of its types
   b) Single phase full converter Drives for DC motor
   c) Firing circuit for TRIAC using DIAC
   d) Stepper motor

[Time: Three Hours] [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. Explain the advantages and applications of DSP. 5

b. Sketch the direct-form II structure for the system with transfer function: 5

$$H(z) = \frac{0.25 + z^{-1} + 3.22\,z^{-2} + 4.5\,z^{-3}}{5 - 2.5\,z^{-1} + 1.5\,z^{-2} - 0.5\,z^{-3}}$$

c. State any two properties of z-transform. 5

d. Determine the digital transfer function of a filter with analog transfer function using impulse invariance method: 5

$$H_a(s) = \frac{s + 16}{(s + 2)(s + 4)}$$

Assume sampling time T = 1 sec.

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

$x_1(n) = \{15, 14, 30, 20\}$, $x_2(n) = \{12, 11, 10, 9\}$

b. Realize direct-form I structure of the discrete-time system described by following difference equation: 5

$$y(n) = -2\,y(n-1) + 3\,y(n-2) - 4\,y(n-3) + 10\,x(n) + 6\,x(n-1) - 5.6\,x(n-3)$$

c. State the differences between FIR and IIR filters. 5

3 a. The FIR low-pass filter should have following desired frequency response: 10

$$H_d(\omega) = \begin{cases} e^{j5\omega}, & 0 \le \omega \le \pi/2 \\ 0, & otherwise \end{cases}$$

Find the desired impulse response and transfer function H(z) using Hanning and Hamming window functions with length 11.

b. Determine and sketch 8-point decimation-in-time (DIT) FFT algorithm for $x(n) = \{0.5, 0.25, 0.25, 0.5\}$. 10

4 a. Convert analog filter with transfer function, $H_a(s) = \frac{s+0.1}{(s+1)(s+3)}$ into a digital IIR filter by means of impulse invariance method. 5

b. Determine the analog poles and transfer function of Butterworth filter with 5

$$|H_a(j\Omega)|^2 = \frac{1}{1+16\Omega^4}$$

c. Explain the major units in the architecture of TMS 320C54XX DSP processor with the help of neat diagram. 10

5 a. Determine and sketch 8-point decimation-in-frequency (DIF) FFT algorithm for $x(n) = \cos(\frac{2\pi n}{4})$. 10

b. Explain any two applications of adaptive filters in detail. Describe the Least Mean Square (LMS) algorithm of adaptive filter design. 10

6 a. Design a digital Butterworth low-pass filter with following specifications: 10
Passband attenuation, $\delta_p = 0.9$
Stopband attenuation, $\delta_s = 0.3$
Passband frequency, $\omega_p = 0.4\pi\ rad/sample$
Stopband frequency, $\omega_s = 0.6\pi\ rad/sample$
Use Bilinear transformation method with sampling time, $T = 0.1$ sec.

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

$$H_d(\omega) = \begin{cases} e^{j5\omega}, & 0 \le \omega \le \pi/4 \\ 0, & otherwise \end{cases}$$

Use rectangular, Blackman and triangular window functions with length 11.

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

Note:

1. Question one is compulsory.

2. Solve any three from remaining and suitable data

Q1. **Solve any four** 20

a. Investigate in detail Physical nonlinearity which has memory.

b. Demonstrate Saturation and dead-zone in detail with sinusoidal input.

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 Investigate the following system around the equilibrium point (0,0) and derive its linear model. 10

1. $\dot{x}_1 = -x_1^2 + x_2$
   $\dot{x}_2 = x_1 - x_2^2$

2. $x_1 = -x_1 + x_2 + x_1^3 + x_1 x_2^2,$
   $x_2 = -x_1 - x_2 + x_2^3 + x_1^2 x_2$

Q2. b Design IMC- PI controller for the following plant model in order to achieve the response with time constant of 1.5 Sec. 10

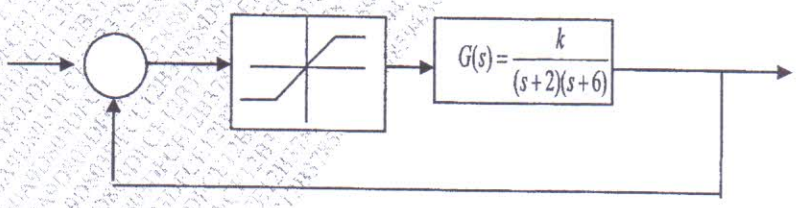
$$G(s) = \frac{(-s+1)}{(2s+1)}$$

Q3.a Derive the Lyapunov function using Variable Gradient method for the system given , 10

$x_1 = -9x_2, x_2 = -x_1^2 - x_2$

Q3.b. Formulate the describing function for relay with dead zone 10

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



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Q4.b. Investigate stability of the following nonlinear system using Lyapunov's method

$$\dot{x}_1 = -x_1 + x_2 + x_1^3 + x_1 x_2^2, \dot{x}_2 = -x_1 - x_2 + x_2^3 + x_1^2 x_2$$

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

Q5.b. Using different equilibrium point comment of singular point and draw trajectories **10**

1. $\dot{x}_1 = -x_1^2 + x_2^2$
   $\dot{x}_2 = x_1^2 - x_2^2$

2. $\dot{x}_1 = x_2$
   $\dot{x}_2 = -x_1 + x_2(1 - x_1^2 + 0.1x_1^4)$

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 Explain in details Jump resonance for nonlinear system **06**

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. What is the function of electrode-electrolyte interface, explain with suitable diagram.

b. Explain any two characteristics of biosensor.

c. What are the different sources of noise? Describe techniques for reduction of noise.

d. How biosensor is used in food industry.

2 a. Explain generation and propogation of biopotentials with suitable diagram. 10

b. Explain working of ion exchange membrane electrode. 10

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

b. Classify chemical sensors and explain the principle and working of any one Chemical sensor. 10

4 a. Explain working of amperometric sensor. 10

b. Explain Fourier transform signal processing technique used for biosensor measurement. 10

5 a. How will you classify biosensors with its applications? 10

b. Explain working of any one fiber optic biosensor. 10

6 Write a short note on :- 20

a. Immuno-sensor.

b. Glucose meter.

Sem-VI / Paper / Subject Code: 89007 / Elective - II Computer Organization and Architecture / May-2019

ice 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**