Total No. of Questions : 5]

SEAT No. : ____

P2762

[Total No. of Pages : 3

[4834] - 11

M.Sc. (ELECTRONIC SCIENCE) (Semester - I)

EL 1UT-01 : Foundation of Semiconductor Devices

(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) ***Draw neat diagrams wherever necessary.***
4) ***Use of non-programmable calculator is allowed.***

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

a) Sketch the unit cell of a face-centered cube crystal. Find the maximum fraction of unit cell volume that can be filled by hard spheres in fcc.

b) Obtain expression for thermal equilibrium electron concentration in the conduction band. Calculate the thermal equilibrium concentration of an electron in silicon at T = 300 k. Assume the Fermi-energy is 0.27 eV below the conduction band. The value of Nc for silicon at 300^{o} K is 2.8×10^{19} cm^{-3}. Given k = 8.63×10^{-5} eV.

c) Draw Hybrid-pi-equivalent circuit of an npn bipolar transistor in a CE configuration and explain the component of equivalent circuit. Hence draw simplified hybrid-pi-equivalent circuit.

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

a) Write down schrodingers wave equations for tunneling of a particle impinzing on a finite potential barrier of height V_0 and width 'a' for $E << V_0$. Discuss qualitatively wave functions through potential barrier.

Calculate probability of an electron tunneling through potential barrier of height 18eV and width of $4A^{o}$. Assume incident electron has energy 1 eV, find transmission coefficient T. Given $m_e = 9.11 \times 10^{-31}$ kg, $\hbar = 1.054 \times 10^{-34}$.

P.T.O.

b) Explain qualitavely charge flow in a pn Junction with energy diagram under forward and reverse biased pn junction.

Assuming expression for built-in potential barrier, obtain expression for electron concentration when junction is forward biased.

c) Differentiate between JFET and MESFET. Explain the constructional details of n-channel MESFET with necessary energy band diagram.

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

a) Explain concept of Quasi-Fermi Energy levels for electrons, repeat for holes.

b) Define Fermi-Dirac distribution function. Explain its dependence on temperature.

c) Calculate the photocurrent density in a silicon PIN photodiode with intrinsic region width of 24 μm. Assume that the photon flux incident on diode is 10^{16} cm^{-2} s^{-1} and absorption coefficient is $\alpha = 10^3$ cm^{-1}.

d) State three operating layers in MOS capacitor. Explain Ideal low frequency capacitance versus gate voltage of an MOS capacitor with a p-type substrate. Give necessary relations.

e) What is SCR? Explain current-voltage characteristic of SCR.

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

a) Explain with diagram working of Heterojunction Bipolar Transistor (HBT) state its advantages over BJT.

b) Explain Hall Effect. How the n-type or p-type semiconductor samples are identified using Hall Voltage?

c) In simplified hybrid-pi-equivalent circuit for BJT, first approximation, $r_\pi = 2.6$ kΩ and $C_\pi = 8$ P^F, if the magnitude of current gain drops to $\frac{1}{\sqrt{2}}$ of its low-frequency value, find frequency '*f*'.

d) Draw different basic MOS structure for the case $V_{GS} < V_T$ for V_{DS} takes small, large and saturation values. Explain variation of I_D versus V_{DS} for n-channel depletion-mode.

e) "The breakdown voltage of a p-n junction decreases as the doping concentration increases" - Comment.

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

a) What is effective mass? If an electron is in the bottom of an allowed energy band, let us assume conduction band in reduced K space is the parabolic approximation, show that m* is positive.

b) Write schrodingers equation for a particle in an infinite potential well. Obtain the quantized energy levels in potential well.

Calculate first three energy levels of an electron in infinite potential well of width $4A^{\circ}$. Given $\hbar = 1.054 \times 10^{-34}$ and $m_e = 9.11 \times 10^{-31}$ Kg.

c) Draw simplified cross-section of npn - Polysilicon Emitter BJT. What are its special feature over BJT?

d) Draw two transistor equivalent circuit of SCR. Write equation for anode current, hence explain condition for turn on of SCR.

e) What is LASER semiconductor diode? Explain how lazing takes place in LASER diode.

Total No. of Questions : 5]

SEAT No. :

P2763

[Total No. of Pages : 3

[4834] - 12

M.Sc. (Electronic Science) (Semester - I)

EL1UT02 : Analog Circuit Design and Analysis

(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) *Draw neat diagrams wherever necessary.*
4) *Use of log table and non-programmable calculators is allowed.*

Q1) Attempt any two :

a) i) Draw Pole-zero diagram for the given network function I(s) and hence obtain s(t). **[4]**

$$I(s) = \frac{20s}{(s+5)(s+2)}$$

ii) Obtain the inverse laplace transformation of F(s) **[4]**

$$F(s) = \frac{2}{(s+1)(s+5)}$$

b) i) Deduce the expression for differential mode gain, common mode gain and C.M.R.R for and emitter coupled pair. **[4]**

ii) Explain the working of Widlar current source with proper circuit diagram. State advantage of it. **[4]**

c) i) What is active filter? What is order of filter? State advantage of active filter over passive filter. **[4]**

ii) With circuit diagram, explain the working of full wave precision rectifier. **[4]**

P.T.O.

Q2) Attempt any two :

a) i) Explain design consideration for low voltage/current amplifiers. **[4]**

ii) Obtain Laplace transform of following signals. **[4]**

1) sin *wt* 2) cos *wt*

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

ii) The OpAmp has slew rate of 0.5 V/μsec and gain 50. The sinusodial input signal has a variable frequency and maximum amplitude of 20 mV peak. What is the maximum frequency of the input at which the output will be undistorted? **[4]**

c) i) What is the need for a S/H circuit? Define aquisation and apperture times. **[4]**

ii) Write short note on programmable op-amp. **[4]**

Q3) Attempt any two :

a) i) Draw circuit diagram of ideal differentiator circuit. Obtain its performance equation. **[4]**

ii) With circuit diagram obtain expression for output voltage of three OpAmp instrumentation amplifier. **[4]**

b) i) Explain following terms with suitable example **[4]**

1) Transfer Function 2) Complex Plane.

ii) What is attenuater? Explain T type attenuater. **[4]**

c) i) What is two port network? Explain Z-parameter and Y-parameter. **[4]**

ii) What is function of equalizer? Explain series equalizer. **[4]**

Q4) Attempt any two :

a) i) Explain the effect of negative feedback on input impedance and output impedance. **[4]**

ii) Explain working of a circuit for boosting output voltage of an Op-amp. **[4]**

b) i) Design k-type Band pass filter having design impedance of 500Ω and cut-off frequencies 1 kHz and 10 kHz. **[4]**

ii) Explain $\Sigma - \Delta$ convertor. **[4]**

c) i) For a 12-bit counter type ADC with 1 MHz clock, calculate maximum conversion time and average conversion time. **[4]**

ii) With circuit diagram explain working of peak detector circuit using Op-Amp, Give its limitations. **[4]**

Q5) Attempt any two :

a) i) What is temperature independent biasing? Explain the working of Zener diode bias reference. **[4]**

ii) Write a short note on micropower design techniques. **[4]**

b) i) Explain specification of DAC converter. **[4]**

ii) Draw circuit diagram of transdiode configuration for log amplifier and explain it. **[4]**

c) i) With proper circuit diagram, explain binary weighted resistor D/A converter. **[4]**

ii) State at least two applications of ADC's and DAC's. **[4]**

Total No. of Questions : 5]

SEAT No. :

P2764

[Total No. of Pages : 4

[4834] - 13

M.Sc. (Electronic Science) (Semester - I)

EL1UT03 : Instrumentation and Measurement Techniques

(2008 Pattern)

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

Instructions to the candidates:

1) ***All questions are compulsory.***
2) ***All questions carry equal marks.***
3) ***Draw neat labelled diagrams wherever necessary.***
4) ***Use of logarithmic table and non-programmable calculator is allowed.***

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

a) Describe the deflection type and null type instruments. Give suitable example of each.

b) Define the following dynamic characteristics of measurement system :

Speed of response, Measuring response, Fidelity and Dynamic error.

c) Discuss the factors influencing the choice of transducer for the measurement of physical parameter.

d) Draw neat circuit diagram of LVDT. Explain working of LVDT. State characteristics of it.

e) Draw neat block diagram of generalised instrumentation system. Write function of each block of the system.

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

a) List the types of strain gauges. Describe wire wound strain gauge. Derive the expression for its gauge factor.

b) Derive the equation for time response of first order electrical system when subjected to a unit step input. Draw the response curve of the system.

c) What is loading effect? Explain loading effect due to series connected instrument. How loading effect minimised in the measurement?

P.T.O.

d) A Copper-constantan thermocouple was found to have linear calibration between $0^{o}C$ to $500^{o}C$ with emf at maximum temperature is 40.68 mV with reference junction at $20^{o}C$. Determine the correction which must be made to indicate emf, if the cold junction temperature is $25^{o}C$. If the indicated emf is 8.92 mV, determine the temperature of hot junction.

e) Calculate the capacitance of parallel plate capacitive transducer with plate area = 500 mm^2

Seperation distance = 200 μm

The transducer is used in air.

Calculate the change in capacitance if a linear displacement reduces the distance between the plates to 180 μm. Calculate the sensitivity.

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

a) State the principle of flow measurement. Write the working principle and application for -

i) Hot wire anemometer.

ii) Electromagnetic flow meter.

b) List the different temperature transducers.

For thermistor the resistance change with temperature is given by

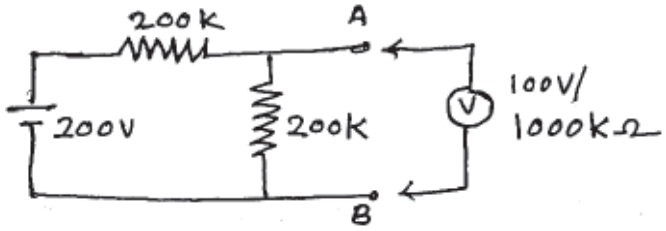
$$R_T = R_0 e^{\beta\left(\frac{1}{T}-\frac{1}{T_0}\right)}$$

Where the symbols have usual meaning,

for a certain thermistor β = $3450^{o}K$ and its resistance at $20^{o}C$ is known to be 1000 ± 2Ω. This thermistor is used for temperature measurement and the resistance measured is 2500 ± 5Ω.

Calculate the temperature and the maximum error in the measurement.

c) A 100 V range voltmeter is connected across terminal AB as shown below, - Voltmeter resistance is 1000 kΩ.



Find the voltmeter reading under open circuit and loaded condition. Find the accuracy and loading error.

d) Define absolute and relative error of measurement. A voltage has true value of 1.50V. An analog indication instrument with scale range of 0 to 2.50V shows a voltage reading to 1.46V. What are the values of absolute error and correction.

Express the error as a fraction of true value and the full scale deflection.

e) Consider a single strain gauge of 120Ω mounted along the axial direction of an axially loaded specimen of steel (E = 200 GPa). If the percentage change in length of the rod to loading is 3% and the corresponding change in resistivity of the strain gauge is 0.3%, Estimate the % change in the resistance of the strain gauge and its gauge factor. (Poisson's ratio = 0.3).

If the strain gauge is connected to measuring device capable of determining change in resistance with an accuracy of $\pm 0.02\Omega$ what is the uncertainty in stress and strain that would result in using this device?

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

a) Describe the different methods of data transmission with block diagram explain general telemetry system. State types of landline telemetry systems.

b) Draw the following circuits with their output equations.

i) Differential Amplifier.

ii) Voltage follower,

iii) Voltage follower with gain and

iv) Integrator.

c) A steel cantilever is 0.25m long, 20 mm wide and 4 mm thick. Calculate the value of deflection at the free end of it when a force of 25 N is applied to its free end.

An LVDT with sensitivity of 0.5 V/mm is used. The voltage is read on 10V voltmeter having 100 divisions. Two tenth of a division can be read with certainty.

Calculate the minimum and maximum of force that can be measured with this arrangement.

(Given : modulus of elasticity of steel is 200 GN/m^2)

d) Describe advantages of digital indicating instrument over analog indicating type.

e) Draw the block diagram of DSO and describe working of it.

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

a) Draw the block diagram of sound level meter. Explain its working for sound pressure level measurement.

b) Draw neat block diagram of DFM. Explain the average mode of frequency measurement.

c) What is role of signal conditioning in measurement system? Draw the block diagram of DC signal condition system. Explain its working.

d) Give working principle of Gorden gauge and Pirani gauge.

e) Draw the equivalent circuit of Piezo-electric transducer "for high frequency the magnitue of voltage across the load is independent of frequency". Comment.

Total No. of Questions : 5]

SEAT No. :

P2765

[Total No. of Pages : 2

[4834] - 21

M.Sc. (ELECTRONIC SCIENCE) (Semester - II)

EL-2UT-04 : Applied Electromagnetics, RF and Microwaves

(2008 Pattern)

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

Instructions to the candidates:

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

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

a) Draw the I-V characteristics of a Gunn diode. How can it be used as an amplifier? Draw the necessary diagram.

b) Why is Horn antenna called as super gain antenna? Explain its construction and important features with necessary diagrams.

c) With suitable examples, explain the electromagnetic effects in high speed digital systems.

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

a) Obtain the expression for Lorentz Gauge condition starting with $\nabla.\vec{A} = 0$. What is its importance?

b) Draw the section of transmission line based on distributed circuit theory and obtain the transmission line equations.

c) What are strip lines? What are different types of strip lines? What are the different losses in strip lines?

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

a) Obtain the expression for Poynting theorem starting with Maxwell's equations.

b) With the necessary diagram, explain the working of a magnetron.

P.T.O.

c) A coaxial cable has characteristic impedance of 50Ω and a dielectric of permittivity 3.0. Calculate the wavelength of signals on the line at 500 MHz and 1 GHz.

d) Explain the working principle of IMPATT diode with necessary diagram.

e) Write a short note on cavity resonators.

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

a) Define the following for an antenna :

Polarization, Radiation Resistance, Gain and Effective length.

b) Determine the wave impedance of electromagnetic wave travelling in alumina $(\in_r = 8.9)$. Find the time average power density if amplitude of electric field is 100 V/m.

c) Write a short note on optical waveguides.

d) An air filled waveguide has dimensions 7 cm × 3.5 cm, operates in the dominent TE_{10} mode. Determine cut-off frequency and phase velocity. (f = 3.5 GHz).

e) What are Waveguides? What are the different methods of exciting different modes in rectangular waveguides. (Diagram to be drawn).

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

a) Write a short note on Global Positioning System.

b) Explain how distant temperature is measured using antenna.

c) A transmission line has reflection coefficient of $0.5\angle -40^{o}$. Find the standing wave ratio.

d) A transmission line has short circuit impedance $Z_{sc} = 1520\angle 16^{o}\Omega$ and open circuit impedance $Z_{OC} = 286\angle -40^{o}\Omega$ at 700 Hz. Find its characteristic impedance.

e) Write a short note on patch antenna.

Total No. of Questions : 5]

SEAT No. :

P2766

[Total No. of Pages : 2

[4834] - 22

M.Sc. (Electronic Science) (Semester - II)

EL2UT05 : Communication Electronics

(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) ***Draw neat diagram wherever necessary.***

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

a) Describe any one method of SSB AM generator. Write the advantages of it.

b) Explain the utility of time and frequency domain in the analysis and design of communication system.

c) Draw the circuit diagram of transistor RF amplifier for medium frequency and write the advantages of RF amplifier.

d) With the help of diagram, explain any two digital codes.

e) Explain the working of Frequency Shift Keying (FSK) modulator.

f) Describe the working of local loop of landline telephone in short.

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

a) i) For amplitude modulation, prove that the power contained in the lower and upper sidebands is one third of the total power of the signal.

ii) Draw the block diagram of frequency modulation receiver and explain each block in short.

b) What is Time Division Multiplexing (TDM)? With the help of block diagram, Explain the working of TDM in detail.

c) Draw the basic format of SDLC and HDLC. Explain the function of each field in short.

P.T.O.

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

a) With the help of diagram, explain any one AM detector.

b) Explain the terms in short :

i) Sensitivity of radio receiver.

ii) Image frequency and its rejection.

c) Describe any one method of error detector and correction in short.

d) What is Digital Subscriber Line (DSL)? Explain any one type of it.

e) What is 3G standards? Write its advantages and disadvantages.

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

a) Draw the block diagram of Pulse Code Modulation (PCM) and explain the working of each block of it in detail.

b) What is Quadrature Amplitude Modulation (QAM). With the help of diagram, explain the working of 8QAM in detail.

c) What is ISDN? Draw the segregated architecture of ISDN and explain the working of each component of it in short.

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

a) Explain the atmospheric and equipment noise in short.

b) Write the freqeuncy modulated wave equation for a 25 MHz carrier is modulated by a 400 Hz audio sine wave. If the carrier voltage is 4V and the maximum deviation is 10 KHz.

c) Draw the collector neutralisation or compensation diagram and explain its working in short.

d) With the help of diagram, explain the working of delta modulator.

e) Describe the working of digital exchange in short.

Total No. of Questions : 5]

SEAT No. :

P2767

[Total No. of Pages : 2

[4834] - 23

M.Sc. I (ELECTRONIC SCIENCE) (Semester - II)

EL-2 UT-06 : Digital System Design Using VHDL

(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 drawn wherever necessary.***

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

a) What is the procedure in VHDL? Write a VHDL code to illustrate the procedure.

b) List different sequential statements used in VHDL. Explain any two of them with suitable example.

c) Explain structural modeling in VHDL. Write VHDL code for full adder. Write VHDL code for ALU.

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

a) i) Write down the VHDL code for an S-R flip-flop.

ii) Explain the difference between function and procedure in VHDL. Give suitable example.

b) Compare demultiplexer and decoder? Design 16 to 1 multiplexer using 8 to 1-multiplexer.

c) What is parity bit? Explain even and odd parity. Design a logic circuit of parity.

B) Attempt any one of the following : **[1 × 4 = 4]**

a) Design a circuit for full adder using 3 : 8 decoder.

b) Write VHDL code for octal to binary encoder.

P.T.O.

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

a) Using JK flip-flops design an asynchronous counter for the sequence : 4, 6, 7, 3, 1, 4.

b) What do you mean by excitation equations, transition table? List different steps for the design of clocked sequential circuits.

c) What is state machine? Draw state machine structure of Mealy/Moore machine. Write a VHDL code for BCD counter.

Q4) Attempt any two of the following : **[2 × 6 = 12]**

a) Explain with neat diagram processor unit with scratch pad memory.

b) What is PAL? Design 4-bit binary to gray code using PAL. Explain the difference between PLA and PAL.

c) Write VHDL code for 4-bit ALU.

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

a) Explain different types of RAM and ROM. Explain how data is stored and erased in EEPROM.

b) Draw the functional block architecture of CPLD. Explain each block in detail.

c) Draw FPGA architecture. What are the advantages of FPGA? Explain configurable logic block of FPGA.

Total No. of Questions : 5]

SEAT No. :

P2768

[Total No. of Pages : 2

[4834] - 31

M.Sc. (Electronic Science) (Semester - III)

EL3UT05 : Embedded Systems

(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) ***Draw neat diagrams wherever necessary.***

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

a) What is embedded system? Draw the block diagram and explain the components used in it.

b) Compare 8-bit AVR and PIC microcontroller.

c) Explain with neat diagram timer/counter control logic of 8051.

d) Draw and explain port structure of PORT1 of 8051.

e) Explain different data types with their value range used in embedded C for 8051.

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

a) Write short note on CAN protocol.

b) Explain how PWM feature of microcontroller is used to control speed of DC motor?

c) Explain watch-dog timer in microcontroller. Explain WDTCR register in ATmega 16 microcontroller.

d) Explain interfacing of 8-bit DAC to 8051. Write C program for 8051 to generate triangular waveform using DAC.

e) Write C program for 8051, to send letter ‘A’ serially at 4800 band rate continiously. Use 8-bit data, 1-stop bit.

P.T.O.

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

a) Describe development steps of embedded system design using microcontroller.

b) Explain hardware development tools used in embedded system design.

c) Explain different methods of programming (burning) code memory of microcontroller.

d) Explain function of $\overline{EA}$ and $\overline{PSEN}$ pins of 8051. Draw block diagram to interface 8 KB RAM and 8 KB EPROM with 8051. Write memory map.

e) Explain software development tools used in embedded system design using microcontroller.

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

a) Draw interfacing of a switch and stepper motor to PIC16F877A microcontroller. Write C program which monitor switch and rotate stepper motor clockwise, if switch is closed and anti clock wise when switch is open.

b) Draw architecture of PIC16F877A microcontroller and explain each block in it in detail.

c) Draw interfacing diagram of 2 × 16 LCD to PIC16F877A. Write C program to display 'Electron' on it.

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

a) Explain any four addressing modes of AVR, with suitable example. Write function in C, to generate delay using timer in AUR (^tmega16).

b) Draw interfacing of temperature sensor LM35 and 2 × 16 LCD to Atmega16 microcontroller. Write C program to read temperature and display it on LCD.

c) Draw interface of two multiplexed seven segment displays connected to Atmega 16 microcontroller. Write a C program for 2-digit BCD counter.

Total No. of Questions : 5]

SEAT No. :

P2769

[Total No. of Pages : 2

[4834] - 41

M.Sc. (ELECTRONIC SCIENCE) (Semester - IV)

EL4UT06 : Control Systems : Theory and Application

(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) ***Use of log table calculator is allowed.***

Q1) Solve any two : **[2 × 8 = 16]**

a) Draw block diagram of feed back control system. Explain the function of various parts in it and state various types of controllers used in it.

b) i) What is Canonical form of a block diagram? Obtain the expression of overall transfer function for it.

ii) Write the advantages and disadvantages of block diagram for control system.

c) i) Write a short note on transfer function.

ii) Compare continuous and discrete state process control system.

Q2) Solve any two : **[2 × 8 = 16]**

a) Explain stability of control system on the basis of step response and location of its closed loop poles.

b) i) For unity feedback system, $G(s) = \frac{K}{s(1+0.4s)(1+0.25s)}$ Find range of values of k, marginal value of k and frequency of sustained oscillations.

ii) Write a short note on special cases of Routh's criteria.

c) Discuss closed loop transient response of control systems on the basis of location of its closed looop poles.

P.T.O.

Q3) Solve any two : **[2 × 8 = 16]**

a) Explain PID control mode. How would you implement it using Op-Amp? What is meant by derivative over run?

b) i) Describe PD control mode.

ii) Determine if the following characteristic equation has any roots with positive real parts.

$S^4 + S^3 - S - 1 = 0$

c) What is process-loop tuning? Explain open-loop transient response method for a process-loop tuning. Write the limitation of this method.

Q4) Solve any two : **[2 × 8 = 16]**

a) Draw and explain architecture of PLC.

b) i) Explain the event sequence for a bottle filling plant.

ii) Draw PLC ladder diagram to realise 4 : 1 MUX.

c) Explain any three data handling instructions for a PLC.

Q5) Solve any four : **[4 × 4 = 16]**

a) Write a short note on an annunciator.

b) Explain ON-DELAY timer instruction.

c) What is watchdog timer? How it is used in PLC Operation.

d) Compare dumb and smart programming terminals.

e) Explain adaptive control mode.

f) Explain the need for method of documenting a PLC system.