UNIVERSITY OF PUNE

[4362]-220

Electrical/Instrumentation/Computer/I.T.

S. E. Examination - 2013

Engineering Mathematics - III

(2008 Pattern)

Total No. of Questions : 12 **[Total No. of Printed Pages :6]**

[Time : 3 Hours] **[Max. Marks : 100]**

Instructions :

(1) Answer Q1 or Q2, Q3 OR Q4, Q5 OR Q6, From section I and Q7 OR Q8, Q9 OR Q10, Q11 OR Q12 From section II.

*(2) Answers to the **two sections** should be written in **separate answer-books**.*

(3) Neat diagrams must be drawn wherever necessary.

(4) Black figures to the right indicate full marks.

(5) Use of logarithmic tables, slide rule, Mollier charts, electronic pocket calculator and steam tables is allowed.

(6) Assume suitable data, if necessary.

SECTION-I

Q1. (a) Solve (any three) [12]

1)$(D^2-1)y = cosx\ coshx$

2) $(D^2+2D+D)y = e^{-x}logx$

3) $\frac{d^2y}{dx^2}+\frac{1}{x}\frac{dy}{dx} = 2+logx$

4) $\frac{dx}{xy^3-2x^4} = \frac{dy}{2y^4-x^3y} = \frac{dz}{9z(x^3-y^3)}$

Q.1 (b) An inductor of 0.25 henries is connected in series with a capacitor of 0.04 farads and a generator having alternative voltage given by 12sin10t. Find the charge and current at any time t. [5]

OR

Q2. (a) Solve: (any three) [12]

(1) $(D^2+1)y = xcos2x$

(2) $(D^2-2D+2)y = x^2+e^{-x}$

(3) $(D^2-2D)y = e^x sin^x$ (variation of parameters)

(4) $((2x+5)^2\frac{d^2y}{dx^2}+8y-4(2x+5)\frac{dy}{dx} = 5\log(2x+5)$

Q2. (b) Solve: [5]

$$\frac{dx}{dt}+\frac{dy}{dt}-3x-y = e^t; \frac{dx}{dt}+2x+y = 0$$

Q3. (a) If f(z) is analytic, prove that $(\frac{\partial^2}{\partial x^2}+\frac{\partial^2}{\partial y^2})\,|f(z)|^2 = 4\,|f^1(z)|^2$ [5]

(b) Show that the transformation w= z+$\frac{1}{z}-2i$ maps the circle |z|=2 an ellipse. [5]

(c) Evaluate: $\oint_c \frac{z+4}{z^2+2z+5}dz$ where c: |z+2i| = $\frac{3}{2}$ [6]

OR

Q4. (a) If f(z) = u+iv is analytic function, find f(z) if u+v=$3(x+y)+\frac{x-y}{x^2+y^2}$ [5]

(b) Find the bilinear transformation which maps the points 0,1,2 of z-plane to the points 1,$\frac{1}{2}$,$\frac{1}{3}$ of w plane respectively.

(c) Evaluate:

$$\int_o^{2\pi}\frac{d\theta}{5-3cos\theta}$$ [6]

Q5. (a) Find fourier transform of

f(x)=$\begin{cases} cosx+sinx & |x|\le\pi \\ o & |x|>\pi \end{cases}$ [5]

(b) using fourier integral representation, show that :

$\frac{2}{\pi}\int_o^\infty \frac{(\lambda^2+2)cos\lambda x}{\lambda^4+4} d\lambda = e^{-x}cosx, x > 0$ [6]

(c) find z-transform of (any two) [6]

1) f(k)= $\frac{sinak}{k}, k \geq ,0$

2) f(k)= $k^2, k \geq 0$

3) f(k)= $\begin{cases} 7^k & k < 0 \\ 5^k & k \geq 0 \end{cases}$

OR

Q6. (a) Find inverse Z-transform of: (Any two) [8]

1) $\frac{2z^2-10z+13}{(z-3)^2(z-2)}$ $2 < |z| < 3$
2) $\frac{z(z+1)}{z^2-2z+1}$ |z| >1
3) $\frac{z^2}{z^2+4}$ inversion integral method

b) Solve:

f(k)-4f(k-2)=$\left(\frac{1}{2}\right)^k$, 4≥ 0 [4]

c) Solve integral equation:

$\int_0^\infty f(x)sin\lambda x dx = \frac{e^{-a\lambda}}{\lambda}, \lambda > 0$ [5]

SECTION II

Q.7 (a) Following are the marks of ten students in math's- III and strength of material (SOM) calculate the coefficient of correlation. [8]

M-III	23	28	42	17	26	35	29	37	16	46
SOM	25	22	38	21	27	39	24	32	18	44

(b) Calculate the first four central moments and β_1, β_2 for the following distribution. [9]

x	0	1	2	3	4	5	6	7	8
F	1	8	28	56	70	56	28	8	1

OR

Q8. (a) The mean and varience of Binomial distribution are 6 and 2 respectively

Find: 1) $p(r \leq 1)$ 2) $p(r \geq 2)$ [6]

(b) If the probability that an individual suffers a bad reaction from a certain injection is 0.001, then determine the probability that out of 2000 individuals

1) Exactly 3 will suffer a bad reaction

2) More than 2 will suffer a bad reaction [6]

(c) A manufacturer of envelops knows that the weight of envelope is normally distributed with mean 1.9 gm and varience 0.01gm. find how many envelopes weighing

1) 2 grams or more

2) 2.1 grams or more

Can be expected in a given packet of 1000 envelopes (Given Area for z=1 is 0.3413 and Area for z=2 is 0.4772) [5]

Q.9 (a) If $\overline{r}(t) = t^2\overline{i} + t\overline{j} - 2t^3\overline{k}$ then [5]

Evaluate $\int_1^2 \overline{r} \times \frac{d^2\overline{r}}{dt^2} dt$

(b) Prove the following (any two) [6]

1) $\overline{b} \times \nabla[\overline{a} \cdot \nabla logr] = \frac{\overline{b}\times\overline{a}}{r^2} - 2\frac{(\overline{a}.\overline{r})(\overline{b}\overline{r})}{r^4}$

2) $\nabla^2\left(\frac{\overline{a}\cdot\overline{b}}{r}\right) = 0$

3) $\nabla \times (\frac{\overline{a}\times\overline{r}}{r}) = \frac{\overline{a}}{r} + \frac{(\overline{a}\cdot\overline{r})\overline{r}}{r^3}$

Q9. (c) Find the directional derivative of $\phi = 4xz^3 - 3x^2y^2z$ at (2,-1,2) in direction towards the point (2,-2,4) [5]

OR

Q10. (a) Verify whether $\overline{F} = (ysinz - sinx)\overline{i} + (xsinz + 2yz)\overline{j} + (xycosz + y^2)\overline{k}$ is irrotational and if so find the scalar ϕ such that $\overline{F} = \nabla\phi$ [5]

(b) If $\overline{u}$ and $\overline{v}$ are irrotational vectors then prove that $\overline{u} \times \overline{v}$ is solenoidal vector. [5]

(c) If directional derivate of $\phi = ax^2y + by^2z + cz^2x$. at (1,1,1) has maximum magnitude 15 in the direction parallel to $\frac{x-1}{2} = \frac{y-3}{-2} = \frac{z}{1}$
Then find values of a,b,c. [6]

Q11. (a) Find the work done in moving the particle long the curve $x = acos\theta$, $y = asin\theta, z = b\theta$ from $\theta = \frac{\pi}{4}$ to $\theta = \frac{\pi}{2}$ under the field of force given by $\overline{F} = -3asin^2\theta\, cos\theta\overline{i} + a(2sin\theta - 3sin^3\theta)\overline{j} + bsin2\theta\overline{k}$ [5]

(b) Evaluate $\int\int_s (\nabla \times \overline{F}) \cdot \hat{n}\, ds$ where [6]

$\overline{F} = (x^3 - y^3)\overline{i} - xyz\,\overline{j} + y^3\overline{k}$ And S is the surface $x^2 + 4y^2 + z^2 - 2x = 4$ above the plane x=0.

(c) Evaluate $\int\int_s (x^3\overline{i} + y^3\overline{j} + z^3\overline{k}) \cdot\ d\overline{s}$ where S is the surface of the sphere $x^2 + y^2 + z^2 = 16$ [6]

Q.12 (a) Evaluate $\int\int_s \frac{\bar{r}}{r^3} \cdot \hat{n}\, ds$ by using Gauss Divergence theorem [5]

(b) Use Stoke's theorem to evaluate [6]

$\int_c (4y\bar{i} + 2z\bar{j} + 6y\bar{k}) \cdot d\bar{r}$ where 'c' is the curve of intersection of $x^2 + y^2 + z^2 = 2z$ and $x = z - 1$

(c) Two of the maxwell's equation are $\nabla \cdot \overline{B} = 0$, $\nabla \text{X}\, \overline{E} = -\frac{\partial \overline{B}}{\partial t}$. given $\overline{B}$ = curl $\overline{A}$ then deduce that $\overline{E} + \frac{\partial \overline{A}}{\partial t} = -$grad (v) where V is a scalar point function.

[Total No. of Questions: *12*] **[Total No. of Printed Pages:** *2*]

UNIVERSITY OF PUNE

[4362]-177

S. E. (*I & C*) Examination - 2013

Transducers and Signal Conditioning (2008 Course)

[Time: *3* **Hours]** **[Max. Marks: 100]**

Instructions :

1 *All questions are compulsory.*

2 *Answers to the* ***two sections*** *should be written in* ***separate answer-books****.*

3 *Neat diagrams must be drawn wherever necessary.*

SECTION -I

Q.1	A	Explain different method to convert resistance into voltage and current with neat sketch.	09
	B	Which blocks are required for signal conditioning? Explain and three blocks in detail.	09
		OR	
Q.2	A	Explain optical pyrometer with the help of block diagram.	09
	B	Discuss with neat circuit diagram how LM 35 can be used in thermocouple signal conditioning circuit for cold junction compensation.	09
Q. 3	A	Explain charge amplifier in detail.	08
	B	What are the advantages of four arm bridge load cell? Explain how zero adjustment is done in load cell signal conditioner.	08
		OR	
Q. 4	A	Explain the working principle of speed pickup along with signal conditioning blocks.	08
	B	Discuss different of error in strain gauge. How can they be eliminated?	08
Q. 5	A	Explain absolute encoder and its disadvantages over incremental encoder.	08
	B	Explain optical proximity sensors in detail.	08
		OR	
Q. 6	A	Explain Stroboscope with a neat diagram.	08

	B	Explain signal conditioning of LVDT in respect to phase demodulation, phase detection.	08

SECTION II

Q. 7	A	Explain the principle of capacitive level sensor? Explain signal conditioning scheme for the same.	09
	B	What are the advantages of nuclear transducer? Explain different techniques to measure radiation intensity.	09
		OR	
Q. 8	A	Explain ultrasonic level measurement with necessary signal conditioning circuit.	09
	B	Explain level measurement using Load Cell along with suitable signal conditioning blocks and necessary assumption.	09
Q. 9	A	Explain working of electromagnetic flow meter along with excitation and construction consideration.	08
	B	Explain working principle of DP cell along with necessary signal conditioning blocks.	08
		OR	
Q. 10	A	Explain working principle of Turbine flow meter. What is nature of output signal? How can it be converted into current?	08
	B	Explain electromagnetic flow meter along necessary constructional design consideration.	08
Q. 11	A	Why vibrations measurement is necessary? Explain any one method to measure vibrations.	08
	B	Explain capacitive microphone along with advantages and disadvantages.	08
		OR	
Q. 12		Write short notes on a. Conductivity meter b. pH meter.	16

UNIVERSITY OF PUNE

[4362-171]

S.E.(Instrumentation & Control)

Fundamentals of Instrumentation

(2008 pattern)

Time-Three hours **Maximum Marks-100**

[Total No. of Question=12] **[Total no. of printed pages= 4]**

Instructions:

(1)Answers to the two sections should be written in separate answer books.

(2)Neat diagram must be drawn necessary.

(3)Figures to the right indicate full marks.

(4)Assume suitable data wherever necessary.

SECTION-I

Q.1 (a)Define and explain all the dynamic characteristics of measuring instruments. (8)

(b)Prove that when a shunt connected instrument is connected to a circuit,the measured voltage is given by,

$$E_L = \frac{E_0}{1 + Z_0 / Z_L}$$

Where E_0 = voltage at no load (without the instrument connected)

Z_0 = output impedance of circuit

Z_L =input impedance of voltage measuring device.

Discuss the methods of reducing the loading error in the above case. (10)

OR

Q.2 (a)Define calibration. Explain the requirement of calibration certificate and calibration report in the calibration process. (10)

(b)Define and explain the following characteristics of an instrument. (8)

(i)Accuracy

(ii)Resolution

(iii)Sensitivity

(iv)Linearity

Q.3 (a)Describe the construction details of d' Arsonval galvanometer. Derive the expression for steady state deflection. (8)

(b)A single phase energy meter has a registration constant of 100 rev/KWh. If the meter is connected to a load carrying 20 A at 230 V and 0.8 power factor for an hour,find the number of revolutions made by it.If it actually makes 360 revolutions,find the percentage error. (8)

OR

Q.4 (a)Explain how D.C. Potentiometer can be used for calibration of voltmeter. (8)

(b)A moving coil instrument gives full scale deflection with 15mA.The resistance of coil is 5Ω.It is desired to convert this instrument into an ammeter to read up to 2A.How to achieve it?How to convert this instrument to read up to 30V? (8)

Q5. (a)Derive equation for measuring dissipation of an unknown capacitance using Schering bridge. (8)

(b)In the Wheatstone Bridge the values of resistances of various arms P=1000Ω, Q=100Ω,R=200Ω.Tha battery has an EMF of 5V negligible internal resistance.The galvanometer has current sensitivity of 10mm/μA and an internal resistance of 100 Ω. Calculate the deflection of bridge in terms of deflection per unit change in R. (8)

OR

Q.6 (a)Write the difference between. (8)

(i)Null type and Deflection type bridge

(ii)Current Sensitive and Voltage Sensitive Bridges.

(b)Derive equation for sensitivity in Wheatstone bridge and show that Bridge sensitivity is maximum when ratio of ratio arm is equal to 1. (8)

SECTION-II

Q.7 (a)What are the advantages of digital instruments over analog instruments? What are the basic components of Digital System? (8)

(b)Explain the measurement of Distance using Ultrasonic Principle. (8)

OR

Q.8 (a)Explain the working of digital Thermometer with typical Specifications. (8)

(b)Explain the measurement of phase using Digital Phase Meter. (8)

Q.9 (a)Explain the internal structure of CRT. (6)

(b)Explain the different techniques of frequency measurement on CRO. (8)

(c)Explain the need of vertical amplifier and time base generator. (4)

OR

Q.10 (a)Differentiate between Dual Beam CRO and Dual Trace CRO. Draw necessary diagrams. (8)

(b)What is the minimum bandwidth the CRO must have to be able to display without distortion , a square wave with a rise time of 18 ns. (4)

(c)Explain ALT and CHOP mode of CRO. (6)

Q.11 (a)Explain different marking mechanism used in Recorders. (8)

(b)Explain the block diagram of function generator in detail. (8)

OR

Q.12 Write a short notes on: (16)

(a)Virtual instrument

(b)X-Y Recorder

UNIVERSITY OF PUNE

[4362]-172

S. E. (Linear Integrated Circuits-I),(206262) Examination May - 2013

Instrumentation and Control Eng (2008 Course)

[Total No. of Questions:12] **[Total No. of Printed pages :]**

[Time : 3 Hours] **[Max. Marks : 100]**

Instructions :

*(1) Answer **any three** questions from each section.*

*(2) Answers to the **two sections** should be written in **separate answer-books**.*

(3) Neat diagrams must be drawn wherever necessary.

(4) Use of logarithmic tables, slide rule, Mollier charts, electronic pocket calculator and steam tables is allowed.

(5) Assume suitable data, if necessary.

Section I

Q.1 A] Draw the block diagram of Operational amplifier and explain each block. [10]

Q.1B] Compare amplifier ICs IC741, LM324 and OP 07 with respect to any four parameters. [8]

Or

Q.2A] Define the following terms: [10]

i) CMRR

ii) PSRR

iii) Slew rate

iv) Gain bandwidth product

v) Output voltage swing

Q.2B] Write short note on LM324 and Op-07. [8]

Q.3A] With a suitable diagram, prove that the gain of voltage follower using Op-amp is 1 and also explain any one application of voltage follower. [8]

Q.3B] For an amplifier with negative feedback, input resistance is of 2KΩ [8] and feedback resistance is of 5K$\mathbf{\Omega}$. Calculate output voltage of the circuit in inverting and non inverting configurations. 3 V DC signal applied at input terminal of op-amp and the supply voltage for circuit is 15V. Draw the circuit diagrams.

Or

Q.4A] Compare Voltage Series feedback amplifier with Voltage Shunt type feedback amplifier. [8]

Q.4B] Explain with derivation how negative feedback increases bandwidth of Op-amp. [8]

Q.5A] Draw a neat labeled diagram of 3 Op-amp Instrumentation Amplifier and derive its gain equation. [8]

Q.5B] A certain instrumentation amplifier has a gain of 40 dB and common mode rejection ratio of 100 dB. It is used in noisy environment in which the signal has a level of 50m V, and the common mode noise level is 100m V. Determine (a) common mode gain, (b) signal output,(c) noise output, (d) output signal voltage to noise voltage ration. [8]

Or

Q.6A] Draw neat labeled diagrams of- [8]

i) Ideal integrator using Op-amp
ii) Voltage to Current Converter (grounded load)
iii) Practical differentiator using Op-amp
iv) Current to Voltage Converter.

Q.6B] Implement the following equation using op-amp. [8]

$V_0 = 2V_1 - V_2$

Where, V_1 and V_2 are inputs and V_0 is output of op-amp. Draw the circuit diagram.

Section II

Q.7A] State Barkhausen stability criteria and explain RC phase shift oscillator with neat diagram. [8]

Q.7B] Explain how comparator works in following two cases: [10]

a) Non inverting comparator with reference voltage of 1V.
b) Inverting comparator with reference voltage of 2.V

Assume input signal is 6V peak to peak sine wave and supply voltage is of 15V.

Or

Q.8A] With a neat labeled diagram explain working of precision full wave rectifier using Op-amp. [10]

Q.8B] Design a Schmitt Trigger for UTP = + 1.5V and LTP = -1.5V. Assume Op-amp to be IC741 and saturation voltages as $\pm$10V. Draw the neat labeled diagram as well. [8]

Q.9A] Draw a neat circuit diagram to generate +5V DC supply using IC 7805. [8]

Q.9B] In a monostable circuit using IC555, R_A = 10KΩ, C= 1μF, V_{CC} =+5V What is the maximum capacitor voltage and what is the width of output pulse.

Or

Q.10A] Draw the pin diagram of IC555 and explain the function of each pin [8]

Q.10B] With a neat labeled diagram explain how IC555 can be used as an Astable multivibrator. [8]

Q.11A] Define the following terms with respect to active filter [6]
a) Pass band, b) Stop band, c) Transition band

Q.11B] Draw the practical frequency response plot for low pass, high pass, band pass and band stop Filters. [10]

Or

Q.12A] Draw the ideal frequency response plot for low pass, high pass, band pass and band stop Filters. [10]

Q.12B] State four major points of differentiation between active and passive filters. [4]

Q.12C] Higher the order of filter, faster is the roll off rate. State True or False. [2]

UNIVERSITY OF PUNE

[4362-173]

S.E.(Instrumentation) Examination 2013

Principles Of Sensors And Transducers

(2008 pattern)

Time-Three hours **Maximum Marks-100**

[Total No. of Question=12] **[Total no. of printed pages= 3]**

Instructions:

(1)Answer any 3 questions from each section.

(2)Answer to the TWO sections should be written in separate answer books

(3)Neat diagrams must be drawn whenever necessary.

(4)Figures to the right indicate full marks.

(5)Use of logarithmic tables slide rule,Mollier charts,electronic pocket calculator and steam tables is allowed.

(6)Assume suitable data whenever necessary.

SECTION-I

Q.1 (a)Define instrument.Explain function of instrument?
Compare Null Type and deflection type of instrument. (8)

(b)What is calibration?Explain standards available for calibration. (8)

OR

Q.2 (a)Define Measurement. List and explain various types of errors in measurement. (8)

(b)Explain the following terms. (8)

(i)Accuracy (ii)Precision (iii)Threshold (iv)Hysterrsis

Q.3 (a)Explain with diagram bimetallic strip system for temperature measurement. state its applications. (8)

(b)Define atmospheric pressure and absolute pressure. Give units of pressure. Explain with diagram bellows. (8)

OR

Q.4 (a)Explain with diagram torsion bar for torque measurement. Explain in brief principle of gyroscope. (8)

(b)List different types of load cells. Draw and explain force measurement using load cell. (8)

Q.5 (a)List different units of flow measurement. (2)

(b)Explain with diagram viscosity to torque converter. (6)

(c)Water is pumped through a 1.5 -in diameter pipe with a flow velocity of 2.5ft/s.Find the volume flow rate (ft^3/min) and weight flow rate (lb/min). The weight density is $62.4\,lb/ft^2$. (10)

OR

Q.6 (a)Draw and explain level to pressure converter. (8)

(b)Define the following terms. (4)

(i)Newtonian fluid (ii)Non- Newtonian fluid

(c)Flow is to be controlled from 20 to 150 gal/min.The flow is measured using orifice plate system with K=119.5 $(gal/min)/psi^{(1/2)}$ a bellow measures the pressure with an LVDT so that the o/p is 1.8 V/psi. Find the range of voltage that result from the given flow range. (6)

SECTION-II

Q.7 (a)Explain the working principle of LVDT.State its advantages and applications. (9)

(b)A capacitive transducer uses two quartz diaphragms or area 750 mm^2 separated by distance of 3.5 mm. A pressure of 900 kN/m^2

when applied to the top diaphragms produces a deflection of 0.6mm. The capacitance is 35- Pf when no pressure is applied to the diaphragms. Find the value of capacitance after the application of a pressure of 900 kN/m^2 . (9)

OR

Q.8 (a)State the principle of strain guage. Draw and explain different types of strain gauges (any two) (9)

(b)Draw and explain thickness measurement using capacitive trabsducer. Give its applications. (8)

Q.9 (a)List various types of encoders. Explain encoder for angular displacement measurement. (8)

(b)State piezoelectric phenomenon. Explain piezoelectric transducer for pressure measurement. (8)

OR

Q.10 (a)Draw and explain electro-magnetic folwmeter. State its advantages and limitations. (8)

(b)Explain principle of pH measurement. Draw and explain reference calomel electrode. (8)

Q.11 (a)Enlist different digital input-output devices.Explain with neat sketch a servo operated manometer. (8)

(b)Write a short note on: (8)

(i)Magnetic tape recorder.

(ii)Feedback transducer system.

OR

Q.12 (a)Explain with neat sketch Data logger. (8)

(b)Write short notes on: (8)

(i)Analog and Digital readout system

(ii)Self balancing system.

UNIVERSITY OF PUNE

[4362]-174
S. E. (Instrumentation & Control)
Examination - 2013
AUTOMATIC CONTROL SYSTEM
(2008 Pattern)

[Time : 3 Hours] **[Max. Marks : 100]**
[Total No. of Questions : 12] **[Total No. of Printed Pages :6]**

Instructions :

*(1) Answers three questions from **Sections I** and three questions from **Section II**.*
*(2) Answers to the **two sections** should be written in **separate answer-books**.*
(3) Black figures to the right indicate full marks.
(4) Neat diagrams must be drawn wherever necessary.
(5) Assume suitable data, if necessary.

SECTION I

Q1) a) with an example explain the difference between: [6]

1. Feedback and Feed-Forward.
2. LTI and LTV.
3. Linear and Non-linear.

b) Fine the transfer function for the following system using $f \rightarrow v$ analogy and draw the circuit diagram for the same. [10]

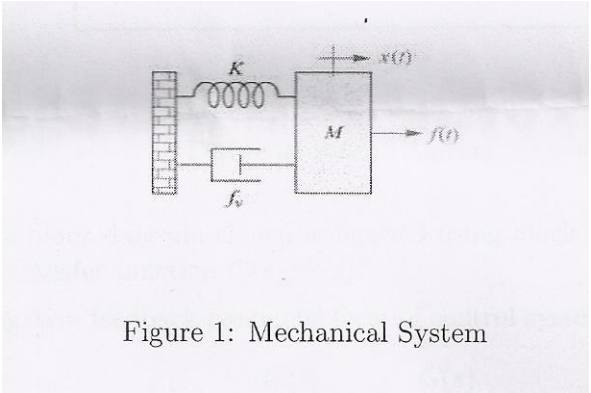


Figure 1: Mechanical System

OR

Q2) a) With an example explain the difference between: [6]

1. Open-loop and Closed-loop.
2. LTI and LTV.
3. Stable and Unstable.

b) Figure 2 shows a liquid level system, where q_i, q_0, h, A, ρ and R are inflow, outflow, liquid level cross-sectional area of tank, fluid density and restriction to outflow respectively. Find the transfer for same. [10]

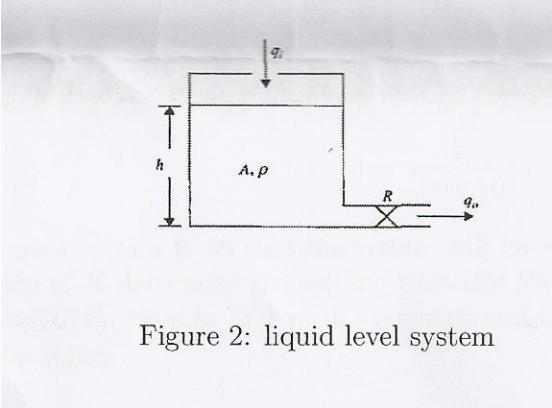


Figure 2: liquid level system

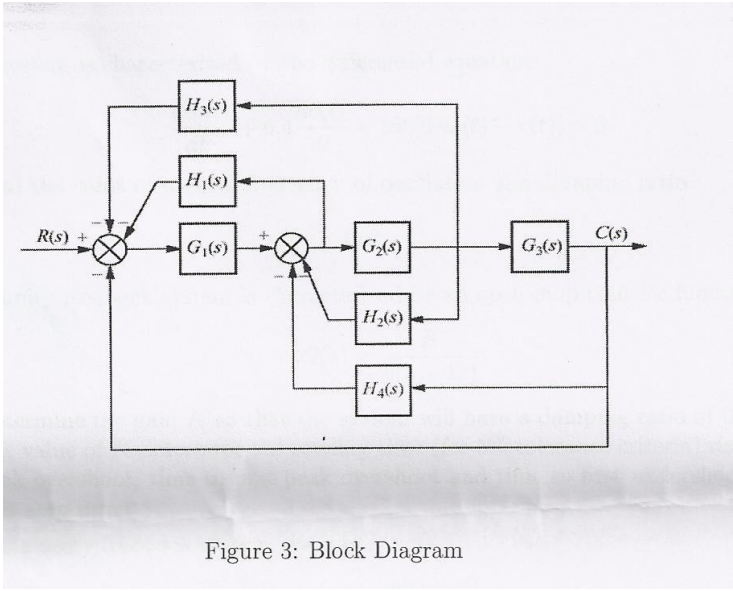


Figure 3: Block Diagram

Q3) a) Reduce a block shown in figure 3 using block reduction technique and find the transfer function C(s)/R(s). [10]

b) For a negative feedback canonical form of control system prove that: [6]

$$\frac{C\ (s)}{R\ (s)} = \frac{G\ (s)}{1+G\ (s)H(s)}$$

OR

Q4) a) Find a transfer function C(s)/R(s) of a block diagram shown in figure 3 using Mason's gain formula. [10]

b) For a positive feedback canonical form of control system prove that: [6]

$$\frac{C\ (s)}{R\ (s)} = \frac{G\ (s)}{1-G\ (s)H(s)}$$

Q5) a) A unity feedback system is characterized by an open-loop transfer function: [12]

$$G(s) = \frac{K}{s(s+10)}$$

Determine the gain K so that the system will have a damping ratio of 0.5. For This value of K determine the settling time (for 5% tolerance criteria), rise time, peak overshoot, time to first peak overshoot and time to first undershoot for a unit step input.

b) A system is characterized by the differential equation: [6]

$$\frac{d^2c(t)}{dt^2} + 6.4\,\frac{dc(t)}{dt} + 160\,[0.4\ c(t) - r(t)] = 0$$

Find the value of natural frequency of oscillation and damping ratio.

OR

Q6) a) A unity feedback system is characterized by an open-loop transfer function: [12]

$$G(s) = \frac{K}{s(s+12)}$$

Determine the gain K so that the system will have a damping ratio of 0.5. For This value of K determine the settling time (for 5% tolerance criteria), rise time,

peak overshoot, time to first peak overshoot and time to first undershoot for a unit step input.

b) For a unity feedback system given by: [6]

$$G(s) = \frac{20\ (s+2)}{s(s+3)(s+4)}$$

Find the static error constants.

SECTION II

Q7) a) Check the stability of the system with characteristic equation: [6]

$$S^5 + 2s^4 + 24s^3 + 48\ s^2 - 25s - 50 = 0$$

b) Sketch the root loops of the unity feedback system with open-loop transfer function: [12]

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

and comment on the stability of the system.

OR

Q8) a) The characteristic equation of a feedback control system is: [6]

$$s^4 + 25s^3 + 15\ s^2 + 20s + k = 0$$

Determine the value of k so the system is marginally stable and the frequency of sustained oscillations.

b) Sketch the root locus of the unity feedback system with open-loop transfer function: [12]

$$G(s) = \frac{K(s+3)}{(s+1)(s+2)}$$

and comment on the stability of the system.

Q9) a) The forward path transfer function of a unity feedback system is: [6]

$$G(s) = \frac{100}{s(s+6)}$$

Find the resonant peak M_r , resonant frequency w_r and bandwidth of the closed loop system.

b) Consider the open-loop transfer function of a closed loop system: [10]

$$G(s) = \frac{K\, e^{-T_d s}}{s(s+2)(s+4)}$$

Draw the bode plot for K = 1 and T_d = 1. Determine gain margin and phase margin. Comment on the system stability

OR

Q10) a) The specifications on a second-order unity feedback control system with closed loop transfer function: [6]

$$T(s) = \frac{w_n^2}{(s^2+2\xi w_n+w_n^2)}$$

are that the maximum overshoot must not exceed 30% and rise time must be less than 0.2 Sec. Find the limiting values of M_r and Bandwidth.

b) Draw the Bodeplot of the open-loop transfer function [10]

$$G(s) = \frac{200(s+10)}{s(s+5)(s+20)}$$

Q11) a) Sketch polar plot for the unity feedback system with open-loop transfer function: [8]

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

b) For the given transfer function: [8]

$$T(s) = \frac{s+3}{s^2+2s+1}$$

Obtain the state model in controllable canonical form.

OR

Q12) a) Sketch polar plot for the unity feedback system with open-loop transfer function: [8]

$$G(s) = \frac{1}{(s+4)}$$

b) State model of control system is given below: [8]

$$\begin{bmatrix} \dot{x_1} \\ \dot{x_2} \end{bmatrix} = \begin{bmatrix} 0 & 1 \\ -7 & -2 \end{bmatrix} \begin{bmatrix} x_1 \\ x_2 \end{bmatrix} + \begin{bmatrix} 0 \\ 1 \end{bmatrix} u$$

$$Y = \begin{bmatrix} 3 & 1 \end{bmatrix} \begin{bmatrix} x_1 \\ x_2 \end{bmatrix}$$

Find a transfer function of a system.

UNIVERSITY OF PUNE

[4362]-175

S. E. (Instrumentation & Control)

Examination - 2013

DIGITAL TECHNIQUES

(2008 Pattern)

[Time : 3 Hours] **[Max. Marks : 100]**

Total No. of Questions : 12 **[Total No. of Printed Pages :5]**

Instructions :

*(1) Answers three questions from **Sections I** and three questions from **Section II***

*(2) Answers to the **two sections** should be written in **separate answer-books**.*

(3) Black figures to the right indicate full marks.

(4) Neat diagrams must be drawn wherever necessary.

(5) Use of logarithmic tables, slide rule, Mollier charts, electronic pocket calculator and steam tables is allowed.

(6) Assume suitable data, if necessary.

SECTION I

Q1) a) Convert the following: [08]

a. $A92_H$ TO Octal

b. $(10011.1101)_2$ to hexadecimal

c. $(268.75)_{10}$ to binary

d. $(725.25)_8$ to decimal

b) Simplify the following Boolean function by using a Quine McCluskey method [08]

f(A, B, C, D) = $\sum m(0,1,2,3,5,7,8,9.11.14)$

OR

Q2) a) 1) Obtain excess-3 code for $(428)_{10}$ [02]

2) Obtain 2s complement of 100011 [02]

3) Convert 0.95 Decimal number to its binary equivalent [04]

b) 1) Perform $(9)_{10}$- $(5)_{10}$ using 2s complment Method [02]

2) Add $(3F8)_H$ And $(5B3)_H$ [02]

3) Explain how parity bit are used for error detection [04]

Q3) a) Reduce the Boolean repression (any Three) [06]

i) XY + XYZ + XY$\overline{Z}$ + $\overline{X}$YZ

ii) Y = $\overline{A}$ BC$\overline{D}$ + BC$\overline{D}$ + B$\overline{C}$ $\overline{D}$ + B $\overline{C}$ D

iii) Y= $\overline{A}$ B$\overline{C}$ D+ $\overline{A}$ BC$\overline{D}$ + ABD

iv) Y = AB + $\overline{A}$ C + A $\overline{B}$ C(AB +C)

b) Reduce the following function using K-map technique: [12]

1) Y = $\overline{A}$ $\overline{B}$C$\overline{D}$+ABC$\overline{D}$+A$\overline{B}$C$\overline{D}$+A$\overline{B}$CD+A $\overline{B}$ $\overline{C}$ $\overline{D}$+AB$\overline{C}$ $\overline{D}$+$\overline{A}$ $\overline{B}$CD+ $\overline{A}$ $\overline{B}$ $\overline{C}$ $\overline{D}$

2) Y = $\sum m$(0.1,5,9,13,14,15) + d (3.4, 7, 10, 11)

OR

Q4) a) 1) Convert SR flip-flop to T flip-flop [06]

2) Convert JK flip-flop to D flip-flop [06]

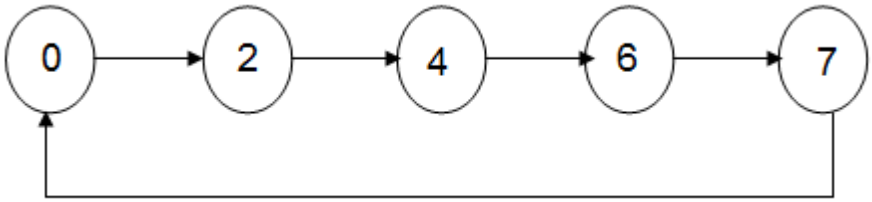
b) Write a short notes on (any two) [06]

1) SRAM

2) EPROM

3) EEPROM

Q5) a) Design Non-sequential counter which goes through the States By using suitable flip flop. [10]



avoid lockout condition

b) Design MOD-96 counter using IC7490 [6]

OR

Q6) a) 1) Explain how synchronous counter differ from asynchronous counter. [06]

2) Write a short notes on counter application [04]

b) Design MOD-128 counter using ICs 7493 [06]

SECTION II

Q7) a) Implement the following function using 16:1 multiplexer [08]

$F(A,B,C,D) = \sum(2,4,5,7,10,14,15,16,17,25,26,30,31)$

b) Design 1:32 demultiplexer using 1:8 demultiplexer [08]

OR

Q8) a) Implement the following function using using 3:8 Decoder [08]

$F_1(A,B,C) = \sum m(0,4,7) + d(2,3)$

$F_2(A,B,C) = \sum m(1,5,6)$

$F_3(A,B,C) = \sum m(0,2,4,6)$

b) Implement the BCD to seven segment decoder using 4 line to 16 line decoder. [08]

Assume the display to be common anode display

Q9) a) Explain different schemes for interfacing TTL to CMOS [08]

b) Explain what is wired AND? What happens if gates with totem pole output connected in wired AND manner. [08]

OR

Q10) a) Define the following: [08]

1) Fan-in

2) fan-out

3) Propagation delay

4) Power dissipation

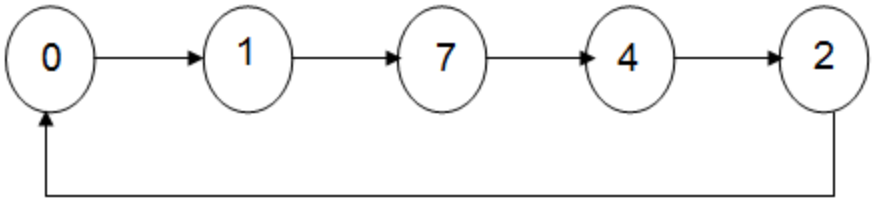
b) Explain the working of CMOS NOR and CMOS NAND gate with appropriate circuit. [08]

Q11) a) Design a sequence generator to generate the following pulse train using shift register 11001110. [10]

b) Describe in detail 'Minutes and Hours' section of digital clock with the help of circuit diagram. [08]

OR

Q12) a) Design sequence generator using T flip-flop. [10]



b) Explain Alarm Annunciator with neat sketch. [08]

UNIVERSITY OF PUNE

[4362]-176

S. E. (Instrumentation & Control)
Examination - 2013
APPLIED ELECTRONICS (206267)
(2008 Pattern)

[Time : 3 Hours] **[Max. Marks : 100]**

Total No. of Questions : 12 **[Total No. of Printed Pages :3]**

Instructions :

*(1) Answers three questions from **Sections I** and three questions from **Section II**.*

*(2) Answers to the **two sections** should be written in **separate answer-books**.*

(3) Neat diagrams must be drawn wherever necessary.

(4) Black figures to the right indicate full marks.

(5) Your answers will be valued as a whole.

(6) Use of logarithmic tables, slide rule, Mollier charts, electronic pocket calculator and steam tables is allowed.

(7) Assume suitable data, if necessary.

SECTION I

Q1) a) Develop a system where input signals are coming from different transducers like thermocouple (output is mV), Pressure transducer (output is change in resistance), PH sensor (output is current), Level transmitter (output is current), Encoder (output is pulses), and Sound sensor (output is audio signal) are applied to Multiplexer IC CD4051simultaneously. How the circuit works? Explain it by suitable diagram. [10]

b) How to apply continuous analog signals to the ADC's? Explain the concept using Sample and hold circuit. [8]

OR

Q2) a) Design 3-bit flash type ADC, when analog input is changes from 0 to 5 volts and Vref is 5 Volt. Write necessary observation table with diagram. [10]

b) Explain the following performance characteristics of ADC [8]

i) Linearity

ii) Resolution

iii) Quantization Error

iv) DNL or INL Error

Q3) a) Derive output equation for 4-bit binary weighted register type DAC with neat circuit Diagram. [8]

b) What is PWM type DAC? Explain it with suitable diagrams. [8]

OR

Q4) a) Using Thevenin's theorem, derive output voltage equation for 4-bit, R-2R type DAC. [8]

b) Explain following performance characteristics of DAC's [8]

i) Resolution ii) Accuracy iii) Full-scale Range (FSR)

iv) Monotonacity

Q5) a) Is SCR is voltage controlled or current controlled device? Justify with suitable diagrams [8]

b) Is MOSFET is voltage or current controlled device? Justify correct answer with neat Diagrams. [8]

OR

Q6) a) Is TRIAC is better than SCR? Justify correct answer with neat diagrams [8]

b) Draw and explain the symbol and characteristics of IGBT. [8]

SECTION II

Q7) a) List out primary and secondary types of batteries. Explain the concept battery [10]

monitoring System with neat diagram.

b) Explain the taper, Pulsed, Trickle and Float charging methods in details? [8]

OR

Q8) a) How the IC L-200 is used as a adjustable voltage and current regulator charger? Explain with neat diagrams. [10]

b) What is memory effect and Capacity of battery? Explain [8]

Q9) a) A Temperature transducer gives output in the range of 1V to 5V. Design suitable circuit that gives output in the range of 4 to 20 mA. Assume suitable data. [8]

b) Why VCO needs a constant current source? Explain VCO with neat block diagram. [8]

OR

Q10) a) Derive output current equation of grounded load type V to I convertor. [8]

b) Explain the frequency to voltage conversion technique with neat block diagram. [8]

Q11) a) In data transmission and telemetry how Amplitude modulation is useful? Explain. [8]

b) Explain FDM technique using neat block diagram. [8]

OR

Q12) a) How ASK is useful in wireless telegraphy? Explain with neat diagram coherent and non-coherent detector. [8]

b) Explain TDM technique using neat block diagram. [8]

[Total No. of Questions: 12] **[Total No. of Printed Pages: 3]**

UNIVERSITY OF PUNE
[4362]-178
S. E. (Instrumentation)(Second Semester)Examination - 2013
PHOTONICS AND INSTRUMENTATION
(206269)(2008 Course)

[Time: 3 Hours] **[Max. Marks: 100]**

Instructions:

1. *Answer any three questions from Section I and any three questions from Section II*
2. *Answers to the two sections should be written in separate answer-books.*
3. *Neat diagrams must be drawn wherever necessary.*
4. *Black figures to the right indicate full marks.*
5. *Use of logarithmic tables, slide rule, Mollier charts, electronic pocket calculator and steam tables is allowed.*
6. *Assume suitable data, if necessary.*

SECTION -I

Q.1	A)	Explain Electromagnetic spectrum of light of different range with suitable diagram and state advantages of it.	[12]
	B)	Light having frequency range of 10^6 Hz. Calculate wavelength in meter	[4]
	C)	State the Plank's equation	[2]
		OR	
Q.2	A)	Differentiate the following properties of light with suitable diagram : i) Polarization and coherence ii) Absorption and Transmittance iii) Scattering and Dispersion iv) Diffraction and Interference	[18]
Q. 3	A)	Explain construction and working principle of Incandescent lamp. Enlist the advantages and application of it	[12]
	B)	Describe Natural sources of light	[4]

OR

Q. 4 A) Explain working principle of any one gas discharge lamp with suitable diagram [8]

B) For an incandescent lamp, the design parameters are: [8]

i) Design voltage = 5v
ii) Design current = 0.145 Amp
iii) M.S.C.P. at design voltage = 0.16
iv) Lamp life = 10,000 Hrs

If this lamp is operated at 4.5v, then calculate:

1) Rerated M.S.C.P.
2) Rerated life
3) Rerated Current

Q. 5 A) Explain working principle of semiconductor laser with the help of neat diagram and its application [8]

B) Explain working of Light emitting diode Draw the LED characteristics [8]

OR

Q. 6 A) Explain basic steps required for generation of laser beam. What are different properties of Laser? State advantages and disadvantages of it. [8]

B) What do you understand by a term radiation pattern of light emitting diode? Suggest experimental set up and procedure to draw it [8]

SECTION II

Q. 7 A) Explain the following photo effects related the quantum detectors with suitable diagram [14]

i) photoconductive
ii) photovoltic
iii) photoelectromagnetic
iv) photoemissive

B) Differentiate between PIN and avalanche photodiode [4]

OR

Q. 8 A) Explain the following type of thermal detector with suitable diagram. [14]

i) Balometric
ii) Thermovoltic
iii) Thermopneumatic
iv) Pyroelectric

B) Differentiate between solar cells and CCD devices. [4]

Q. 9	A)	Differentiate the following : i) Dispersion prism and reflection prism ii) Absorption filter and Interference filter iii) Cancave grating and Diffraction grating iv) Plane mirror and spherical mirror.	[16]
		OR	
Q. 10	A)	Explain diffraction grating equation with its application. suggest experimental set up to determine the unknown wavelength	[12]
	B)	Explain any two i) Lenses ii) Polarizers iii) Beam splitter	[4]
Q.11	A)	Explain working principle of Astronomical telescope with suitable diagram.	[8]
	B)	Explain working principle of Abbe's refractometer with suitable diagram	[8]
		OR	
Q. 12	A)	Describe the following on any two i) Cameras ii) Microscopes iii) Optical projection system	[16]

[Total No. of Questions: 12] **[Total No. of Printed Pages: 2]**

UNIVERSITY OF PUNE
[4362]-179
S. E. (Instrumentation And Control) Examination - 2013
DRIVES AND CONTROL (2008 Course)
[Time: 3 Hours] **[Max. Marks: 100]**

Instructions:

1 *Answer 3 questions from Section I and 3 questions from Section II*
2 *Answers to the two sections should be written in separate answer-books.*
3 *Neat diagrams must be drawn wherever necessary.*
4 *Black figures to the right indicate full marks.*
5 *Use of logarithmic tables, slide rule, Mollier charts, electronic pocket calculator and steam tables is allowed.*
6 *Assume suitable data, if necessary.*

SECTION -I

Q.1	A	Describe the basic principle of Generator. What is lap winding and wave winding? Write the differences.	8
	B	An 8 pole d.c. shunt generator with 778 wave connected armature conductors and running at 500 rpm supplies a load of 12.5 ohm resistance at terminal voltage at 250 V. The armature resistance is 0.24 ohm and field resistance is 250 ohm. Find the armature current, the induced emf and the flux per code.	8
		OR	
Q.2	A	Write the necessity of the starter in d.c. motors. Explain the three point starter in detail in shunt motor.	8
	B	A d.c. motor takes an armature current of 110 A at 480 V. The armature circuit resistance is 0.2 ohm. The machine has 6 poles and the armature is lap connected with 864 conductors. The flux per pole is 0.05 Wb. Calculate 1) the speed and 2) the gross torque developed by the armature.	8
Q. 3	A	Write the difference between squirrel-cage rotor and phase-wound in induction motor detail. Which type is mostly used in industries and why?	8
	B	Draw and write the relation between torque and ship in induction motor.	8
		OR	
Q. 4	A	What is rotating magnetic field. Explain the reason why does rotor rotate in the induction motor.	8
	B	Explain the working and construction of alternator.	8

Q. 5	A	Explain the working principle and construction of Universal motor. Explain the speed control methods.	8
	B	Write a working principle of steeper motors in details. Why the steeper motor is widely used in automation systems. Mention the two applications of it.	10
		OR	
Q. 6	A	Write the classification of steeper motors. Explain one in details.	10
	B	Explain the construction and working principle of synchronous motor.	8

SECTION II

Q. 7	A	Compare SCR, DIAC and TRIAC	10
	B	Write the specifications of the SCR.	6
		OR	
Q. 8	A	Write the construction, working and characteristics of UJT.	8
	B	What is natural and forced commutation of SCR. Explain Class 'B' commutation of SCR.	8
Q. 9	A	Explain the signal phase half wave controlled rectifier with RL load. Explain the necessity of flywheel diode. Draw the waveforms.	10
	B	Write short note on choppers.	8
		OR	
Q. 10	A	Explain the single phase half-controlled bridge rectifier with RL load. Explain the necessity of flywheel diode. Draw the waveforms.	10
	B	Write the short note on inverters.	8
Q. 11	A	Write short note on: three phase SCR drive in DC motor control.	8
	B	Explain need of industrial drive, as conventional speed control of motors is available	8
		OR	
Q. 12	A	Close loop control system for DC motor control	8
	B	Give the methods by which speed of the induction motors can be varied. Explain any one in detail.	8

UNIVERSITY OF PUNE

[4362]-179A

S. E. (Instrumentation & Control)

Examination - 2013

MATERIALS AND PROCESSES FOR SENSORS

(2003 Pattern)

[Time : 3 Hours] **[Max. Marks : 100]**

Total No. of Questions : 12 **[Total No. of Printed Pages :2]**

Instructions :

*(1) Answers to the **two sections** should be written in **separate answer-books**.*

(2) Neat diagrams must be drawn wherever necessary.

(3) Black figures to the right indicate full marks.

(4) Assume suitable data, if necessary.

SECTION I

Q1) a) Discuss the material selection for thermocouple and RTD. [8]

b) Explain the properties and applications of Tungsten. [8]

OR

Q2) a) Explain the properties required for strain gauge. [8]

b) Enlist the guidelines for material selection of mercury filled thermometer. [8]

Q3) a) What are the various factors affecting selection of elastic materials? Give example of any two elastic transducers. [8]

b) Explain polarization and Magnetostrictive effect. [8]

OR

Q4) a) Explain the application of piezoelectric material. [8]

b) Explain the properties of Elastic materials. [8]

Q5) a) Explain the types of Corrosion. [8]

b) List various methods of corrosion control and explain any two of them in detail [10]

OR

Q6) a) Explain the term service performance of ceramic. [8]

b) Explain properties and uses of following insulators:

i) Glass ii) Insulating Resins [10]

SECTION II

Q7) a) Discuss the material selection criteria for LVDT. [8]

b) Give properties and applications of soft magnetic materials. [8]

OR

Q8) a) Suggest any two materials for the following and justify: [8]

i) Bourdon gauge

ii) Transformer

b)Discuss effect of temperature on ferromagnetism [8]

Q9) a) What are various ret of quirements of fiber optic materials. [8]

b) Write a note on Bio-materials. [10]

OR

Q10) a) Write a note on materials for fiber-optic cables. [8]

b) What is radioactivity? What are various radioactive elements? Explain various applications of radioactive elements. [10]

Q11) a) Explain Ion Plating. [8]

b) What is electroplating? Explain its use and any one technique in detail. [8]

OR

Q12) a) Compare thick and thin film technology. [8]

b) Write a note on Types of Stainless Steels. [8]

[Total No. of Questions: *10*] **[Total No. of Printed Pages:** *4*]

UNIVERSITY OF PUNE

[4362]-179B

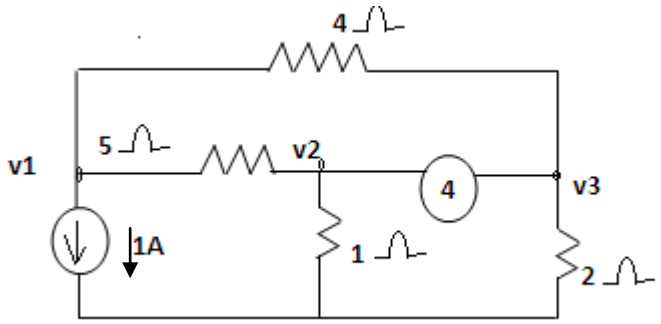
S. E. (*Instrumentation & Control***) Examination - 2013**

Network Theory (2003 Course)

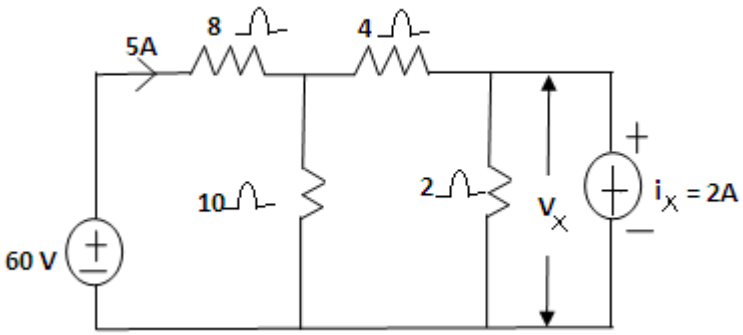
[Time: *3* **Hours]** **[Max. Marks: 100]**

SECTION -I

Q.1 A In the given network find the voltages V1, V2, V3 using nodal analysis. Refer fig 1. 8

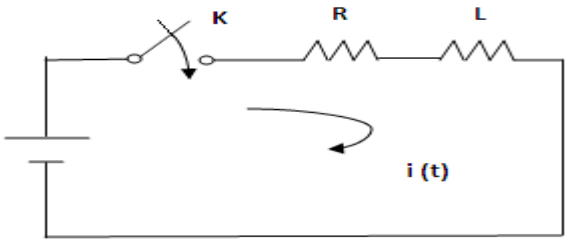


B Determine V_x in the following ckt shown in fig 2 8



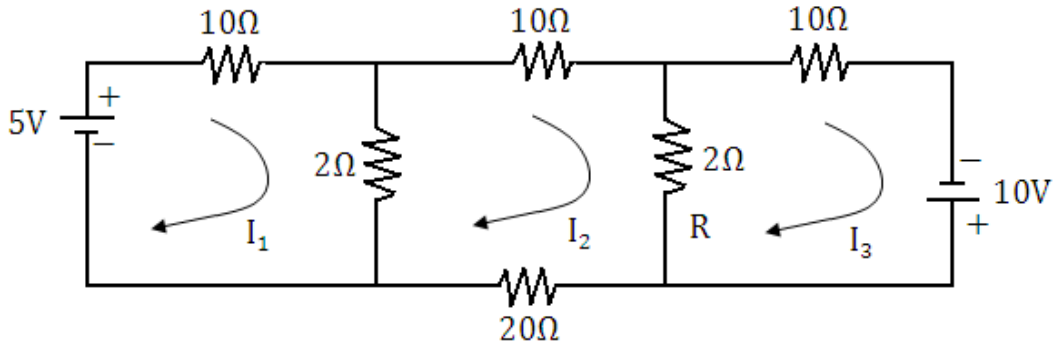
OR

Q.2 A In the given series RL circuit, derive expression for the instantaneous current i(t). Find voltage drop across resistor. Show in fig 3 8



B By Mesh analysis find the voltage across R in the given Network. 8

Shown in fig. 4



Q. 3 A The driving point impedance of RC network is given by 8

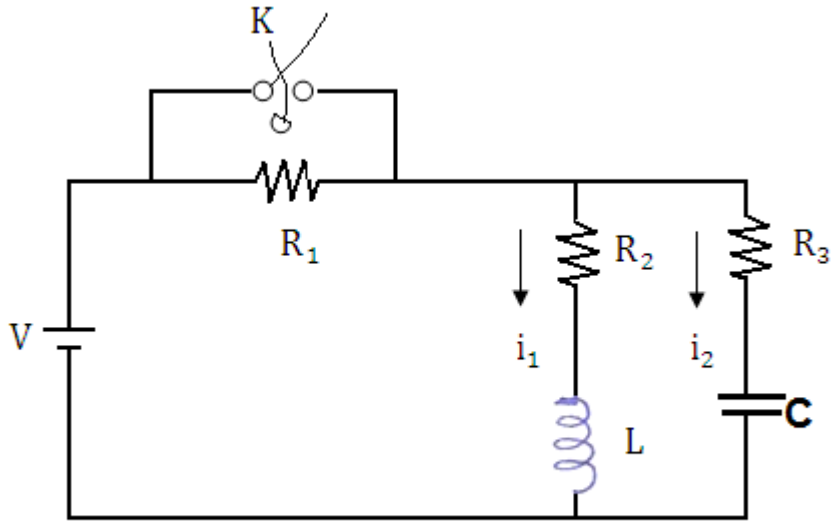
$$Z(s)=\frac{(S+3)(S+5)}{S(S+4)}$$

Obtains first cauer form.

B In the network shown in fig. 5, a steady state is reached with the switch K open with V=100V, R_1=10Ω, R_2=20Ω, L=1H, & C=1μF, 8

At time t=0, the switch is closed.

Solve for the $\frac{di_1}{dt}$ and $\frac{di_2}{dt}$ at t=0^+



OR

Q. 4 A The driving point impedance of an LC network is given by: 8

$$Z(s)\frac{10(S^2+4)(S^2+16)}{S(S^2+9)}$$

Obtain the first form of foster network

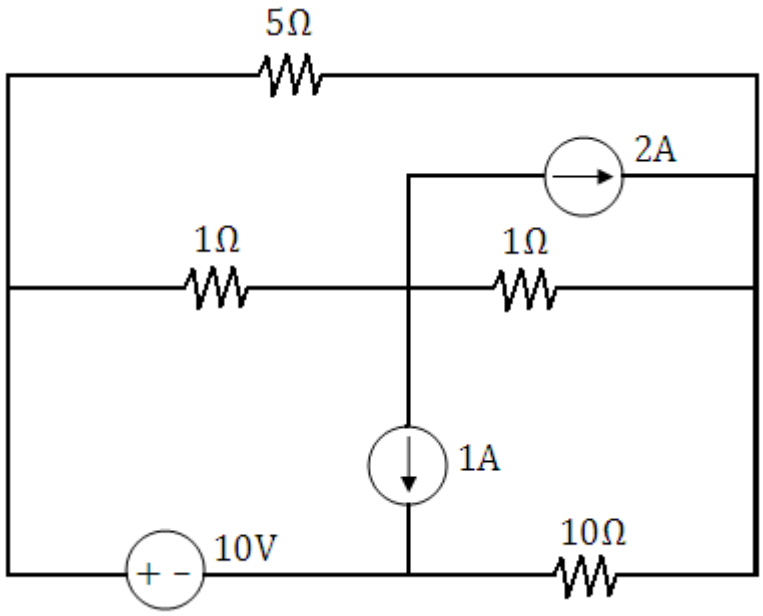
B The driving point impedance of RC network is given by: 8

$$Z(s)=\frac{(S+3)(S+5)}{S(S+4)}$$

Find the first foster form

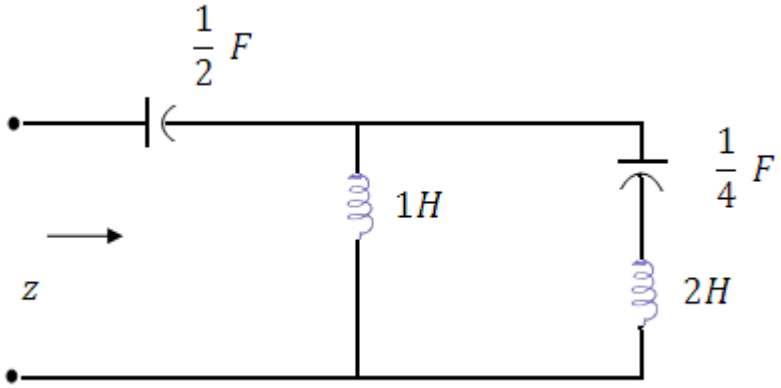
Q. 5 A State and prove Tellegan's Theorem. 10

B Find the current in the 10Ω resistor using superposition theorem show in fig.6 8



SECTION II

Q. 6 A Find the driving point admittance of the network shown in fig.7 8



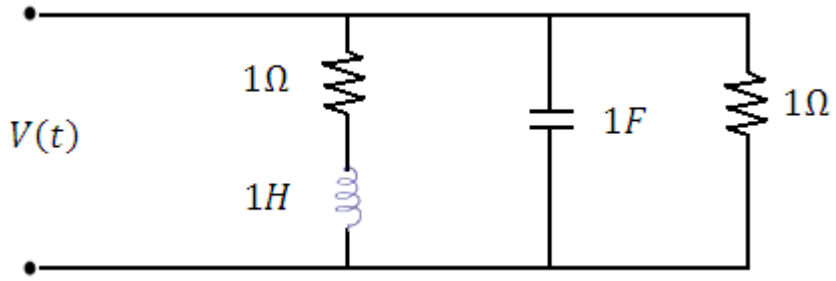
B Draw the pole-zero plot of the given network function V(S) an obtain 8

V(t) from the pole zero plot.

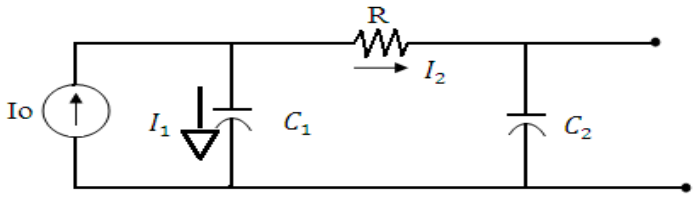
$$V(s)=\frac{10S}{(S+3)(S+2)}$$

OR

Q. 7 A Find the driving point admittance Y(s) for the network shown in figure. 8 — 8



B Obtain the current transfer Ratio of the Network shown in fig.9 — 8



Q. 8 A Define various Two-port Network parameters. — 8

B Define poles and zeros for the Network function. — 8

OR

Q. 9 A What is the conditions for symmetry and reciprocity for Z, Y, H, T, parameters? — 8

B Prove that $Z_{12}=Z_{21}$ for Z parameters — 8

Q.10 A Draw second order Butterworth 10w pass filter with cut off frequency of 5 KHz. draw the necessary ckt using op-Amp. — 8

B Explain various types of filters. Draw the characteristics from same — 10