

Total No. of Questions : 5]

SEAT No. :

P2313

[Total No. of Pages : 3

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M.Sc. (Semester - I)

ELECTRONIC SCIENCE

EL1UT01 : 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 diagram wherever necessary.
- 4) Use of non-programmable calculator is allowed.

Q1) Attempt any two of the following:

[2 × 8 = 16]

- a) Discuss the position of Fermi-level dependence on concentration and temperature for n-type and p-type semiconductor. Use proper mathematical relations.
Calculate the thermal equilibrium concentrations of electrons and holes for silicon at $T = 300^\circ\text{K}$. Given $N_c = 2.8 \times 10^{19} \text{ cm}^{-3}$, $N_v = 1.04 \times 10^{19} \text{ cm}^{-3}$. Assume that the Fermi energy is 0.30 eV below the conduction band and band gap energy for silicon is 1.12 eV. (Boltzmann constant $k = 8.6 \times 10^{-5} \text{ eV}$)
- b) Define the following terms of crystal structure
 - i) Lattice.
 - ii) Unit cell.
 - iii) Primitive cell.

For a bcc lattice of identical atoms with a lattice constant of 5.45 \AA . Calculate maximum packing fraction and radius of atom, assume atoms as hard spheres.

P.T.O.

- c) Explain with diagram the following terms of JFET.
- i) Internal pinch off voltage.
 - ii) Threshold voltage.

How MOSFET are different from JFET in terms of performance?

Q2) Attempt any two of the following:

[2 x 8 = 16]

- a) State diode equation. Explain qualitatively current - voltage characteristic of p-n junction diode.

Differentiate between the

- i) Reverse - biased breakdown.
 - ii) Avelanch breakdown.
 - iii) Zener breakdown.
- b) Obtain the time-independent wave solution for a infinite potential well. Show that energy of the particle is quantized. The lowest energy of a particle in an potential well with a width of 100\AA is 0.025 eV . Calculate mass of particle.

Given $\hbar = 1.054 \times 10^{-34}$.

- c) Explain different regions of I-V characteristic of SCR. Differentiate between SCR and TRIAC. Give two applications of each.

Q3) Attempt any four of the following:

[4 x 4 = 16]

- a) Discuss the Eber-moll equations in computer aided circuit analysis program such as SPICE.
- b) What is Miller Indices? Explain concept of equivalent plane. What is importance of it?

- c) Explain working of LED. Define radiative efficiency in terms of lifetime.
- d) Describe n-channel enhancement mode of MESFET. What are advantage and disadvantage of MESFET?
- e) What is diffusion process? Obtain expression for electron diffusion current density in one dimensional semiconductor.

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

- a) Draw two-port equivalent circuit of BJT for characterising the ac response. Define cutoff frequency and beta cutoff frequency.
- b) Describe time-delay factors of the bipolar transistor. What is figure of merit of transistor?
- c) For BJT having $\alpha_{dc} = 0.98$, $I_c = 9\text{mA}$ and $I_{CBO} = 10 \mu\text{A}$. Calculate I_B and current gain.
- d) Explain current - voltage characteristic of TRIAC. State any two applications of it.
- e) What is stimulated emission? Explain how population inversion and lasing takes place in semiconductor laser diode?

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

- a) Draw schematic diagram of basic MOS capacitor structure. Explain phenomenon of inversion layer of electrons at the oxide-semiconductor interface, draw energy-band diagram with a p-type substrate for large positive gate bias.
- b) What is Schottky barrier diode? Explain the terms Schottky barrier and built - in potential barrier.
- c) What is effective mass? Show that the effective mass of electron in a semiconductor material is positive.
- d) Explain epitaxial growth technique that is used in device and IC fabrication.
- e) Explain construction of Heterojunction Bipolar Transistor (HBT). What is special feature of HBT over BJT.



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SEAT No. :

P2314

[Total No. of Pages : 3

[4934] - 12

M.Sc. (Semester - I)

ELECTRONIC SCIENCE

EL1UT-02 : 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 diagram wherever necessary.
- 4) Use of log-table/non-programmable calculator is allowed.

Q1) Attempt any two:

a) Obtain the inverse Laplace transform for the given functions [8]

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

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

b) i) Explain the effect of negative feedback on amplifier parameters (any two). [4]

ii) What is supply independent biasing? How is it achieved? [4]

c) i) What is peak detector? Explain the working of peak detector circuit using OPAMP. [4]

ii) Design second order butter worth low pass filter for cut-off frequency 1 kHz. [4]

P.T.O.

Q2) Attempt any two:

- a) i) Explain working of high accuracy two op-Amp S/H circuit. [4]
ii) Draw the circuit diagram of practical integrator circuit. Give the designing steps of it. [4]
- b) i) Obtain an expression for transmission parameters. [4]
ii) For the given denominator polynomial of a network function, determine the value of k for which the network to stable. [4]
- $$Q(s) = s^3 + 2s^2 + 4s + k$$
- c) i) Explain following terms with suitable example. [4]
1) Transfer function.
2) Poles and zeros.
ii) What is attenuator? Explain π type attenuator. [4]

Q3) Attempt any Two:

- a) i) Explain pipe line ADC architecture. What is its advantage? [4]
ii) An inverting amplifier using 741 must have a flat response upto 40 kHz. The gain of the amplifier is 10. What maximum peak-to-peak input signal can be applied without distorting the output. [4]
- b) i) Explain shielding and guarding techniques used in construction of opAmp circuit. [4]
ii) Find Laplace transformer of following signal [4]
1) $F(t) = e^{-at}$.
2) $\cos\omega t$.
- c) i) Write a short note on micropower design techniques. [4]
ii) Explain the working of two-op amp practical log amplifier circuit. [4]

Q4) Attempt any Two:

- a) i) Design a m-derived high pass filter with cut-off frequency of 10 kHz, design impedance of $5\ \Omega$ and $m = 0.4$. [4]
ii) Write a short note on “segmented DAC”. [4]
- b) i) A 4 bit D/A convertor of type R-2R ladder, has digital inputs 1010 and 1101. If $V_{\text{ref}} = 5\text{V}$, $R_f = 1\text{k}\Omega$ and $R = 5\text{k}\Omega$. Obtain output voltages for given digital inputs. [4]
ii) Draw the circuit diagram of instrumentation amplifier, using three op-amps and explain the working of it. [4]
- c) i) Explain the following terms associated with op-amp. [4]
1) CMRR.
2) Input offset voltage.
ii) Explain with circuit diagram, how to boost the output current capability of an op-amp. [4]

Q5) Attempt any Two:

- a) i) Explain the working of successive approximation type ADC. [4]
ii) Explain application of DAC. [4]
- b) i) Discuss device mismatch effect in emitter coupled pair. [4]
ii) Explain the need and application of low power design. [4]
- c) i) With circuit diagram, explain the working of bridge amplifier with earthed bridge supply. Give equation for its output. [4]
ii) Explain ADC specifications. [4]



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SEAT No. :

P2315

[Total No. of Pages : 4

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M.Sc. (Semester - I)

ELECTRONIC SCIENCE

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 labeled diagrams wherever necessary.*
- 4) *Use of logarithmic table and non-programmable calculators is allowed.*

Q1) Attempt any four of the following:

[4 × 4 = 16]

- a) Describe transducer selection criteria for the measurement of given physical parameter.
- b) List the static parameters of measurement system. Explain accuracy and precision with suitable example.
- c) Give detail classification of transducers. State applications and limitations of Thermistor.
- d) With suitable example, describe the loading effect due to shunt connected instrument.
- e) What is error in measurement? State different types of errors involved in measurement. Explain limiting error with suitable example.

Q2) Attempt any four of the following:

[4 × 4 = 16]

- a) List the dynamic parameters of measurement system. A first order instrument is used to measure signal with frequency content upto 100 Hz with an amplitude accuracy of 10%. What is the maximum time constant and phase shift at 50 Hz?

P.T.O.

- b) List the transducers used for linear displacement measurement. A linear potentiometer is 50 mm long uniformly wound with wire having resistance of $10\text{ K}\Omega$. Under normal condition the slider of potentiometer is at the centre. Find the linear displacement with the resistance of the potentiometer is 3500Ω and 8500Ω . Are the two displacements in the same direction.
- c) State different sources of noise. Explain noise factor and noise figure. A measurement system uses a resistance strain gage for the measurement of pressure. The unstrain resistance of the gauge is 120Ω is connected in one arm of a wheatstone's bridge. The other three arms having resistance of 120Ω each. The temperature is 300°K and bandwidth is 100 kHz , the bridge output is voltage. Find signal to noise ratio generated by the resistors.
- i) When a pressure of 7000 kN/m^2 is applied.
 - ii) When the applied pressure of 7 kN/m^2 , comment on result.
- d) Explain working principle of LVDT. The output voltage of LVDT is 2.5 V at maximum displacement of load of $500\text{ K}\Omega$, the deviation from linearity is maximum and is 0.003 V from a straight line from origin. Find the linearity at the given load.
- e) List the different types of strain gauges. State different applications of strain gauges. For simple wire type strain gauge, derive expression of its gauge factor.

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

- a) List the pressure transducers. Write working principle of thermal conductivity and ionization gage, used for very low pressure measurement.
- b) List the transducers used for temperature measurement. Describe temperature measurement system using thermocouple why compensation is required for thermocouple. Give different compensation techniques used.
- c) Give working principle of the following:
 - i) Electromagnetic flowmeter,
 - ii) Capacitance microphone,
 - iii) Hot wire anemometer and
 - iv) Radiation pyrometer.

- d) A strain gauge is bonded to a beam of 0.1 meter long and has cross sectional area of 4cm^2 . The unstrain resistance of the gauge is 240Ω and gauge factor of 2.2. When load is applied, the resistance of gauge changes by 0.013Ω , calculate change in length of the steelbeam and the amount of force applied the beam.

(Given Young's modulus of steel is 207 GN/m^2).

- e) A platinum resistance thermometer has a resistance of 100Ω at 25°C . Find its resistance at 65°C . Platinum has resistance temperature coefficient of $0.00392/^\circ\text{C}$. If the thermometer has a resistance of 150Ω calculate the temperature.

Q4) Attempt any four of the following:

[4 × 4 = 16]

- a) Draw neat circuit diagram of wheatstone's bridge. Derive an expression for bridge sensitivity having equal arms.
- b) With the help of neat circuit diagram explain the working of 3-opamp Instrumentation Amplifier. Write the equation of its output voltage.
- c) Draw neat circuit diagram and output equation for the following:
- Zero crossing detector.
 - Comparator with $V_{\text{ref}} = 5\text{V}$.
 - Inverting amplifier with gain = 5.
 - Voltage follower.
- d) Draw neat block diagram of DFM, explain working of frequency measurement mode.
- e) What is telemetry? State types of landline telemetry systems. Explain any one.

Q5) Attempt any four of the following:

[4 × 4 = 16]

- a) Describe the techniques used for magnetic recording. State advantages of FM over AM type magnetic recording.
- b) Explain signal conditioning system used in measurement system. Draw neat circuit block diagram of DC signal conditioning system.
- c) List the types recorders as measurement system. With neat diagram describe strip chart recorder system.
- d) Write working principle of ultrasonic flow meter and turbine flow meter.
- e) Draw the neat block diagram of sound level meter. Explain working of sound level meter used for sound pressure level measurement.



Total No. of Questions : 5]

SEAT No. :

P2316

[Total No. of Pages : 3

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M.Sc. - I (Semester - II)

ELECTRONIC SCIENCE

**EL2UT04 : Applied Electromagnetics, RF and Microwaves
(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 tables or non-programmable calculator is allowed.*

Q1) Attempt any two of the following:

[2 × 8 = 16]

- a) Starting with Maxwell's equations, obtain the expressions for electric wave equation and magnetic wave equation.
- b) With the help of energy band diagram and I-V characteristics of a tunnel diode, explain its working.
- c) Discuss Smith chart with reference to its important characteristics and applications.

Q2) Attempt any two of the following:

[2 × 8 = 16]

- a) What are striplines? Where are they used? Explain the construction, characteristic impedance and attenuation losses in case of parallel striplines.
- b) Discuss electromagnetic effects in high speed digital systems with suitable examples.
- c) How are antennas classified? Define directivity, bandwidth and field pattern of an antenna.

P.T.O.

Q3) Attempt any four of the following:

[4 × 4 = 16]

- a) Explain the concept of retarded potential.
- b) A transmission line has characteristic impedance of 75Ω and is operated at a frequency of 10 MHz. It is terminated with a load $Z_L = 50 + j 50 \Omega$. Find the reflection coefficient and SWR.
- c) Write a short note on GPS.
- d) Explain the absorption of microwaves by atmosphere.
- e) State the basic rules for boundary conditions at the surface between two materials/mediums having different properties.

Q4) Attempt any four of the following:

[4 × 4 = 16]

- a) Determine the phase velocities of electromagnetic waves propagating in non-magnetic mediums with $\epsilon_r = 12$ and $\epsilon_r = 81$.
- b) What is 'skin depth'? Obtain the expression for skin depth.
- c) With the necessary diagram explain the working of Reflex Klystron.
- d) What is an optical fiber? What are its advantages over copper wire?
- e) Describe any two techniques for EMI control.

Q5) Attempt any four of the following:

[4 × 4 = 16]

- a) What is a MESFET? Why are MESFETs used in microwave integrated circuits?
- b) Write the equation of complex Poynting theorem and explain each term in it.

- c) A uniform plane wave is travelling in a medium and its equation is

$$\vec{E} = 10 \sin(10^8 t - \beta z) \hat{a}_y, \text{ V/m}$$

If the medium has $\epsilon_r = 1$ and $\sigma = 5 \text{ S/m}$ determine whether the medium is a lossy dielectric or good conductor.

- d) Write a short note on patch antenna.
- e) Write the procedure to determine the characteristic impedance and propagation constant of a given transmission line.



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SEAT No. :

P2317

[Total No. of Pages : 3

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M.Sc. (Semester - II)

ELECTRONIC SCIENCE

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 indicates full marks.*
- 3) *Draw neat diagram wherever necessary.*

Q1) Answer any Four of the following:

[4 × 4 = 16]

- a) Explain the working of balanced slope detector.
- b) Define the terms:
 - i) Signal to noise ratio.
 - ii) Noise figure.

Write the importance of Noise figure.

- c) Draw the circuit diagram of transistor RF amplifier for very high frequency (VHF) and write the importance of RF amplifier.
- d) Write short note on data compression.
- e) Describe the working of bluetooth technology used in wireless communication.
- f) With the help of neat diagram, explain the working of amplitude shift keying (ASK) in short.

P.T.O.

Q2) Attempt any Two of the following:

[2 × 8 = 16]

- a) Draw the labeled block diagram of high level amplitude modulation transmitter and explain each block in short.
- b) What is frequency division multiplexing (FDM)? With the help of block diagram, explain the working of FDM in detail.
- c) What is XMODEM protocol? Describe the importance of it. With the help of frame structure, explain the function of each field in short.

Q3) Write any Four of the following:

[4 × 4 = 16]

- a) Calculate the carrier and modulating frequencies, the modulation index and the maximum deviation of the frequency modulated wave represented by the voltage equation $v = 12 \sin (6 \times 10^8 t + 5 \sin 1250 t)$
- b) Explain the terms in short:
 - i) Selectivity of a receiver.
 - ii) Image frequency.
- c) With the help of diagram, explain any two signal encoding format.
- d) Draw the frame structure of HDLC and explain it in short.
- e) What is ISDN? Describe any two applications of it in short.

Q4) Attempt any Two of the following:

[2 × 8 = 16]

- a) With reference to pulse code modulation (PCM), explain the terms
 - i) Quantisation.
 - ii) Quantisation noise.
 - iii) Sample and hold circuit.
 - iv) Encoding.

- b) What is quadrature amplitude modulation (QAM)? With the help of diagram, explain the working of 16 QAM.
- c) i) With reference to satellite communication, explain the terms :
Up link and Cross link.
- ii) With the help of block diagram, explain any one type of transponder working in short.

Q5) Write any Four of the following:

[4 × 4 = 16]

- a) Describe the sampling theorem. Explain the importance of it.
- b) With the help of neat diagram, explain the working of varactor diode modulator.
- c) Draw the base neutralisation or compensation diagram and explain its working in short.
- d) Write short note on error detection and error correction.
- e) Explain the working of very small aperture terminal (VSAT) in short.



Total No. of Questions : 5]

SEAT No. :

P2318

[Total No. of Pages : 2

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M.Sc. - I (Semester - II)

ELECTRONIC SCIENCE

EL2UT 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 function in VHDL? Write an example showing function definition and function call.
- b) List different sequential statements used in VHDL. Explain any two of them with suitable example.
- c) What are variables, signals and constants in VHDL? Explain user defined and predefined VHDL types for them.

Q2) A) Attempt any Two of the following:

[2 × 8 = 16]

- a)
 - i) What is parallel adder? What is look ahead carry in parallel adder?
 - ii) Compare demultiplexer and decoder. Can we use demultiplexer as decoder and Vice-Versa.
- b) Design a 4-bit multiplier to multiply two 4-bit unsigned binary numbers.
- c) List the applications of multiplexer, demultiplexer and decoder.

P.T.O.

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

- a) Write down the VHDL code for an S-R flip-flop.
- b) Explain the subtypes used in VHDL, in brief.

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

- a) Design synchronous counter to generate the sequence 0-2-4-5 and repeat using T-flip-flops.
- b) Explain with neat diagram 3-bit up/down ripple counter.
- c) Draw the block diagram of a digital traffic light controller and explain it, in adequate details.

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

- a) What is PLA? Draw the diagram showing PLA structure.
- b) Explain with block diagram processor unit with scratch pad memory.
- c) What do you mean by GAL? List different modes of GAL.

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

- a) What is DRAM? Explain working of DRAM with respect to read and write operation. Give difference between SRAM and DRAM.
- b) Draw the functional block architecture of CPLD. Explain each block in detail.
- c) Draw the functional block architecture of FPGA. What are advantages of FPGA? What are advantages of FPGA over ASIC?



Total No. of Questions : 5]

SEAT No. :

P2319

[Total No. of Pages : 3

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M.Sc. - II (Semester - III)

ELECTRONIC SCIENCE

**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 diagram wherever necessary.*

Q1) Attempt any FOUR of the following:

[4 × 4 = 16]

- a) Draw the block diagram of 8051 based target board. Explain the design of target board with reference to power supply reset circuit, clock circuit, programming method, port connections.
- b) Compare Harvard and Van-Neumann architecture. Give two examples of CISC and RISC processors.
- c) Explain with neat diagram internal data and program memory organization of 8051.
- d) Explain briefly interrupts of 8051. Indicate their vector addresses.
- e) Write C program for 8051 to convert 2-digit BCD number to HEX. Get 2-digit BCD number from PORT0, write HEX number to PORT 1.

Q2) Attempt any FOUR of the following:

[4 × 4 = 16]

- a) What is I2C bus? Explain with timing diagram, how data is transmitted on it.
- b) Explain with block diagram interfacing of 4 × 4 matrix keyboard, 2 × 16 LCD and stepper motor to 8051. Explain the logic to rotate stepper motor for an angle in degree entered through keyboard.

P.T.O.

- c) Draw and describe, how 8051 microcontroller communicate serially with computer.
- d) Draw interface of LDR and relay to P 0.0 and P 1.0 of 8051. Write C program to monitor ambient light and turn ON/OFF lamp connected to 8051 through relay.
- e) Explain watch-dog timer in microcontroller. Explain WDTCR register in Atmega 16 microcontroller.

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

- a) Explain following software development tools in detail. Compiler, simulator.
- b) What is IDE? Explain different IDEs used in embedded system design using 8051, AVR, PIC microcontroller.
- c) Explain different methods of communication with reference to microcontroller.
- d) Explain the function of ALE and \overline{EA} pins of 8051. Draw block diagram to interface 16 KB RAM and 8 KB EPROM with 8051. Write memory map.
- e) Write note on-Emulator, Debugger.

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

- a) List features of PIC 16 F 877 microcontroller. Write C program to monitor PORT B.4 continuously, when it becomes low, send 55H to PORT D otherwise send AAH to PORT D.
- b) Write note on status register of PIC 16F 877. Write C program for PIC microcontroller, for B-bit ring counter on PORT D.
- c) Explain timer in PIC 16 F 877 microcontroller. Write C program to generate 2 kHz square wave with 50% duty cycle. Use timer for delay.

Q5) Attempt any TWO of the following:

[2 × 8 = 16]

- a) Explain with suitable timing diagram Fast PWM mode for PWM generation using timer 0 of Atmega 16. Write C program to generate PWM using Fast PWM mode, used to vary brightness of LED.
- b) List features of on Chip ADC to Atmega 16. Write C program to read ADC and display the results on PORT C and PORT D.
- c) Explain different PORT registers of Atmega 16. Write C program to display two digit BCD counter on common cathode seven segment displays connected to PORT A and PORT D.



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SEAT No. :

P2320

[Total No. of Pages : 2

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M.Sc. (Semester - IV)

ELECTRONIC SCIENCE

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) Explain the need for control system. What are the different types of control systems? Explain feed forward control strategy.
- b)
 - i) Write a short note on transfer function.
 - ii) Give the advantages and limitations of open-loop control system.
- c)
 - i) What is simple or canonical form of a block diagram? Obtain the expression for overall transfer function for it.
 - ii) Explain the concept of programmable logic controller with suitable block diagram.

Q2) Solve any two:

[2 × 8 = 16]

- a) How the location of closed loop poles can be used to analyse the stability of a control system?
- b) Discuss closed loop transient response of control system on the basis of location of its closed-loop poles.
- c)
 - i) Explain Routh - Hurwitz method. Give its advantages and limitations.
 - ii) Examine stability of control system having characteristics equation:
 $s^8 + 5s^6 + 2s^4 + 3s^2 + 1 = 0$ using Routh's Method.

P.T.O.

Q3) Solve any two:

[2 x 8 = 16]

- a) Give a circuit diagram and explain the working of ON-OFF controller using LM-35 temperature sensor. Explain OFF-DELAY timer instruction.
- b)
 - i) What is meant by soft PLC?
 - ii) What is watchdog timer? How it is used in PLC operation.
- c)
 - i) Compare PLC with hardwired relay logic.
 - ii) Develop a ladder diagram for coffee-vending machine.

Q4) Solve any two:

[2 x 8 = 16]

- a) Explain any three data handling instructions for PLC.
- b)
 - i) Explain smart programming terminal. What are its advantages?
 - ii) For $G(s).H(s) = \frac{k}{s(s+4)}$. Obtain the nature of root locus.
- c) Give a block diagram of PLC memory. How is application memory organised? Discuss memory map for Allen Bradley SLC 500 PLC.

Q5) Solve any four:

[4 x 4 = 16]

- a) Write a short note on solenoid.
- b) Explain sequencer output instruction.
- c) What is adaptive control mode? Explain in short.
- d) Explain integral windup in a PID. Give a circuit scheme to solve this problem.
- e) Explain any two comparison instruction.
- f) Write a short note on different symbols used in ladder diagram.

