Total No. of Questions : 5] **[Total No. of Pages : 2**

P1154

[3729]- 101
M.Sc.
ELECTRONIC SCIENCE
EL1 UTO 1 : Foundation of Semiconductor Devices
(Sem.-I) (New 2008 pattern)

Time : 3 Hours] ***[Max. Marks : 80***

Instructions to the candidates:

1) ***All questions are compulsory.***
2) ***Draw neat diagrams wherever necessary.***
3) ***Use of non-programmable calculator is allowed.***

Q1) Attempt any Two : **[2 × 8 = 16]**

a) State and explain the importance of schrodinger's wave equation. Deduce the expression for quantized energy 'En' of a particle kept in a infite potential well with V(x) = 0 [for $0 < x < 1$] and V (x) = ∞ [for x = 0, L]

b) Using proper energy band diagram, explain the phenomenon of tunneling in a P-n junction diode.

c) What is Hall effect ? Explain Hall Voltage and Hall coefficient. what are the Hall voltage values for n-type and p-type semiconductors?

Q2) Attempt any Two : **[2 × 8 = 16]**

a) Why are equivalent circuit models used in BJT analysis? Explain an hybrid-P: model for this device.

b) How are JFETS different from MOSFETS? Draw the small-signal equivalent circuit for JFET and explain ac response of this device.

c) Explain the construction of a MOSFET. Describe the I_D-V_D characteristics of this device.

P.T.O.

Q3) Attempt any four : **[4 ×4 = 16]**

a) Describe ionic bond, covalent bond and metallic bond with proper examples of each.

b) What are Miller indices? what is the significance of labeling a crystal using reciprocal lattice?

c) Obtain the diffusion equation, $D_n/\mu_n = KT/q$.

d) Differentiate between BJT and HBT.

e) "The breakdown voltage of P - n junction decreases as doping concentration increases" comment.

Q4) Attempt any four : **[4 × 4 = 16]**

a) What is a PIN photodiode? Explain its working in brief.

b) A sample of Si is doped with 10^{17} phosphorous atoms / cm^3. find the resistivity and hall voltage in the sample with dimensions: thickness $=100\mu m$ $I_x = 1mA$, $B_z = 10^{-5}$ wb/cm^2, $\mu_n = 700cm^2/V\text{-sec}$.

c) A silicon sample is doped with 10^{20} Arsenic atoms/cm^3. Find the fermilevel E_f relative to the intrinsic level E_i. Also determine the equilibrium hole concentration at 300K.

d) Explain the effect of narrow channel on the working of MOSFET.

e) Describe the current - voltage characterisfics of a schottky diode.

Q5) Attempt any four : **[4 × 4 = 16]**

a) What is the correlation between lattice matching and epitaxial growth? Explain.

b) State poissons's equation in terms of charge density and number of charge carriers.

c) Consider a diode to be reverse biased. write and explain its 'junction capacitance'

d) What is effective mass? state its importance in semiconductors.

e) What are non-ideal effects in JFET? Explain any one in detail.

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Total No. of Questions : 5] **[Total No. of Pages : 3**

P1155

[3729]- 102
M.Sc.
ELECTRONIC SCIENCE
EL1 UT 02 : Analog Circuit Design and Analysis
(New Course) (2008 Pattern) (Sem. - I)

Time : 3 Hours] ***[Max. Marks : 80***

Instructions to the candidates:

1) ***All questions are compulsory.***
2) ***Figures to the right indicate full marks.***
3) ***Draw neat diagrams wherever necessary.***
4) ***Use of log table, non-programmable calculator is allowed.***

Q1) Solve any two :

a) i) Define Laplace transform. Explain following theorems regarding Laplace transform.
– Transform of first derivative.
– Laplace transform of linear combinations. **[4]**

ii) What are the advantages of Laplace transformation over classical method? What are its applications. **[4]**

b) i) What is a two port network? Explain what are its transmission and admittance parameters? **[4]**

ii) What is an attenuator? What is its use? Draw the circuit of symmetrical Π - attenuator and give its design equations. **[4]**

c) i) Design an inverting amplifier with a gain of –15. It must have an input impedance of 10 kΩ. How would you estimate its offset error? **[4]**

ii) A voltage $V(t) = 6\ e^{-2t}$ is applied at time t = 0 to a series RL circuit with R = 3 ohm and L = 1 henry. Obtain complete solution for current i(t) in the circuit using Laplace transformation. Assume zero current through L before application of voltage. **[4]**

Q2) Solve any two :

a) i) Define the terms open loop gain, loop gain and closed loop gain of an operational amplifier. What is gain error factor. **[4]**

ii) Explain applications of constant current source in discrete circuits as well as in internal circuit of op-amp. **[4]**

P.T.O.

b) i) Explain the working of Widlar current source. What is its advantage? **[4]**

ii) Explain giving necessary equations working of source coupled JFET pair. **[4]**

c) i) Design a 3-op-amp instrumentation amplifier for an overall gain of 60. **[4]**

ii) An op-amp has a slew rate of 1V/μsec. What is the maximum frequency for which the amplifier will give an undistorted sinewave output of

→ 12 Vp – p → 15 Vp – p **[4]**

Q3) Solve <u>any two</u> :

a) i) Compare the performance of inverting and non-inverting amplifiers regarding the following. **[4]**

– Feedback connection – gain – common mode errors – input impedance.

ii) Give the steps involved in the design of a differentiator circuit. Why is differentiator inherently unstable? **[4]**

b) i) Explain the term 'unity gain frequency compensation'. Why is such an amplifier stable for any value of resistive feedback? **[4]**

ii) Explain the significance of dc and low frequency parameters of an op-amp. **[4]**

c) i) Explain the working of a two op-amp practical log amplifier circuit. Obtain the necessary equation. **[4]**

ii) The input to an inverting amplifier with a gain of 10 is $V_i = 0.5 \sin 2000 \pi t$ volt. Find the output V_o and the frequency and period of V_i and V_o. **[4]**

Q4) Solve <u>any two</u> :

a) i) Explain shielding and guarding techniques used in low current/ voltage amplifiers. **[4]**

ii) What are the applications in which a high power op-amp is needed. Explain working and relevant parameters of a typical power op-amp. **[4]**

b) i) Explain woking of the circuits to boost the output current capability of an op-amp. **[6]**

ii) State the output voltage and current ratings of a typical general purpose op-amp. **[2]**

c) What is an active filter? What are its advantages and limitations as compared to passive filters? Give the circuit diagram, transfer function and design equations for a VCVS second order Butterworth low pass filter. **[8]**

Q5) Solve <u>any two</u> :

a) Giving a neat block diagram explain the working of a first order sigma-delta analog to digital converter. In this regards explain the terms oversampling, digital filter and decimation. **[8]**

b) i) Explain typical performance specifications of analogue to digital converters. **[4]**

ii) Explain applications of digital to analogue converters. **[4]**

c) i) Give the working of potentiometric DAC. What are its advantages? **[4]**

ii) Explain the working of successive approximation type ADC. **[4]**

Total No. of Questions : 05] **[Total No. of Pages : 02**

P1160

[3729]- 301
M.Sc. - II (Sem. - III)
ELECTRONIC SCIENCE
EL3 UT05 : Embedded Systems
(New)

Time : 3 Hours] ***[Max. Marks : 80***

Instructions to the candidates:

1) ***All questions are compulsory.***
2) ***Figures to the right indicate full marks.***
3) ***Draw neat diagram wherever necessary.***

Q1) Attempt any FOUR of the following : **[4 × 4 = 16]**

a) Explain the ports along with their functions of 8051 microcontroller.

b) Describe TMOD register in short of 8051 controller.

c) Write short note on Harvard and von-neuman architecture.

d) Write the help of neat diagram, explain LCD interfacing to 8051 controller in short.

e) Write an assembly language program to toggle bits P1.0 and P1.7 continuously of 8051.

Q2) Write any FOUR of the following : **[4 × 4 = 16]**

a) Describe any two methods of delay generation in short.

b) With the help of neat diagram, interface ADC to 8051 controller and explain its working in short.

c) Describe logical and branch group of instructions with suitable example of 8051 microcontroller.

d) List five interrupts of 8051. Explain their priority.

e) Draw a neat diagram to show connection of 8051 microcontroller to relay . Write a program to on and off the lamp using relay switching.

P.T.O.

Q3) Attempt any TWO of the following : **[2 × 8 = 16]**

a) Write an assembly language program using timer 0 to generate a 500 Hz square wave frequency on one of the pins of port P1.

b) Write an assembly language program to transfer message " Electronics" to serial terminal with band rate of 9600.

c) Draw the architecture of 8051 microcontroller and explain each block in short.

Q4) Write any FOUR of the following : **[4 × 4 = 16]**

a) List the features of PIC 16 F 877A.

b) Explain register file structure of PIC 16 F 877A.

c) Explain different interrupts of AVR microcontroller.

d) Write short note on timer/counter of AVR.

e) Explain ADC module and associated register of PIC.

Q5) Attempt any TWOof the following : **[2 × 8 = 16]**

a) Draw the interface diagram of 4 keys and 4 LEDs to AVR microcontroller. write a 'C' program to read the keys and display its status on LEDs.

b) Draw the block diagram of PIC 16 F 877A and explain it in short.

c) Describe any two software development tools and any two hardware development tools used for development of embedded system.

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Total No. of Questions : 5] **[Total No. of Pages : 3**

P1161

[3729]- 401
M.Sc. (Sem. - IV)
ELECTRONIC SCIENCE
EL4 UTO6 : Control Systems: Theory and Applications
(New Course) (2008 Pattern)

Time : 3 Hours] ***[Max. Marks : 80***

Instructions to the candidates:

1) ***All questions are compulsory.***
2) ***Figures to the right indicate full marks.***
3) ***Neat diagrams must be drawh wherever necessary.***

Q1) Solve any Two

a) Draw block diagram of a feedback control system and explain various parts in it and their functions. State various types of controllers used in feedback control. **[8]**

b) i) Explain adaptive control strategy. **[6]**

ii) Define transfer function of a control system. **[2]**

c) i) Compare continuous control and discrete state process control . Give an example of each. **[4]**

ii) What are minimum area and quarter amplitude criteria for control system evaluation? **[4]**

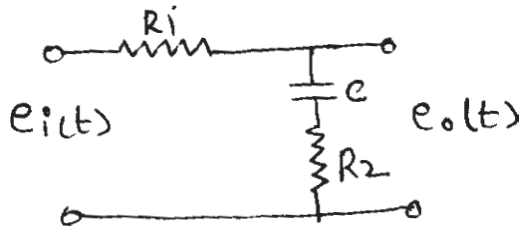
Q2) Solve any Two

a) Define and explain following terms related to transfer function of a system. - Poles - zeroes - characteristic equation - order - pole - zero plot. **[8]**

b) Taking a suitable example explain the concept of block diagram of a control system. State its advantages and limitations. Explain associative law for block diagram reduction. **[8]**

P.T.O.

c) i) Obtain the transfer function of lag network shown below. **[4]**



ii) A proportional controller is used to control the height of water in a tank where the water level can vary from 0 - 9 meter. Calculate the value of PB and K_p that will set the water level at a desired height of 5 meter.The controller is required to fully close the inlet valve when water level rises to 5.5 meter and fully open it when it falls down to 4.5 meter. **[4]**

Q3) Solve any Two

a) i) State Routh's stability criterian . What are its advantages and limitations? **[4]**

ii) Define root locus. Explain angle and magnitude conditions. What is their use? **[4]**

b) What is meant by process loop tuning? Explain open - loop transient response method for process loop tuning. **[8]**

c) i) Consider a control system with

$$G(s)\,H(s) = \frac{k}{s(s+4)}$$

Test the point s = -2 + j 5 for its existence on root locus. Also find the corresponding value of K. **[4]**

ii) What is the difference between a smart and dumb programming terminal? Compare their performance. **[4]**

Q4) Solve any Two

a) What is processor scanning? Discuss PLC program sweep for General Electric series go - 30 PLC. **[8]**

b) i) Explain ON - delay timer instruction. What is meant by 'timer element'? **[4]**

ii) Explain the working of coffee vending machine as a discrete state control system. Give necessary ladder diagram. **[4]**

c) i) Explain the count - up instruction. What is its use ? **[4]**

ii) With a neat circuit diagram and equation explain the working of PID controller. **[4]**

Q5) Solve any Two

a) Explain the data formats used in PLC. **[4]**

b) i) Design a motor controller that has a forward and a reverse button. The motor forward and reverse outputs will only be on when one of the button is pushed. When both buttons are pushed the motor will not work. construct the necessary ladder diagram. **[4]**

ii) Explain the following data handling instructions.

→ Masked move instruction (MVM)

→ Converting an integer to BCD (TOD) **[4]**

c) Write short notes on any Two of the following **[8]**

i) Processor status file.

ii) Annunciators.

iii) Open PLC systems.

iv) ON - OFF control mode.

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Total No. of Questions : 5] **[Total No. of Pages : 2**

P1162

[3729]- 21
M.Sc. (Sem. - II)
ELECTRONIC SCIENCE
EL2 UT 03 : Applied Electromagnetics, RF, Microwave
(Old Pattern)

Time : 3 Hours] ***[Max. Marks : 80***

Instructions to the candidates:

1) ***All questions are compulsory.***
2) ***Use of non-programmable calculator is allowed.***
3) ***Draw a neat diagram wherever necessary.***

Q1) Solve any two : **[2 × 8 = 16]**

a) State Helmoltz equation. Explain how it can be solved to determine electromagnetic wave propagation.

b) With the help of neat diagram explain the principle of tunnel diode and discuss its I-V characteristics.

c) An X-band pulsed magnetron has the following operating parameters.

Anode voltage V_o = 5.5kV, Beam current I_o = 4.5Amp, operating frequency f = g GHz, Resonator conductance $G_r = 2 \times 10^{-4}$ mho, loaded conductance $G_l = 2.5 \times 10^{-5}$ mho, vane capacitance, C = 2.5 pF.

Duty cycle DC = 0.002, power loss : P loss = 18.50kW.

Compute :

i) Angular resonant frequency.

ii) Unloaded quality factor.

iii) Loaded quality factor.

iv) External quality factor.

Q2) Solve any two : **[2 × 8 = 16]**

a) With the help of neat diagrams explain parabolic-reflector antenna, dielectric lens antennas and metal lens antennas in detail.

b) What is axon? Explain with the help of a typical neuron showing details. Draw a equivalent circuit of oxan transmission and explain it in detail.

c) Starting from Maxwell's equation, determine the electric and magnetic wave equations.

P.T.O.

Q3) Write a short note on <u>any four</u> : **[4 × 4 = 16]**

a) Q factor of cavity resonator.

b) Smith chart.

c) Power loss in rectangular wave guide.

d) Materials for monolithic microwave integrated circuits.

e) Characteristics impedance of microstripline.

Q4) Solve <u>any four</u> : **[4 × 4 = 16]**

a) Explain electromagnetic wave propagation through an optical wave guide.

b) What are wave guide Tees? Explain series-Tee in short.

c) Discuss modes of operation of n-channel MOSFET.

d) What is meant by electromagnetic interference? How it arises? Explain with the help of any one example.

e) State and prove poynting vector theorem.

Q5) Solve <u>any four</u> : **[4 × 4 = 16]**

a) Write a short note on RF heating.

b) What is magnetic navigation at birds explain in short.

c) Starting with Maxwell's equation, obtain an expression for intrinsic impedance of a medium.

d) Determine the power radiated by 10cm dipole antenna operated at 50Hz with an average current of 5mA.

e) How microwave solid state devices are classified? List the various devices.

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Total No. of Questions : 5] **[Total No. of Pages : 2**

P1163

[3729]- 22
M.Sc. - I
ELECTRONIC SCIENCE
EL2 UT 04 : Design and Implementation of Digital Circuits
(Old) (Sem. - II)

Time : 3 Hours] ***[Max. Marks : 80***

Instructions to the candidates:

1) ***All questions are compulsory.***
2) ***Figures to the right indicate full marks.***
3) ***Neat diagrams must be drawn wherever necessary.***

Q1) Attempt any two : **[16]**

a) Design a system accept 2 digit number from two different sources and display two digit number on common display.

b) Define Bus. Explain the busing structure of microprocessor. What is floating bus? What is bus contension and how it is avoided.

c) Design a BCD to Gray code converter using decoder and logic gates.

Q2) Attempt any two : **[16]**

a) Design the sequential circuit with JK filp flop to satisfy the following equations.

$A(t+1) = A'B'CD + A'B'C + ACD + AC'D'$

$B(t+1) = A'C + CD' + A'BC'$

$C(t+1) = B$

$D(t+1) = D'$

b) Draw logic diagram of ALU, explain the function table for 2 bit data.

c) Design synchronous counter to produce 0,2,4,3,6,7 and repeat.

Q3) Attempt any two : **[16]**

a) What is OLMC in GAL 16V 8? List different parts and different modes with dedicated input pins in GAL 16V 8.

b) Draw the block diagram of bit organized processor. Discuss its merits and demerits.

c) What is PLA? Draw diagram showing PLA structure. Implement any example of combination circuit using PLA.

P.T.O.

Q4) Attempt any two : **[16]**

a) Draw functional block diagram of FPGA. Explain its advantages over ASIC.

b) Compare SRAM with DRAM and draw read cycle of SRAM.

c) What do you mean by CPLD? Draw diagram of general CPLD and explain different elements of its architecture.

Q5) Attempt any two : **[16]**

a) List various sequential statements used in VHDL. Explain any two with examples.

b) What are tools used for hardware testing of digital circuits developed with VHDL.

c) Explain different steps used in designing any circuits using VHDL.

Total No. of Questions : 5] **[Total No. of Pages : 4**

P1164

[3729]-23
M.Sc.
ELECTRONIC SCIENCE
EL2 UOT03 : Communication Electronics
(Old Course) (Semester - II)

Time : 3 Hours] ***[Max. Marks : 80***

Instructions to the candidates:

1) ***All questions are compulsory.***
2) ***Figures to the right indicate full marks.***
3) ***Draw neat and labelled diagrams wherever necessary.***

Q1) Attempt any four of the following : **[4 × 4 = 16]**

a) What are sources of noise? Establish frequency domain characterization of noise.

b) Define
   i) Sensitivity,
   ii) Selectivity,
   iii) Signal to noise ratio,
   iv) Dynamic range with context to Am-receiver.

c) Compare ratio detector and discriminator in FM detectors.

d) What is companding? What are its advantages in digital communication?

e) Compare between voice and data transmission.

Q2) Attempt any two : **[2 × 8 = 16]**

a) Explain FM transmitter and receiver with block diagram.

b) What are the sections of internal layout of communication satellite. Draw and explain single channel transponder block diagram.

c) Explain Pulse Amplitude Modulation and recovery of the PAM signal in detail.

Q3) Solve any two : **[2 × 8 = 16]**

a) Explain the importance of bit oriented protocol. Draw the basic format of SDLC and HDLC messages. Give the significance of each field.

P.T.O.

b) What do you mean by bit rate? Explain ASK, FSK and Q-PSK.

c) What are the advantages of SSB amplitude modulated transmission? Explain the phase-shift method of SSB AM generation.

Q4) Attempt any four : **[4 × 4 = 16]**

a) Explain the basic elements of communication system with block diagram.

b) Why R.F. Amplifier is necessary in FM receivers? With circuit diagram explain RF amplifier.

c) Explain the diode type balanced modulator used for suppressing the carrier.

d) What are basic principles of ISDN? Enumerate types of connection to the network provided by it.

e) Explain the working of delta modulated transmitter system.

Q5) Solve any four : **[4 × 4 = 16]**

a) What are the types of telephone modem? Explain any one of them.

b) Explain telemetry with suitable diagram.

c) An FM broadcast carrier is deviated by ± 30 kHz. Find the % of modulation. The maximum carrier frequency change for FM broadcast radio is ± 75 kHz.

d) Explain the difference between unipolar NRZ code and bipolar NRZ code. Mention the draw-back of NRZ code.

e) Explain the following terms with reference to satellite communication.

i) Uplink.
ii) Downlink.
iii) Cross talk.
iv) Propagation delay.

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Total No. of Questions : 5] **[Total No. of Pages : 2**

P1164

[3729]-23
M.Sc. - I
ELECTRONIC SCIENCE
EL2 UOT04 : Instrumentation
(Old Course) (Semester - II)

Time : 3 Hours] ***[Max. Marks : 80***

Instructions to the candidates:

1) ***All questions are compulsory.***
2) ***Figures to the right indicate full marks.***
3) ***Draw neat diagrams wherever necessary.***

Q1) Attempt any FOUR of the following : **[4 × 4 = 16]**

a) Define accuracy and precision for a measurement system. State its importance in applications of the measurement system.

b) With neat diagram explain variable reluctance type pressure sensor.

c) What are actuators? Explain with example solenoid valve as an actuator.

d) Explain FFT realization used for digital filter design. List various window functions used in it.

e) What is XRD? Where it is used? State principle of working of it.

Q2) Attempt any FOUR of the following : **[4 × 4 = 16]**

a) Explain ratiometric conversion for strain gauge transducer used in wheatstone bridge network.

b) Classify flow meters. Explain with diagram the construction and working of turbine type flow meter.

c) State the different cardiograms in biomedical measurements. With block diagram explain the working of ECG machine.

d) A platinum resistance thermometer has a resistance of 120 ohm at 20ºC. Find –
   i) The resistance at 60ºC.
   ii) The temperature if resistance is 100 ohm.
   Given :- α for platinum is 0.0039/ºC.

e) Design Butterworth second order low-pass filter for F_C = 10 kHz, if C = 0.01 μF.

P.T.O.

Q3) Attempt any FOUR of the following : **[4 × 4 = 16]**

a) How percentage content of a product is calculated? Explain oven drying method to determine moisture in a sample of a produce.

b) What is a pH? Explain potentiometric method to estimate pH of a solution.

c) Explain with block diagram working of direct reading vector impedence meter.

d) Explain in brief instrumental methods of chemical analysis.

e) What is the concept of 3 wire lead compensation in RTD? How the self heating effect in it is reduced?

Q4) Attempt any FOUR of the following : **[4 × 4 = 16]**

a) What is green house? State parameters of green house. Explain instrumentation technique to control light in it.

b) Explain importance of guarding and shielding in instrumentation system.

c) Draw the circuit diagram and explain operation of basic digital panel meter.

d) State principle and working of flame photometer. Give its limitations.

e) Draw the basic constructional diagram of LVDT. Explain it as a displacement sensor.

Q5) Attempt any FOUR of the following : **[4 × 4 = 16]**

a) Define transducer. What are basic requirements of a transducer?

b) What is the concept of charge amplification? Draw its circuit and explain the operation.

c) Draw schematic block diagram of a heterodyne wave analyzer. Explain its working in brief.

d) List various leaf parameters. Explain measurement of any one parameter in brief.

e) What is seebeck effect? Explain various types of thermocouples used in temperature measurement systems.

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Total No. of Questions : 5] **[Total No. of Pages : 3**

P1165

[3729]- 31
M.Sc. (Sem. - III)
ELECTRONIC SCIENCE
EL3 UTO5 : DSP Systems and Applications
(2004 Pattern)

Time : 3 Hours] ***[Max. Marks : 80***

Instructions to the candidates:

1) ***All questions are compulsory.***
2) ***Figures to the right indicate full marks.***
3) ***Draw neat diagrams wherever necessary.***

Q1) Attempt any two of the following : **[2 × 8 = 16]**

a) Check whether the following discrete time system is linear or not ?

i) $y(n)=ax(n)+b$

ii) $y(n)=x(n)\cos\omega_o n$

b) What are singularity functions ? Explain different types of singularity functions.

c) A digital communication link carries binary coded words representing samples of input signal

$x(t)$=3cos 600π t + 2 cos 1800 π t .The link is operated at 10,000 bits/ sec and each input sample is quantized into 1024 different voltage levels. Calculate sampling frequency and folding frequency in Hz. Find out resolution of quantization.

Q2) Attempt any two of the following : **[2 × 8 = 16]**

a) Draw a block diagram representing the Architecture of typical DSP processor. Explain the need and operational features of it in detail.

b) Explain application of DSP in modulation and demodulation of digital signals.

c) List various kinds of peripheral interfaces incorporated in typical DSP. Explain their role in brief.

P.T.O.

Q3) Attempt any two of the following : **[2 × 8 = 16]**

a) i) Compare fixed point and floating point DSP processor.

ii) What is Von Neumann architecture and Harward architecture? which is used in DSP?

b) Explain with suitable example correlation of DT signals. Discuss crosscorrelation and autocorrelation sequences.

c) List features of FIR filter. Write steps of designing FIR filters using various kinds of windows.

Q4) Attempt any two of the following: **[2 × 8 = 16]**

a) i) For an analog signal

$x_a(t) = 3 \cos 50\ \pi t + 10 \sin 300\ \pi t - \cos 100\ \pi t$ calculate Nyquist rate.

ii) Determine Z transform of

$x(n) = (n+1)\ u(n)$. Draw ROC diagram for it.

b) Find out H (z) using impulse invariance method at 5 Hz sampling frequency from H (s) as given below.

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

c) Draw the block diagram of Analog to Digital converter. Explain quantization and quantization error.

Q5) Attempt any two of the following : **[2 × 8 = 16]**

a) A system has impulse response h (n) . poles and zeros of system are at $z_1 = 1$.

$$P_1 = -\frac{1}{2},\ P_2 = -\frac{1}{4}.$$

Draw poles and zeros of a system if its impulse response is

$h_1(n) = h(n-z)$.

b) Find the linear convolution of x_1 (n) and x_2 (n).

if x_1 (n) = {1,2,3,4} and x_2 (n) = {1,1,1}
$\uparrow$ $\uparrow$

obtain the same result using circular convolution.

c) Draw the block diagram for two pole, two zero IIR filter. Hence draw the signal flowgraph for the same. State applications of signal flowgraph.

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Total No. of Questions : 5] **[Total No. of Pages : 2**

P1166

[3729]- 41
M.Sc.
ELECTRONIC SCIENCE
EL4 UT 06 : Control Systems : Theory and Applications
(New Course) (Sem. - IV)

Time : 3 Hours] ***[Max. Marks : 80***

Instructions to the candidates:

1) ***All questions are compulsory.***
2) ***Figures to the right indicate full marks.***
3) ***Neat diagrams must be drawn wherever necessary.***

Q1) Solve any two :

a) Explain Feedback control strategy. Describe the functional elements used in such a system. Explain the terms 'minimum area' and 'quarter amplitude criterion'. **[8]**

b) i) What is meant by the terms 'event sequence' and 'discrete state' related to control systems? **[4]**

ii) How can we analyse a control system with multiple inputs and outputs? **[4]**

c) i) What is meant by relative stability of a control system? **[4]**

ii) Explain the terms 'gain margin' and 'phase margin'. **[4]**

Q2) Solve any two :

a) Explain the concept of stability. How can you predict stability of a control system from location of its closed loop poles in the S-Plane? **[8]**

b) i) Describe Routh's stability criterion. **[4]**

ii) For the unity feedback system. **[4]**

$$G(s) = \frac{k}{s(1 + 0.4s)(1 + 0.25s)}$$

Find range of values of k and marginal value of k.

c) Explain open-loop transient response method for process loop tuning. **[8]**

P.T.O.

Q3) Solve any two :

a) Give the special features of proportional, integral and derivative modes. Give a circuit for PID controller. What is meant by integral windup? **[8]**

b) Explain the working of ON-OFF controller circuit. What is meant by 'differential gap'? Why is it necessary? State applications of ON-OFF controller. **[8]**

c) i) Define the term 'root-locus'. State the essential conditions that every point on a root-locus has to satisfy. **[4]**

ii) If a control system has a closed loop pole in the right half of S-plane then the system is unstable. Prove mathematically. **[4]**

Q4) Solve any two :

a) Explain the working of a programmable logic controller. What are the different files stored in PLC memory? **[8]**

b) i) Design a motor controller that has a forward and a reverse button. The motor forward and reverse outputs will only be ON when one of the buttons is pushed. When both buttons are pushed the motor will not work. **[4]**

ii) Explain the difference between conventional ladder logic and PLC ladder logic. **[4]**

c) i) What are dumb programming terminals and smart or stand alone programming terminals? **[4]**

ii) What are open PLC systems? **[4]**

Q5) Solve any two :

a) Explain following bit or relay instructions.

– Normally open or examine ON (XIC).
– Output instruction.
– Normally closed or examine OFF (XIO).
– One shot instruction (OSR). **[8]**

b) i) What is watch dog timer? What are its functions? **[4]**

ii) Explain Allen-Bradley processor operating modes. **[4]**

c) Write short notes on any two : **[8]**

i) Adaptive control.
ii) Open-loop control.
iii) Annunciator.