Instrumentation Department

Bachelor Of Engineering

Question Papers May-June 2019

Sem III to VIII

SE (III) (IS) (Choice Based) 8th May 2019

Q.P. Code: 25475

Duration : 3 Hours **Max. Marks: 80**

N.B . 1) Question No. 1 is compulsory .

2) Attempt any three questions out of the remaining five questions .

3) Figures to the right indicate full marks .

1. (a) Find the Laplace transform of $t^n(1 + cosh9t.sinh7t)$. 5
   (b) Find the Fourier series for $f(x) = x^2$ in $(-\pi, \pi)$ 5
   (c) Show that the vector $\vec{F} = \frac{-yi + xj}{x^2+y^2}$ is irrotational. 5
   (d) Determine constant a,b,c,d if
   $f(z) = (4x^2 + ay^2 + 8bxy) + i(2cxy + 4dx^2 + 2x^2)$ is analytic. 5

2. (a) Find Fourier transform of $f(x) = \begin{cases} e^{iwx} & a < x < b \\ 0 & x < a \\ 0 & x > b \end{cases}$ 6
   (b) Solve using Laplace transform $(D^3 - 3D - 2)y = 540.t^3.e^{3t}$
   $y(0) = 0 , y'(0) = 0 , y''(0) = 0$. 6
   (c) Find half range cosine series for $cos\alpha x$ in $(0,\pi)$, where α is not an integer and hence show that $\sum_{n=1}^{\infty} \frac{1}{\alpha^2-n^2} = \frac{\alpha\pi cot\alpha\pi}{1+2\alpha^2}$. 8

3. (a) If $u = (x^2 + y^2 + z^2)$ Prove that Curl(grad u) $=\vec{0}$. 6
   (b) Find Fourier Series for f(x) = $x^2 + 2x$ in $(0 , 2\pi)$. 6
   (c) Evaluate $\int_0^{\infty} e^{-3t} \int_0^t (usinh^2u)^2.cosh5u\, e^{3u}\, du.dt$ 8

4. (a) Find the bilinear transformation which maps the points $z = 1, i, -1$ onto the points $w = i, 0, -i$. 6
   (b) By using Stoke's theorem evaluate $\int_C \vec{F}.\vec{dr}$ where
   $\vec{F} = (2x + y)i - 4z^2j - y^2zk$ and C is the boundary of the hemisphere $x^2 + y^2 + z^2 = a^2 , z = 0$. 6
   (c) Find Inverse Laplace transform
   $i) \left\{\frac{5s+3}{s^2+6s+25}\right\}$ $ii) \log\left\{\frac{s^2+16}{s^2+81}\right\}$ 8

TURN OVER

Q.P. Code: 25475

5. a) Define Orthogonal set of functions on (a,b) ,Show that the functions $f_1(x) = 1$, $f_2(x) = 3x$ are orthogonal on (-2,2). Determine the constants P , Q such that $f_3(x) = Px^2 + Qx + 9$ is orthogonal to both $f_1(x)$ & $f_2(x)$ on the same interval . 6

(b) Find the analytic function $f(z) = u + iv$ in terms of Z if
$$3u - 7v = x^3 + x^2 - 3xy^2 - y^2 - 3yx^2 + y^3 - 2xy .$$ 6

(c) Verify Green's theorem for $\int_C (4xy - x^2)dx + (2x + 6y^2)dy$, C is the closed curve in the XY-plane bounded by $y = x^2$ and $x = y^2$. 8

6. (a) Find Laplace transform of $f(x) = \begin{cases} sin7t & 0 < t < \pi/2 \\ 2 & \pi/2 < t < \pi \end{cases}$ and $f(t) = f(t + \pi)$. 6

(b) Find the invariant points of the Bilinear transformation $w = \left(\frac{4z-9}{z-2}\right)$,also express it in the normal form. 6

(c) Obtain Complex form of Fourier series for $f(x) = sinhx$ in $(-l, l)$ 8

14/05/19.

S.E. (IS) CBCGS (Choice Base) II Semester

[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.

Q.1o Attempt any four questions. 20

a) Draw the circuit diagram and waveforms for positive and negative clamper circuit.

b) Explain, How BJT can be used as a switch?

c) Describe total harmonic distortion.

d) What input must be applied to the input of Fig.1 to result in an output of 2.4 V?

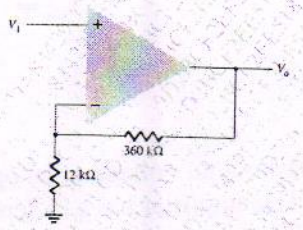

Fig. 1

e) Explain the condition for oscillation using opamp.

Q.2 a) Determine the current I_1, I_2 and I_{D2} for the fig.2 10

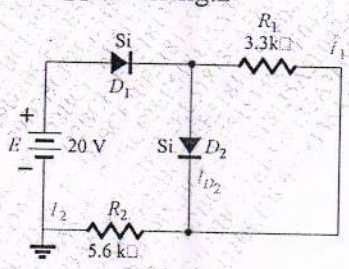

Fig.2

b) Describe how the Centre tapped full wave rectifier works, calculate its output voltage and peak inverse voltage. 10

Q.3 a) Sketch the majority and minority carrier flow for the npn transistor, Describe the resulting carrier motion. What is the source of leakage current. 10

b) For the emitter Bias network, find the parameters (Fig.3): 10
I_B, I_C, V_{CE}, V_C, V_B

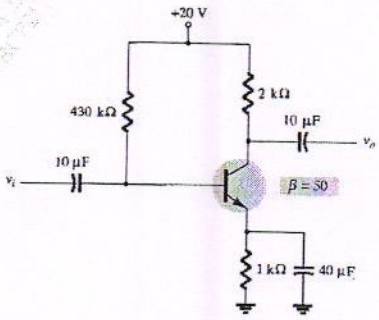

Fig. 3

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Q.4 a) Is the relationship between change in V_{GS} and resulting change in I_D is linear or nonlinear, Explain? Describe in your own words why is the input impedance of JFET so high. 10

b) For the network of Fig. 4, the levels of V_{DQ} and I_{DQ} are specified. Determine the required values of R_D and R_S? 10

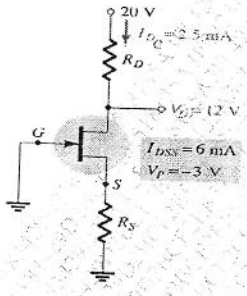

Fig.4

Q.5 a) Determine the output voltage of an op-amp for input voltages of V_{i1} = 200 mV and V_{i2} = 140 mV. The amplifier has a differential gain of A_d = 6000 and the value of CMRR is: i.) 200. ii). 10^5 10

b) Draw and explain the circuit for summation and differentiator using opamp. 10

Q.6 a) Explain class A amplifier with the help of circuit diagrams. 10

b) Derive the expression for 3 opamp Instrumentation amplifier with neat diagram. 10

SE(Instru)/Sem-III/ choice based 20/5/2019

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

Note:
1. **Question one is compulsory.**
2. **Attempt any three from remaining five questions**
3. **Assume suitable data wherever necessary.**

Q1. Attempt any four **20**

a. What is the difference between sensor and transducer?

b. What do you mean by calibration? What is the need of calibration?

c. Explain absolute humidity and relative humidity.

d. Explain liquid level measurement using float and LVDT with appropriate diagram.

e. Explain working of bimetallic thermometer.

Q2. a Draw and explain block diagram of generalized measurement system. **10**

Q2. b Explain the flapper nozzle transducer for displacement measurement and also draw its characteristics. **10**

Q3.a A copper constantan thermocouple was found to have linear calibration between 0 to 500°C with emf at maximum temperature equal to 40.68mv. Reference junction at 20°C. **10**

i) Determine the correction which must be made to indicate emf if the cold junction temperature is 25°C.

ii) If the indicated emf is 8.92mv in the thermocouple circuit. Determine the temperature of hot junction.

Q3.b. Compare RTD, Thermistor and Thermocouple. **10**

Q4.a. Explain construction and working principle of LVDT. **10**

Q4.b. A linear resistance potentiometer is 5cm long and having resistance of 10KΩ. Under normal condition the slider is at center of potentiometer. What will be the displacement when the resistance of potentiometer as measured by bridge circuit is i) 3.8KΩ. and ii) 8.3KΩ. Comment on direction of motion of slider. **10**

Q5.a. Explain with neat sketch how the capacitance probe can be used for level measurement of non-conducting and conducting liquids. **10**

Q5.b. Explain the air purge type level gauge with advantages and disadvantages. **10**

Q6. Write a short note on (Any two) :- **20**

a. Lead wire compensation in RTD

b. Hall Effect Transducer

c. Sound Pressure Level)SPL (meter

d. Proximity sensors

S. E (IS) sem - III Choice Base 24/5/2019

(3 Hours) [Total Marks: 80]

N.B: (1) **Question No. 1** is **compulsory**.
(2) Attempt any **THREE** questions from remaining.
(3) **Figures** to the **right** indicate **full marks**.
(4) Assume suitable **data** if **necessary**.

1. Answer the following: - [20]
   (a) Convert $(123.091)_{10}$ to Octal and Binary.
   (b) Verify De Morgan's Theorem.
   (c) Convert JK flipflop to T flipflop.
   (d) Design Half Adder circuit.

2. (a) Simplify using K-Map [10]
   i) $Y = \sum m\,(4,5,7,12,14,15) + d\,(3,8,10)$
   ii) $Y = \sum m\,(0,1,2,3,5,7,8,9,11,14)$
   (b) Perform: - i) $(29)_{10} - (33)_{10}$ using 2's complement method. [10]
   ii) $(123)_{16} * (ABC)_{16}$

3. (a) Design 4 bit Binary to Gray code converter. [10]
   (b) Design two-bit magnitude Comparator using logic gates. [10]

4. (a) Design Mod 5 synchronous counter using JK flip- flop. [10]
   (b) Explain with a neat diagram working of SISO shift register.
   Draw necessary timing diagram. [10]

5. (a) Explain working of static and dynamic RAM cell. [10]
   (b) Design and implement a full subtractor circuit using 3: 8 Decoder. [10]

6. Write note on: - **(Any Four)** [20]
   (a) FPGA.
   (b) Hazards and Hazard elimination.
   (c) Johnson Counter.
   (d) ECL Family.
   (e) Priority Encoder

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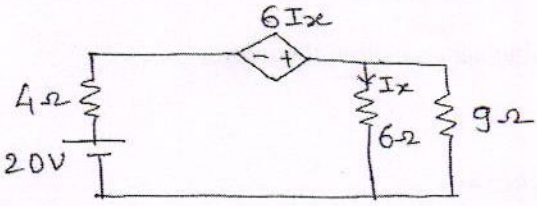
1 SE (I.S.) sem III choice base 30/5/19

[Time: Three Hours] [Marks:80]

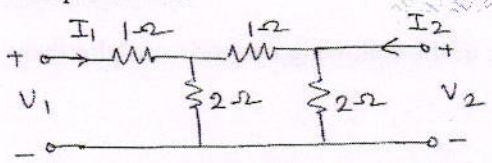
N.B: 1. Question.No.1 is compulsory.
2. Attempt any three questions from remaining five questions.
3. Assume suitable data wherever necessary.

1. Attempt the following. **(20)**

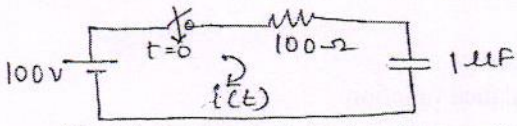
a) Find current in 9 Ω resistor of the network.



b) Find Z parameters



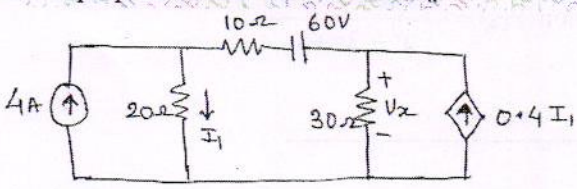
c) Find I and $\frac{di}{dt}$ at $t = 0^+$ with capacitor uncharged and switch is closed at t = 0



d) Write the properties of positive real function.

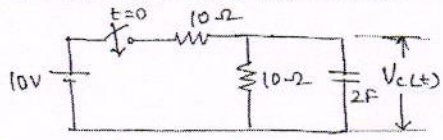
e) Write the working principle of D'Arsonval galvanometer.

2. **a)** Use superposition theorem to find V_x **(10)**



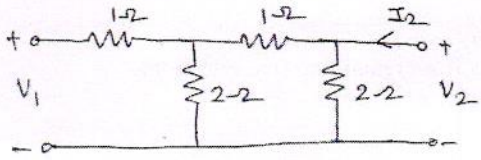
b) Explain the method to measure very high resistance. **(10)**

3. **a)** Switch is closed at t = 0. Find $V_c(t)$



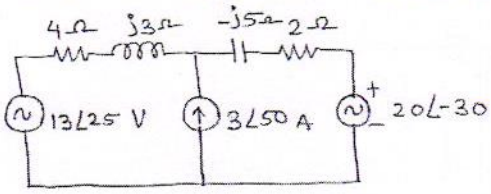
b) Explain an a.c. bridge used for measurement of capacitance. **(10)**

4. a) Determine ABCD parameters. (10)

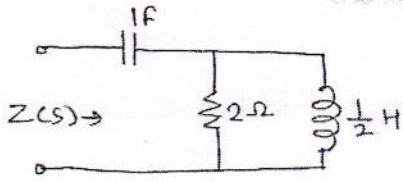


b) Explain construction and working of PMMC instrument. (10)

5. a) Find current flowing through 4 Ω using superposition theorem. (10)



b) Find poles and zeros of the impedance of the following network and plot them on S-plane (10)



6. a) Realize foster forms of the impedance function (10)

$$Z(s) = \frac{2(s+2)(s+4)}{(s+1)(s+3)}$$

b) Test whether the polynomial is Hurwitz $p(s) = s^5 + s^3 + s$ (5)

c) Test positive realness of the function $F(s) = \dfrac{s^3 + 6s^2 + 7s + 3}{s^2 + 2s + 1}$ (5)

B.E. (IV) (IS) (CBCS) 7th May 2019

choice base

Duration: 3 hours

Max. Marks 80

N. B.: 1. Question No. 1 is Compulsory.

2. Attempt any 3 Questions from Question no. 2 to 6.

3. Figures to the right indicate the full Marks.

4. Statistical tables are allowed.

Que. 1 a If λ is an eigen value of square matrix A then prove that λ^n is an eigen value of matrix A^n 5

b Let X be a continuous random variable with probability density function f(x)=kx(1-x), $0 \le x \le 1$. Find k and determine the number 'b' such that $P(X \le b) = P(X \ge b)$ 5

c Verify Cauchy – Schwartz inequality $U = (2, 3, 1)$ and $V = (3, 0, 4)$ also find the angle between U and V 5

d Evaluate $\int_{-2}^{2} \frac{2z+3}{z} dz$ along the upper half of the circle $|z| = 2$ 5

Que.2. a If $A=\begin{bmatrix} 2 & 3 & 4 \\ 0 & 4 & 2 \\ 0 & 0 & 3 \end{bmatrix}$ find eigen values and eigen vectors of A^2-2A+I. 6

b In a precision bombing attach there is a 50% chance that any one bomb will strike the target. Two direct hits are required to destroy the target completely. How many bombs must be dropped to give a 99% chance or better of completely destroying the target. 6

c Find all Taylor and Laurent series expansions for $f(z) = \frac{z}{(z-2)(z-3)}$ about z=1 indicating the region of convergence. 8

Que.3. a Three factories A, B, and C produces 35%, 45% and 20% of the total production of an item. Out of their production 90%, 50%,and 10% are defective. Find probability that it is produced by factory A 6

b Verify Cayley-Hamilton theorem for $A=\begin{bmatrix} 2 & 1 & 1 \\ 0 & 1 & 0 \\ 1 & 1 & 2 \end{bmatrix}$ and hence find A^{-1} 6

c Obtain the equations of the lines of regression for the following data. Also obtain the estimate of X for Y=70. 8

X	65	66	67	67	68	69	70	72
Y	67	68	65	68	72	72	69	71

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Que.4. a By using Cauchy's residue theorem, evaluate $\oint_C \frac{\sin \pi z + \cos \pi z}{(z-1)(z-2)} dz$ 6

where C is $|z| = 3$

b Construct an orthonormal basis of R^3 using Gram Schmidt process to S={(3, 0, 4), (-1, 0, 7), (2, 9, 11)} 6

c Determine whether the matrix $A = \begin{bmatrix} -2 & 2 & -3 \\ 2 & 1 & -6 \\ -1 & -2 & 0 \end{bmatrix}$ is diagonalizable, if yes diagonalise it. 8

Que. 5 a Show that the matrix $A = \begin{bmatrix} 5 & -6 & -6 \\ -1 & 4 & 2 \\ 3 & -6 & -4 \end{bmatrix}$ is derogatory and find the minimal polynomial of the matrix. 6

b The weekly wages of 1000 workmen are normally distributed around a mean of Rs 70 and standard deviation Rs 5. Estimate the number of workers whose weekly wages will be (i) between 65 and 75 (ii) more than 75 6

c By using Cauchy residue theorem, evaluate 8

i. $\int_0^\infty \frac{dx}{x^2+9}$ ii. $\int_0^{2\pi} \frac{1}{5+4\cos\theta} d\theta$

Que.6. a If $A = \begin{bmatrix} 2 & 3 \\ -3 & -4 \end{bmatrix}$ show that $A^{100} = \begin{bmatrix} -299 & -300 \\ 300 & 301 \end{bmatrix}$ 6

b Between 2 pm and 4 pm, the average number of phone calls per minute coming into a switchboard of a company is 2.5. Find the probability that during one particular minute there will be (i) no phone call at all, (ii) at least 5 calls. 6

c If X is a r.v. whose moment generating function is given by $M_X(t) = e^{t^2/2}$, 8

Prove that $E(X^{2k}) = \frac{(2k)!}{2^k k!}$ and $E(X^{2k+1}) = 0$

Paper / Subject Code: 41102 / Transducers -II

B.E (IS) Choice Base Sem IV 13/05/19.

Duration: 3 Hours Total Marks : 80

Note:

1. Question one is compulsory.

2. Solve any three from remaining and assume suitable data wherever necessary.

Q1. Attempt any four **20**

a. Define strain and gauge factor. What is Poisson's ratio? Explain why it is always negative.

b. Explain "Vena Contracta" and draw its pressure flow diagram.

c. State Piezo resistive effect and piezo electric effect.

d. Derive Bernoulli's equation.

e. Explain construction and working of Bourdon tube.

Q2. a Explain different arrangements of strain gauges for better sensitivity and temperature compensation. **10**

Q2. b A strain gauge is bonded to a steel beam 0.1 m long and has a cross sectional area of 4 cm2. Young's modulus of elasticity for steel is 207 GN/m^2. The semiconductor strain gauge has a unstrained resistance of 240Ω and gauge factor 2.2 when load is applied the gauge's resistance changes by 0.013Ω. Calculate force applied to the beam. **10**

Q3.a State the basic principle and explain McLeod gauge. **10**

Q3.b. Classify pressure transducer. Describe working of different types of manometer with advantages and limitations of each type. **10**

Q4.a. Explain working of variable area flow meter. **10**

Q4.b. Derive an expression for fluid flow discharge in variable head type flow meters (Venturi, Orifice, Nozzle). **10**

Q5.a. Describe in detail with neat sketch pH measurement also give its applications. **10**

Q5.b. A venturi tube of throat diameter 60mm is placed in a water pipe of diameter100 mm to measure the volumetric flow. The volumetric flow rate through the tube is 0.08 m^3/s and the water has a density of 1000 kg/m^3 and viscosity of 10^{-3} NS/m^2. **10**

a) Determine the Reynold's number for these conditions.
b) The coefficient of discharge is 0.99. Determine the upstream to throat differential pressure.

Q6. Write a short note on (Any two) :- **20**

a. Dead weight tester
b. Smart sensor
c. Viscosity meter

17/5/2019

SEC Intrd9 / Sem-IV / Chate based

Duration: 3 Hours

Max. Marks 80

N.B.

1. Q.1 is compulsory. Attempt **any three** from the remaining questions.
2. All questions carry equal marks.
3. Figures to the Right indicate full marks.
3. Assume suitable data if necessary

Q.1 Attempt **any four** **20**

a. Write difference between open-loop and closed-loop systems.

b. Define gain margin and phase margin.

c. For a feedback control system with forward path transfer function $G(s)$ and feedback transfer function $H(s)$, define 'Order' and 'Type' of the system.

d. Determine steady state error in unit step response for the system $\frac{Y(s)}{R(s)} = \frac{3}{(s^2+1.5s+2)}$.

e. Write difference between open-loop and closed-loop systems.

f. Define 'time-constant' for the first order system. How much time the first order system response will take to reach at 99% final value?

Q.2 A. For the following system, compute risetime (t_r), peak time (t_p), peak overshoot ($\%M_p$) and settling time (t_s) for 2% tolerable error in response. **10**

$$G(s) = \frac{1}{s^2 + 1.414s + 1}$$

B. Define Transfer function. Obtain the transfer function for the system in **Fig.1** using block diagram reduction techniques. **10**

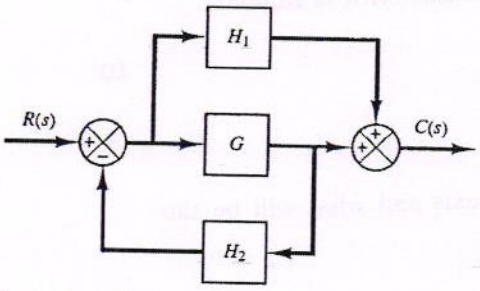

Fig.1

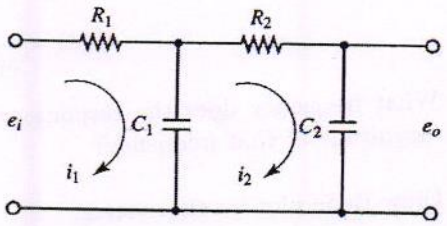

Fig.2

Q.3 A. Obtain the mathematical model of the system in **Fig.2**. What will be the transfer function of this system if $R_1 = R_2 = 1k\Omega$ and $C_1 = C_2 = 0.01\mu F$? **10**

B. Determine the stability of the system having a characteristic equation **10**

$$P(s) = s^5 + 2.1s^4 + 1.51s^3 + 0.471s^2 + 0.064s + 0.0030 = 0$$

using Routh's criterion.

Turn Over

Q.4 A. Determine the position, velocity and acceleration error constants for unity feedback systems with open loop transfer functions **10**

$$\text{(i) } G(s) = \frac{k}{(T_1 s + 1)(0.5T_1 s + 1)} \qquad \text{(ii) } G(s) = \frac{1}{s(s+2)}$$

Where T_1 is a positive constant.

B. Construct the root locus for the system **10**

$$G(s) = \frac{K}{s^3 + 11.5s^2 + 15.5s + 5}$$

with feedback $H(s) = 1$.

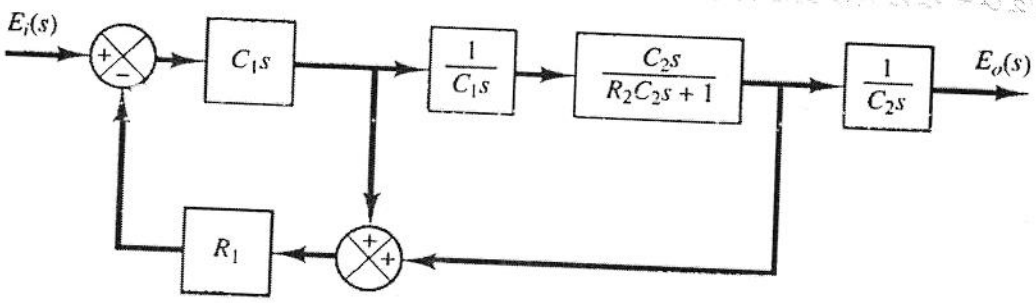

Fig.3

Q.5 A. Construct the signal flow graph and obtain $E_o(s)/E_i(s)$ for the system in **Fig.3** using Mason's gain formula. **10**

B. If the poles of the system are $s = -1 \pm j$. Compute risetime (t_r), peak time (t_p), peak overshoot ($\%M_p$) and settling time (t_s) for 2% tolerable error in response. **10**

Q.6 A. Draw Nyquist plot for the system, **10**

$$G(s) = \frac{1}{s(T_1 s + 1)(T_2 s + 1)}$$

What frequency does the response will cross the real axis and what will be the magnitude at that frequency?

B. Draw Bode plot for the system, **10**

$$G(s) = \frac{1}{(s+1)(s+100)}$$

and obtain gain and phase margins from plot.

S.E. IS - Sem IV - Choice Base -
23/05/2019

(3 Hours) [Total Marks: 80]

N.B: (1) Question No. **1** is compulsory.
(2) Attempt any **Three** questions from remaining.
(3) Figures to the right indicate full marks.

1. Answer the following: - [20]
   (a) Explain the causes for deviation from Beer's law.
   (b) Calculate the energy of 530 nm photon of visible radiation.
   (c) Explain Time decay of radioactive isotopes.
   (d) Explain the principle of Raman Spectroscopy.

2. (a) With neat diagram, explain double beam spectrophotometer. [10]
   (b) Explain the differences between AAS and AES. [10]

3. (a) With neat diagram, explain the working of ionisation chamber. [10]
   (b) Explain CO_2 analyser with neat diagram. [10]

4. (a) With neat diagram, explain NMR Spectrometer. [10]
   (b) With a neat sketch explain working of a high-pressure liquid chromatography. [10]

5. (a) Explain the concept of Fluorescence and Phosphorescence.
   Also explain the working of single beam filter fluorimeter with neat diagram. [10]
   (b) Explain the sample handling techniques for solids and liquids in
   Mass Spectrometer. [10]

6. Write Short Note on: - [Any Two] [20]
   (a) Gas Chromatograph.
   (b) Photomultiplier Tube.
   (c) Sources used in Spectrophotometers.

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SE (IS) sem-IV choice Based 29/5/19

Total Marks : 80 (3 Hours)

Note: (1) **Q1 is compulsory**
(2) Attempt **any three** from the remaining
(3) Assume suitable data wherever necessary

Q1 Answer any four from the following 20

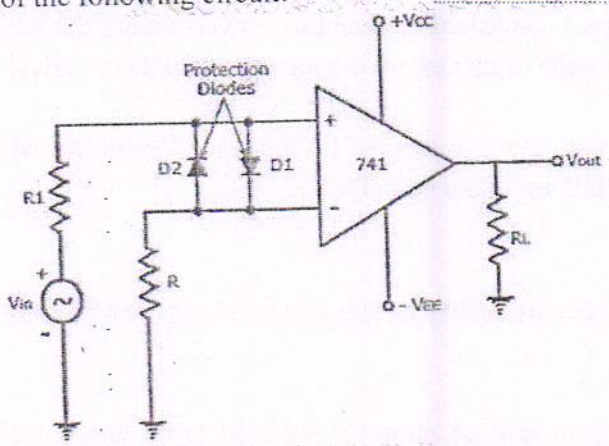
a. An amplifier outputs a voltage that is 10 times the voltage on its input terminals. It has an input resistance of 10kΩ . A sensor outputs a voltage proportional to temperature with a transfer function of 20mV/°C. The sensor has an output resistance of 5kΩ. If the temperature is 50°C, find the amplifier output considering the effect of loading.

b. Draw the absolute value circuit using Op Amp and sketch its input output waveform

c. Explain the block diagram of a SMPS.

d. Discuss the different types of filters with their input output characteristics.

e. Sketch the output of the following circuit:



What could be the function of the circuit?

Q2.

a. Derive the expression for output voltage for an Instrumentation amplifier with a transducer bridge. Also list the applications of the same. 10

b. A Solid –state pressure sensor that outputs 25mV/kPa for a pressure variation of 0.0 to 25kPa will be used to measure the level of a liquid with a density of $1.3*10^3 Kg/m^3$.What voltage output will be expected for level variations from 0 to 2.0m?What is the sensitivity for level measurement expressed in mV/cm? 10

Q3.

a. Describe typical R-2R ladder type Digital to Analog converter for 4 bits data. Determine its step size when R_f=20kΩ. Also calculate the output voltage if b0=b1=b2=0 and b3=5V. **10**

b. Explain how Op-Amp can be used as a voltage to current convertor with (a) floating load and (b) grounded load **10**

Q4.

a. What is a RTD? Explain its construction and the signal conditioning circuitry associated with it. **10**

b. Explain monostable multivibrator using IC 555 with neat input output waveforms. Also design a monostable multivibrator to have an output pulse width of 100ms. **10**

Q5.

a. Design a general signal conditioning circuit to convert sensor output i.e. LDR output to 0 volt (Dark) to 5 volt (Light) for resistance range 90KΩ to 5.1KΩ respectively. **10**

b. What is a voltage regulator? What are its types? Design an adjustable voltage regulator using IC 7805 to obtain an output of 12V. **10**

Q6.

a. List the different types of analog to digital convertors. Explain one of them with a neat diagram. **10**

b. What is operating principle of photovoltaic cell. Give its equivalent circuit and hence discuss the signal conditioning circuit associated with it. **10**

TE (IV) (IS) (Choice Based) 9th May 2019

[Time: 3 Hours] **[Marks:75]**

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

Q.1 Solve **any four** 20

a) State and prove the convolution property of Fourier transform.

b) Determine initial and final value of x(n) If x (z) = $\frac{z}{z^2-\frac{3}{2}z+\frac{1}{2}}$ $|z| > \frac{1}{2}$

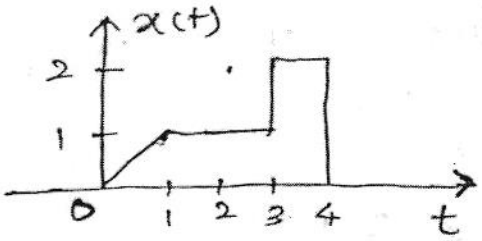
c) State and prove the parsaval theorem.

d) Explain Gibb's phenomenon.

e) Sketch one sided and both sided magnitude and phase spectra

$X(t) = 4 + 6\sin\left(4\pi t - \frac{\pi}{3}\right) + 8\cos\left(8\pi t - \frac{\pi}{4}\right)$

Q.2 a) Express the following signal in functional from. 05



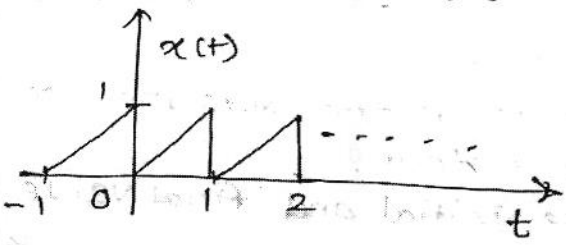
b) Whether the following signal in energy or power. Also find its energy or power x(n)= u(n) 05

c) Obtain the convolution of two continuous signal given below. Also sketch the result. 10

x(t)=1 for $0 \le t \le 1$
0 otherwise

h (t)=1 for $0 \le t \le 1$
-1 $1 \le t \le 2$

Q.3 a) Find the exponential Fourier series coetticient of following signal. 10



b) Given $\frac{d^{2y(t)}}{dt^2} + \frac{8dy(t)}{dt} + 15y(t) = 3\,x(t)$ 10

determine

i) Impulse response of system.

ii) Response to the input $x(t) = 2e^{-3t}u(t)$

Q.4 a) Find the z-transform of x (z) by using p. f. $x(z) = \frac{z}{z^2+z+1}$ 10

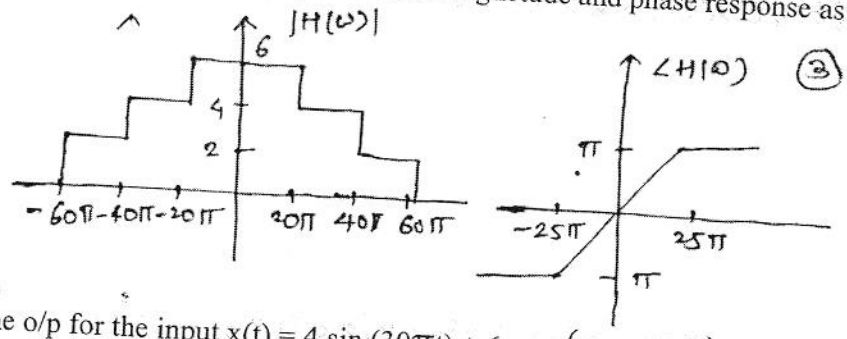
b) Find the following systems are linear / nonlinear, time variant /invariant, causal / noncausal, static or dynamic, stable or unstable. 10

$y(+) = t\,x(t)$

$y(n) = \cos wn\, x(n)$

Q.5 a) Final the inverse Laplace transform for all passible roc condition. $X(s) = \frac{s+3}{(s+1)(s+4)^3}$ 10

b) Consider the following system with magnetude and phase response as shown in figure. 05



Find the o/p for the input $x(t) = 4\sin(30\pi t) + 6\cos\left(50\pi t + \frac{\pi}{3}\right)$

c) Find the fourier transform of signum function. 05

Q.6 Obtain

i) Z –transform of 10

$x(n) = n\left(\frac{1}{4}\right)^n u(n) + u(n-1)$

ii) Laplace transform of

$X(t) = te^{-4t}u(t) + tu(t+1)$

A discrite time LTI system is specified by $y(n) = -7y(n-1) - 12y(n-2) + 4x(n-1) - 2x(n)$ where $y(-1) = -2$ $y(-2) = 3$. Determine 10

i. Zero in put response

ii. Zero state response where $x(n) = u(n)$

iii. Total response.

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68421

Paper / Subject Code: 32503 / Control System Design

21/05/19

TE(IS)/sem-V/choice Based

Duration: 3 Hours Max. Marks 80

N.B.

1. Q.1 is compulsory. Attempt **any three** from the remaining questions.
2. All questions carry equal marks.
3. Figures to the Right indicate full marks.
3. Assume suitable data if necessary

Q.1 Attempt **any four** **20**

a. Obtain the state space representation for following system in diagonal form

$$G(s) = \frac{1}{s^2 + 0.3s - 0.02}$$

b. Obtain the transfer function for the following system.

$$\begin{aligned} \dot{x} &= \begin{bmatrix} 0 & 1 \\ -3 & -4 \end{bmatrix} x + \begin{bmatrix} 0 \\ 1 \end{bmatrix} u \\ y &= \begin{bmatrix} 1 & 0 \end{bmatrix} x \end{aligned}$$

c. Explain PD compensator. Why it is required? Draw a typical circuit diagram for PD compensator.

d. Define controllability and stabilizability.

e. For the system

$$G(s) = \frac{s+1}{s(s+3)}$$

check if $s = -2$ pole is on root locus or not.

f. Write Cayley Hamilton theorem. Check if it holds for the matrix $F = \begin{bmatrix} 0 & 1 \\ -2 & -3 \end{bmatrix}$.

Q.2 A. Check for the controllability and observability of the system, **10**

$$\begin{aligned} \dot{z}_1 &= -z_1 + u \\ \dot{z}_2 &= -2z_2 + z_3 \\ \dot{z}_3 &= -2z_3 + u \\ y &= z_1 + z_3 \end{aligned}$$

using Kalman's tests.

B. Represent the system transfer function **10**

$$G(s) = \frac{s + 0.5}{s^2 + 3s + 2}$$

in **(i)** controllable canonical form **(ii)** diagonal form.

Q.3 A. Design the lag compensator using root-locus for the system 10

$$G(s) = \frac{1}{s(s+5)}$$

such that dominant closed loop poles are at $s_d = -1.91 \pm j1.78$.

B. Write the steps to design lead compensator using Bode plot. 10

Q.4 A. Design the state feedback control for the system 10

$$\dot{x} = \begin{bmatrix} 0 & 1 \\ -1.32 & 2.32 \end{bmatrix} x + \begin{bmatrix} 0 \\ 1 \end{bmatrix} u$$

to place the poles at $-1, -2$.

B. Obtain $x(t)$ for the system 10

$$\dot{x} = \begin{bmatrix} -1 & 1 \\ 0 & -1 \end{bmatrix} x + \begin{bmatrix} 0 \\ 1 \end{bmatrix} \text{u}$$

if initial condition is $x(0) = [1 \;\; 1]^{\top}$.

Q.5 A. Prove the non-uniqueness of state space representation using similarity transformation. Also prove that eigenvalues of system are invariant under linear transformation. 10

B. A system is given by 10

$$\begin{aligned} \dot{x} &= \begin{bmatrix} -4 & 1 \\ -3 & 0 \end{bmatrix} x + \begin{bmatrix} 1 \\ 0 \end{bmatrix} u \\ y &= [1 \;\; 0]\, x \end{aligned}$$

Design the observer that has poles at $-12, -15$.

Q.6 Write short notes on 20

A. Ziegler-Nichols method for PID controller tuning.

B. Lag-lead compensator.

Paper / Subject Code: 32505 / Elective - I Advanced Sensors

T.E(I.S) sem-V choice base. 31/05/2019

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

N. B. 1) Question No. **1** is **compulsory**.
2) Answer any **3** questions from the remaining **5** questions.
3) Assume suitable data wherever necessary.

Q1 Solve any four **20**
(a) Explain MEMS fabrication technique LIGA.
(b) Explain important properties of chemical sensors.
(c) Write note on sensors for food processing like smell or odour, taste.
(d) Give comparative study of thermal sensors.
(e) Explain working principle of digital humidity temperature smart sensor.

Q2 (a) Explain various techniques of etching for MEMS sensor fabrication **20**
(b) Explain photolithography technique used in MEMS.

Q3 (a) Explain briefly:- **20**
(1) Surface processing using sputtering
(2) Chemical vapor deposition
(b) Explain selection criteria for various transducers? Also elaborate design considerations for sensor fabrication.

Q4 (a) Explain in brief **20**
i) ADXL 345
ii) MEMS gyroscope

(b) Give comparative study of analog to digital converters used for sensor signal conditioning.

Q5 (a) Write about different materials used in sensor fabrication. **20**
(b) Explain in detail differences between thin film and thick film sensors.

Q6 Write short note. (Any Four) **20**
a) Surface and bulk micro machining
b) Any one application of optical sensors
c) Biological Oxygen Demand (BOD)
d) Agriculture measurements such as soil moisture, wind speed, leaf wetness duration
e) Measurement of carbon dioxide (COx)

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TE (IS) (VI) (Choice based) 10th May 2019

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)

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)

Date:- 16/5/2019

Paper / Subject Code: 89002 / Industrial Data Communcation

TE (Insru) / Sem 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	

Paper / Subject Code: 89003 / Electrical machinesa and Drives

TE - IS - Sem VI - Choice Based 22/05/10

(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

66207

T. E (IS) sem-VI Choice Based 28/05/2019.

[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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T.E. Sem-VI Choice Based 03/05/2019

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

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**

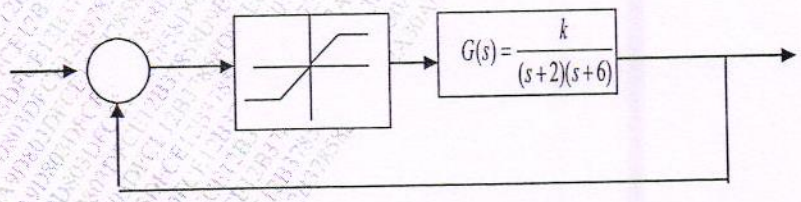
$$G(s) = \frac{(-s+1)}{(2s+1)}$$

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

$$\dot{x}_1 = -9x_2, \dot{x}_2 = -x_1^2 - x_2$$

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



10

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**

~~6866~~ 10/06/2019

[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.

T.E (IS)/Sem VI/Choice Based 10/06/2019

Paper / Subject Code: 89009 //Elective - II Nuclear Instrumentation

Duration: 03 Hours. Total marks: 80

Instructions to the candidates if any:-

N. B. (1) Question No. **1** is **compulsory**.
(2) Answer any **Three** out of remaining questions.
(3) Assumptions made should be **clearly** stated.

Q. 1) Answer the following **(Any Four)** 20

a) Explain natural and artificial radioactivity

b) Explain Half Life Time with suitable example

c) Define Thyroidism (Hyper and Hypo)

d) Explain Isotopes and Isobars with suitable example

e) What are the different laws of Radioactivity?

Q. 2) a) Explain Photoelectric effect and pair production process 10

b) Explain Compton Effect in detail 10

Q. 3) a) Explain Gamma camera with suitable block diagram 10

b) Explain Radiation Uptake studies with suitable block diagram 10

Q.4) a) Explain the Nuclear Instrumentation for power reactor 10

b) Explain need of Quenching in GM counter 10

Q.5) a) Explain working of Pulse Height Analyzer 10

b) Explain working of Multi-channel Analyzer 10

Q.6) Write a note on

a) Units of Radioactivity 10

b) Nuclear Medicine 10

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69576

Paper / Subject Code: 42702 / Biomedical Instrumentaion

B.E I.S. (CBSGS) VII Sem

Date:- 13/05/19.

Duration: 03 Hours.

Total marks: 80

Instructions to the candidates if any:-

N. B. (1) Question No. **1** is **compulsory**.
(2) Answer any **Three** out of remaining questions.
(3) Assumptions made should be **clearly** stated.

Q. 1 Solve **20**

a) Explain structure of Cell

b) What is blood circulation? Explain its types

c) What is Hounsfield Number in CT?

d) Compare direct and indirect blood pressure measurement

Q. 2) a) What is Heart Sound? Explain electrical and mechanical activities of Heart **10**

b) Explain human respiratory system and parameters to be measured **10**

Q. 3) a) Explain EEG measurement with 10-20 Electrode placement system **10**

b) Explain direct blood pressure measurement **10**

Q.4) a) Explain hemodialyser machine and precautions to be taken **10**

b) Explain rate responsive pacemaker **10**

Q. 5) a) Explain working of CT machine with suitable block diagram **10**

b) Compare X ray, CT and ultra sound imaging **10**

Q.6) a) Explain working principle of MRI machine **10**

b) Explain physiological effects of electric current **10**

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54538

Paper / Subject Code: 42703 / Advanced Control System

BE(Instru)|Sem-VII|EBSGS

Date:- 17/5/201

Duration: 3 Hours

Max. Marks 80

N.B.

1. Q.1 is compulsory. Attempt **any three** from the remaining questions.
2. All questions carry equal marks.
3. Figures in the Right margin indicate full marks.
3. Assume suitable data if necessary

Q.1 Attempt **any four** **20**

a. Determine the sign-definiteness of following matrices

$$\text{(i) } F = \begin{bmatrix} 3 & 2 \\ 1 & 1 \end{bmatrix}, \quad \text{(ii) } G = \begin{bmatrix} -1 & -2 \\ -3 & -2 \end{bmatrix}$$

b. Define the singular point in phase-plane. Compute the singular points for the following system.

$$\dot{x} = x^3 - 3x^2 + 2x$$

c. Define relative degree for the system $\dot{z} = f(z) + g(z)u$ at $y = h(z)$.

d. Linearize the following system at point $z_o = [-1 \ 1 \ 1]^\top$ with the nominal input is to be held constant at $u_0 = 1$.

$$\begin{aligned} \dot{z}_1 &= 0.5z_2^2 - 0.5 \\ \dot{z}_2 &= 0.5z_3^2 - 0.5 \\ \dot{z}_3 &= -3z_1 - z_2^2 - z_3^2 + u \end{aligned}$$

e. Obtain the classical control '**c**' from the IMC controller '**q**' using block diagram reduction rules.

f. Explain the linear and nonlinear components of the friction.

Q.2 A. Write the steps to construct the Lyapunov function using variable gradient method. **10**

B. Obtain the describing function for saturation nonlinearity. **10**

Q.3 A. Determine the stability of the system, 10

$$\begin{aligned} \dot{x}_1 &= -2x_1 \\ \dot{x}_2 &= -3x_2 \end{aligned}$$

using Lyapunov's equation.

B. Linearize the following system using feedback control 10

$$\begin{aligned} \dot{x}_1 &= -x_1 - x_2^2 + (\sin x_1 + \cos x_1)u \\ \dot{x}_2 &= x_1 \\ y &= x_2 \end{aligned}$$

Where y is output and u is input.

Q.4 A. What is limit cycle? Explain it with Vander Pol's equation. 10

B. What is jump resonance in frequency response? Explain it with an example. 10

Q.5 A. Construct the phase trajectory for the system $\ddot{x} + \dot{x} + 2x = 0$ using delta method. Consider an initial condition $x(0) = 1,\ \dot{x}(0) = 1$. 10

B. Design the optimal control for the system 10

$$\dot{x} = \begin{bmatrix} 1 & 0 \\ 0 & -1 \end{bmatrix} x + \begin{bmatrix} 1 \\ 1 \end{bmatrix} u$$

that minimizes the performance index

$$J = \frac{1}{2}\int_0^\infty \left\{ x^\top \begin{bmatrix} 1 & 0 \\ 0 & 1 \end{bmatrix} x + u^2 \right\} dt$$

Q.6 A. Design the IMC controller for the system model 10

$$\tilde{G}_p = \frac{e^{-3s}(-0.5s+1)}{25s+1}$$

to track the step input. Use simple factorization for design.

B. Obtain the IMC based PI controller for the model 10

$$\tilde{G}_p = \frac{5}{10s+1}$$

BE IS / SEM- VII CBGS / 23/05/2019.

(3 Hours) [Total Marks: 80]

N.B: (1) Question No. **1** is compulsory.
(2) Attempt any **Three** questions from remaining.
(3) Figures to the right indicate full marks.

1. Answer the following: - [20]
   a) Explain the different types of plants and controls with examples.
   b) Draw a ladder diagram for a Two – Motor system having following conditions: -
      i) Starting push button starts Motor-1.
      ii) After 10 seconds, Motor-2 is ON.
      iii) Stopping the switch stops Motor -1 and 2.
   c) List any three SCADA vendors with their system.
   d) Explain the duties and tasks of level 4 in hierarchical computer control.

2. a) Design a PLC based automation system for Oven with the following sequence of operation: - [10]
   i) Heater will be ON, when the power switch is activated and door is closed and temperature is below the limit.
   ii) The fan will be ON when the temperature is above the limit and door is closed.
   iii) The light will be ON, if the light switch is ON or whenever the door is open.
   Draw the GUI and I/O wiring diagrams. Also show memory calculations.
   b) Explain sinking and sourcing output modules of PLC with neat diagram. [10]

3. a) Explain with block neat diagram, Centralized control system architecture. [10]
   b) Explain the functions and task of supervisory computer in DCS. [10]

4. a) Explain how SCADA is used for a geographically large area with diagram. [10]
   b) Explain with neat diagram, a system that allows an MTU to store data in central data store. [10]

5. a) What are the safety standards? Explain IEC 61508 seven-part standard in detail. [10]
   b) What is an Alarm, categories of Alarm, objectives of good Alarm and factor to be considered in the design of Alarm? [10]

6. Write note on: - **(Any Two)** [20]
   a) ERP and typical modules of ERP.
   b) Advanced PLC instructions.
   c) Evolution of DCS.

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BE (I.S.) sem - VII CBSGS 29/5/2019

(3 Hours) Total Marks: 80

N.B. 1. **Question No.01** is **compulsory**

2. Attempt any **Three** questions from remaining **Five** questions

3. Assume suitable data wherever required

1. Answer the following 20

a. Explain in detail the need of safety instrumented system.
b. What do you understand by operation phase of safety life cycle? Explain.
c. Compare process control system and safety control system.
d. What is consequence analysis? What are the factors to be considered for good impact consequence analysis?

2. a. Explain SIL determination using ALARP method. 10

b. What is complimentary event, mutually exclusive event and non mutually exclusive event? Explain. 10

3. a. Draw and explain the safety life cycle of IEC-61511. 10

b. What is a protection layer? Explain in detail. 10

4. a. Explain in detail fault propagation modelling for likelihood analysis. 10

b. Write short note on safety instrumented function. 10

5. a. What is risk matrix? Explain in detail. 10

b. Explain the following terms with respect to consequence analysis:- 10
i. Hazards
ii. Initiating events
iii. Intermediate events
iv. Incident
v. Incident outcome

6. a. Compare SIS technology based on relay system and solid state device system. 10
b. Explain in detail the SIL determination using risk graph method. 10

Paper / Subject Code: 53201 / Digital Control System

BE (VIII) (CBSGS) (IS) 8th May 2019

Duration: 3 Hours Max. Marks 80

N.B.

1. Q.1 is compulsory. Attempt any three from the remaining questions.
2. All questions carry equal marks.
3. Figures to the Right indicate full marks.
3. Assume suitable data if necessary

Q.1 Attempt any four 20

a. Determine steady state error for unit step, ramp and acceleration inputs for the following system.

$$\frac{0.049545(z+2.972)(z+0.2045)}{(z-1)^2(z-0.3679)}$$

b. What do you mean by discretization? List various methods of discretization and explain any one.

c. Check controllability and observability of the given system.

$$\begin{aligned} z(k+1) &= \begin{bmatrix} 0 & 1 \\ 0.05 & -0.4 \end{bmatrix} z(k) + \begin{bmatrix} 0 \\ 1 \end{bmatrix} u(k) \\ y(k) &= \begin{bmatrix} 1 & 1.5 \end{bmatrix} z(k) \end{aligned}$$

d. Explain block diagram of digital control system by giving appropriate example.

e. What is meant by internal stability? How it is different from BIBO stability?

f. Map the region from s-plane to the z-plane which is bounded by constant frequency lines at $\pm 5j$ and constant damping ratio lines at $\pm 60^o$.

Q.2 A. Determine the values of K for asymptotic stability of the system given by characteristic equation using Jury's stability criteria 10

$$P(z) = z^4 + 0.2z^3 - 0.25z^2 - 0.05z + K = 0$$

B. Explain discrete-time PID controller in detail. 10

Q.3 A. Design the state feedback control law for the open loop system having all the poles at 0.5. 10

$$\begin{aligned} x(k+1) &= \begin{bmatrix} 3 & 1 & 0 \\ -3 & 0 & 1 \\ 1 & 0 & 0 \end{bmatrix} x(k) + \begin{bmatrix} 2 \\ 1 \\ 3 \end{bmatrix} u(k) \\ y(k) &= \begin{bmatrix} 1 & 0 & 0 \end{bmatrix} x(k) \end{aligned}$$

B. What is multirate sampling? Explain multirate output feedback based state estimator. 10

Q.4 A. Obtain state transition matrix for the system defined by **10**

$$z(k+1) = \begin{bmatrix} 1 & 2 & 0 \\ 3 & -1 & -2 \\ 1 & 0 & -3 \end{bmatrix} z(k)$$

B. Explain sampler as an impulse modulator. **10**

Q.5 A The discrete time control system is given by **10**

$$x(k+1) = \begin{bmatrix} 0 & 1 & 0 \\ 0 & 0 & 1 \\ -4 & -2 & -1 \end{bmatrix} x(k) + \begin{bmatrix} 0 \\ 0 \\ 1 \end{bmatrix} u(k)$$

Design a dead beat observer.

B. Discretize the given system **10**

$$G(s) = \frac{s+3}{s^2+3s+2}$$

with sampling period of Ts=0.2 sec.

Q.6 A. Represent the given system in controllable and diagonal canonical form along with its block diagram realization. **10**

$$T(z) = \frac{z^3+8z^2+17z+8}{(z+1)(z^2+5z+6)}$$

B. The block diagram of the system is shown in Figure 1, using signal flow graph determine transfer function of the system **10**

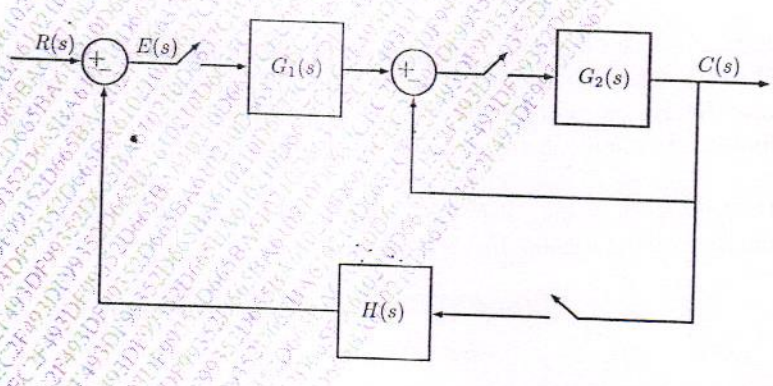

Figure 1:

Paper / Subject Code: 53202 / Instrumentation Project Documentation & Execution

B.E.(IS) VIII Sem CBSGS

Date:- 14/05/19.

Duration: 03 Hours.

Total marks: 80

Marks assigned to each question are stated against each question.

Instructions to the candidates if any:-

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

(2) Answer any **Three** out of remaining **Five** questions.

(3) Assumptions made should be **clearly** stated.

Q. 1 Explain any **Four** **20**

a) Define project and explain types of project .

b) Explain the role of constructor.

c) Describe Cable scheduling.

d) Explain the PUNCH list.

e) What is Tender and its types.

Q.2 a) Explain the project deliverables in detail **10**

b) Explain the importance of specification sheet. Explain the specification sheet For Pressure transmitter. **10**

Q.3 a) Compare project scheduling technique CPM And PERT **10**

b) Write short notes on procurement methods and procedure. **10**

Q. 4 a) Draw and explain electronic loop wiring diagram for level control loop. **10**

b) Draw and explain hook-up diagram for flow and temperature measurement. **10**

Q.5 a) Explain different standard used in Instrumentation projects. **10**

b) Discuss in detail advantages of using software packages for documentation. **10**

Q.6 write a short note on **(ANY TWO)** **20**

a) Checkout procedure for Temperature transmitter and control valve.

b) Draw and explain instrument location plan with example.

c) What is HMI? Explain the importance of graphics in process control industry. Prepare graphical user interface template.

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69366

BE(Instrumention)/ Sem-VIII/ CBSGS 20/5/2019

(3 Hours) [Total Marks: 80]

N.B: (1) Question No. **1** is compulsory.
(2) Attempt any **Three** questions from remaining.
(3) Figures to the right indicate full marks.

1. Answer the following:- [20]
   (a) Explain renewable and non-renewable energy resources with suitable examples.
   (b) Explain Boiler safety interlocks.
   (c) Why is regenerator used in a gas turbine power plant?
   (d) What is the role of control and instrumentation in power plants?

2. (a) A Power generating station has a maximum demand of 10,000KW and the daily load on the station is as follows: [05]

Time	6am to 8am	8am to 12noon	12noon to 1pm	1pm to 5pm	5pm to 7pm	7pm to 9pm	9pm to 11pm	11pm to 6am
KW	3,500	8,000	3,000	7,500	8,500	10,000	4,500	2,000

   Draw the Load Curve and the Load Duration Curve.
   (b) Explain Shrinking and Swelling effects in boiler. [05]
   (c) Explain the following different loops/circuits involved in thermal power plant,
   i) Feed Water and Steam Flow ii) Fuel Circuit.
   iii) Air and Gas Circuit iv) Cooling water circuit. [10]

3. (a) Explain wind turbine aerodynamics using Betz model. Find maximum power extracted. [10]
   (b) Describe the principle of solar photovoltaic energy conversion system with neat sketch. What are the major advantages and disadvantages of solar PV system? [10]

4. (a) Sketch a neat labeled diagram of Pressurized Water Reactor (PWR) and explain its operation with advantages and limitations. [10]
   (b) What is the function of following essential elements of hydroelectric power plant:
   i) Headrace ii) Tailrace iii) Surge Tank iv) Spillways v) Draft Tubes. [10]

5. (a) Explain the energy extraction process from Biomass and Geothermal energy. [10]
   (b) Give the detailed classification of Solar Collector and explain flat plate collector with neat sketch. [10]

6. Write Short note on:- (Any Two) [20]
   (a) Compare Thermal, Nuclear and Hydroelectric power plant.
   (b) Horizontal Axis Wind Turbine.
   (c) Diesel Power Plant.

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BE (IS) sem-VIII CBSGS 24/5/2019.

Duration: 03 Hrs. Total Marks: 80

Note:

1) Q. No 1 is compulsory.
2) Attempt any THREE questions from Q No 2 to Q No 6.
3) Assume suitable Data wherever necessary.

Q.1. Answer any Four. (20)

a) Explain piping geometry factor with its significance in control valve sizing.

b) Explain ergonomics in brief.

c) Explain Cavitation with pressure profile diagram.

d) Explain IP classifications.

e) Prove that expansion factor is 2/3 for choked flow,

Q.2.

a) Explain Control Room Design Criteria. (10)

b) Explain bath tub curve with its significance. (10)

Q.3.

a) Write short note on System engineering. (10)

b) What are different methods used to increase reliability of the System. (10)

Q.4.

a) Discuss different methods for abatement of noise in Control valves (10)

b) Design a C_v for control valve with following application: (10)

P_1=169.6 psia , P_2=20 psia , P_{vp}=20 psia ,C_d=6.5 ,F_L=0.73 , Pipe Size= 3"sch 40

w=2,10,000 lb/hr ,sp. weight. (γ_1)=1/0.01683 lb/ft^3 , Pc=3200 psia.

Q.5.

a) Explain different guidelines for grounding and shielding of equipments. (10)

b) Design a C_v for following application: (10)

Fluid= Saturated Steam, w=63000 lb/hr, P_1=235psia, P_2=215psia ,Pipe size= 6"sch 40 ,

C_d=27 , X_T=0.25.

Q.6.

a) Explain absolute method of Thermocouple calibration. (10)

b) Explain control room design and layout. (10)

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