Total No. of Questions : 5]

SEAT No. : ____

P1225

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M.Sc. - I

ELECTRONIC SCIENCE

EL 1 UT 01 : Foundation of Semiconductor Devices (2008 Pattern) (Semester-I)

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) Discuss qualitatively, formation of allowed and forbidden energy gaps in a crystal structure. State its importance.

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

c) Explain charge flow in a p-n junction with zero-bias, reverse-bias and forward-bias conditions using energy band diagram.

Q2) Attempt any two : **[2×8=16]**

a) Explain Polysilicon-Emitter BJT structure. Comment on the increase in common emitter current gain using this transistor.

b) Draw the ideal I-V characteristics of a JFET. Explain the terms :

i) Pinch-off Voltage,

ii) Pinch-off current,

iii) Drain- to - source saturation voltage.

c) Explain the construction of MOSFET with the I_D-V_D characteristics of MOSFET.

P.T.O.

Q3) Attempt any four: **[4×4=16]**

a) With the help of neat diagram, explain emitter current crowding.

b) Explain the effect of temperature on Fermi-Dirac distribution function.

c) Differentiate between a MESFET and a JFET. Explain any one application of MESFET in brief.

d) Why CMOS technology is widely used than NMOS, PMOS and TTL?

e) Discuss imperfection and impurities in solids.

Q4) Attempt any four: **[4×4=16]**

a) Consider a silicon pn junction at 300k with doping densities, $N_a = 1\times10^{18}$ cm^{-3}. and $N_d = 1x\ 10^{15} cm^{-3}$ Assume $n_i = 1.5\times10^{10}$ cm^{-3}. Calculate built - in potential barrier in pn junction.

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

c) Explain hybrid-pi equivalent circuit of BJT.

d) What are Miller indices? What is the advantage of using reciprocal lattice?

e) Explain the structure and I-V characteristics of SCR. Define various terms in switching action of SCR.

Q5) Attempt any four: **[4×4=16]**

a) Write a short note on Schottky diode.

b) What are space lattices? Discuss a unit cell and primitive cell.

c) What is working principle of LED? Which materials are used in LED? Why the specific color LED are practically possible?

d) Explain :

i) Emitter efficiency.

ii) Base transport factor,

related to BJT.

e) Explain construction and working of TRIAC. State any two applications of it.

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Total No. of Questions : 5]

SEAT No. : ____

P1226

[Total No. of Pages : 2

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M.Sc. - I

ELECTRONIC SCIENCE

EL 1 UT-02 : Analog Circuit Design and Analysis

(2008 Pattern) (Semester-I)

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

Instructions to the candidates:

1) ***All questions carry equal marks.***
2) ***Neat diagrams must be drawn wherever necessary.***
3) ***Figures to the right side indicate full marks.***
4) ***Use of log table / non programmable calculator is allowed.***

Q1) Attempt any two.

a) What is two port network? Explain its admittance, hybrid and transmission parameters. **[8]**

b) What are the important characteristics of instrumentation amplifier? With proper circuit diagram of instrumentation amplifier using three op-amps, deduce an expression for its output voltage. **[8]**

c) i) Explain working principle of successive approximation Analog to Digital Converter (ADC). **[4]**

ii) Write short note on low power sources. **[4]**

Q2) Attempt any two.

a) i) Explain working of current mode segmentation type digital to analog converter (DAC). **[4]**

ii) Explain practical design consideration for an op-amp integrator circuit. **[4]**

b) i) Draw pole - zero plot and find inverse laplace transform for following transfer function. **[4]**

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

ii) What is need for high power op-amp? Explain the relevant parameters of high power op-amp. **[4]**

c) i) Explain the output and transfer characteristics of JFET. Explain working of source follower circuit. **[4]**

ii) For 5 bit digital to analog converter, with a digital input of 10100, it gives 10V output voltage. What will be output voltage for a digital input of 11101? **[4]**

P.T.O.

Q3) Attempt any two:

a) Explain advantages of active filter over passive filter. Draw 2^{nd} order Butter worth low pass Filter Circuit. Design it for a cut-off Frequency of 6KHz and passband gain of 8. **[8]**

b) Determine the unit step response of series RLC circuit using Laplace transform. **[8]**

c) i) What is programmable of-amp? Which parameters can be programmed? **[4]**

ii) State and Explain Nyquist criteria for stability. **[4]**

Q4) Attempt any two:

a) What do you mean by ideal current source? With neat diagram explain the working of Widlar Current Source. **[8]**

b) i) Explain sigma-delta converter in short (ADC). **[4]**

ii) Explain working of Weighted - Capacitor Digital to analog converter (DAC) **[4]**

c) i) Find Laplace transform of $f(t) = e^{-at}$ and $f(t) = \cos(5t)$. **[4]**

ii) Draw block diagram of two port network. Define Voltage, current, transfer admittance, transfer impedance functions. **[4]**

Q5) Attempt any four:

a) What are poles and zeros of network? Explain their significance. **[4]**

b) Explain shielding and guarding methods used for a general purpose op-amp. **[4]**

c) Explain the working of sample and hold (S/H) circuit and comment on choice of capacitor value for S/H circuit. **[4]**

d) Compare the maximum conversion time of a 12 bit digital ramp (counter type) type A/D converter and a 12 bit successive approximation A/D converter if both utilize a 1MHz clock frequency. **[4]**

e) Explain the effect of negative series and shunt feedback on input and out put impedance of an amplifier. **[4]**

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

Total No. of Questions : 5]

SEAT No. : ____

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M.Sc.

ELECTRONIC SCIENCE

EL 1 UT 03 : Instrumentation and Measurement Techniques (2008 Pattern) (Semester-I)

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 diagram wherever necessary.***
4) ***Use of logarithmic table and non- programmable calculator is allowed.***

Q1) Answer any four of the following. **[4×4=16]**

a) State the characteristics of measurement system. Explain the following characteristics with suitable example.

i) Accuracy

ii) Precision

iii) Resolution

b) What is statistical method of analysis of data obtained in measurement of physical parameter. Explain the terms - Mean value, Deviation and Standard Deviation.

c) Describe loading effect of shunt connected instrument. Give suitable example to support your answer.

d) What is Noise? Explain generated, conducted and radiated Noise with suitable example.

e) What is dynamic response of measurement system? Derive the equation for time response of a first order system when subjected to a unit step input.

P.T.O.

Q2) Answer any four of the following. **[4×4=16]**

a) Give transducer classification according to -

i) Requirement of excitation.

ii) Transduction principle.

b) With neat diagram explain the working principle of thermal conductivity gage used for low pressure measurement.

c) Discuss the selection criteria for selection of transducer for the measurement of physical parameter.

d) How potentiometer is used for linear and angular displacement measurement? Write advantages and limitations of potentiometer transducer.

e) Give working principle of the following-

i) Hot wire anemometer.

ii) Ultrasonic flowmeter.

iii) Resistance temperature detector (RTD), and

iv) Capacitor microphone.

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

a) What is signal conditioning of measurement system? With neat block diagram explain DC signal conditioning system.

b) Draw the circuit diagram for following OpAmp circuits with output equation.

i) Zero crossing detector

ii) Schmitt Trigger

iii) Voltage follower with gain

iv) Differential Amplifier

c) What is Telemetry? Give different methods of data transmission with block diagram, explain general telemetry system.

d) List the advantages of digital indicating instruments over analog indicating instruments.

e) With neat circuit blcok diagram, explain the working of strip chart recorder.

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

a) It is desire to measure the value of current in 1000Ω registor as shown in fig.1 by connecting ammeter of 100Ω resistance. Find-

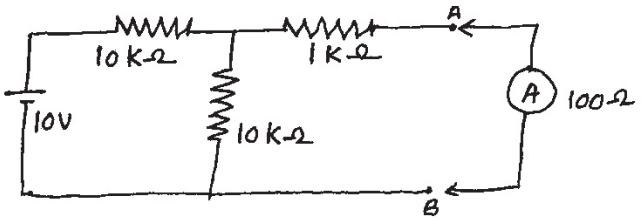

Fig. 1.

i) Actual value of current,

ii) Measured value of current

iii) Percentage error in measurement and

iv) Accuracy

b) List the applications of capacitive transducer.

Calculate the capacitance of parallel plate capacitive transducer with plate area 400 mm^2 each apart at 200 μm. The transducer is used in air. Calculate the change in capacitance if a linear displacement reduce the distance between them to 180 μm, also calculate the sensitivity.

c) List the temperature transducers. A platinum resistance thermometer has a resistance of 100Ω at 25ºC. Find its resistance at 70ºC. The platinum has resistance temperature coefficient of 0.00392/ºC.

If the resistance is 150Ω, calculate the temperature.

d) An LVDT is used in an accelerometer to measure seismic mass displacement. The LVDT and signal conditioning output is 0.30 mV/mm with ±2 cm core displacement. Find

i) the relation between acceleration in m/s^2 and out put voltage.

ii) The maximum acceleration and

iii) The natural frequency in Hz.

(Given : Spring constant is 240 N/m and care mass of 0.05kg).

e) List the types of errors involved in measurement. A voltmeter having sensitivity of 2000 Ω/V reads 100V on its 150V scale when connected across an unknown resistance in series with milliammeter, the milliammeter reads 5 mA, calculate-

i) Apparent resistance of the unknown.

ii) Actual resistance of the unknown and

iii) Error due to loading effect of voltmeter.

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

a) With neat circuit block diagram explain the working of wave analyzer used for audio and RF range.

b) Explain the compensation techniques used with thermocouple based temperature measurement system

c) Consider a strain gauge of resistance of 100Ω mounted along the axial direction of an axially loaded specimen of steel (E=200 Gpa). If the percentage change in length of the rad to loading is 3% and the corresponding change resistivity of the strain gauge material is 0.3%. Estimate the percentage change in resistance of the strain gauge and its gage factor. If the strain gauge is connected to a measuring, device capable of determining change in resistance with an accuracy of ± 0.02Ω. What is the uncertainty is stress that would result in using this resistance measurement device?

d) A thermistor has a resistance of 3980Ω at the ice point (0ºC) and 794Ω at 50ºC. Calculate the constants a and b.

e) A 4½ digit digital voltmeter is used for voltage measurement. Find the resolution of the voltmeter. How would 12.99 be displayed on 20 volt range ? How would 0.σ958 be displayed on ZV and ZOV range.

Total No. of Questions : 5]

SEAT No. : ____

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M.Sc.

ELECTRONIC SCIENCE

EL 2 UT 04 : Applied Electromagnetics, RF & Microwave

(2008 Pattern) (Semester-II)

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

Instructions to the candidates:

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

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

a) Derive an expression for cut-off frequency and cut-off wavelength of a Rectangular waveguide.

b) Explain the construction and working of Horn Antenna. State its salient features. Why it is known as super gain antenna?

c) With the help of energy band diagram, explain the working principle of tunnel diode. Explain its characteristics.

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

a) Discuss the Smith Chart with reference to :

i) Mathematical formulation.

ii) Important characteristics.

iii) Any two applications.

b) Define any four parameters of Antenna.

c) What is RF heating? Why it is called as clean heating systems? Give one examples.

P.T.O.

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

a) Derive an expression for modified Ampere's Circuital Law.

b) A rectangular waveguide have dimensions:

a = 4.0 cm.

b = 2.0 cm.

Find cut-off wave length λ_c for TE_{10}, TE_{20}, TM_{11}.

c) Explain working principle of patch Antenna with neat diagram.

d) Explain in brief, effect of Electromagnetic on Reset signal of a PC card.

e) Write a short note on cavity Resonator.

f) Find the skin depth at 10^4 Hz for copper.

given, $\sigma = 5.80\times10^7$ s/m, $\mu_r = 1.0$, $\mu_0 = 4\pi \times10^{-7}$

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

a) Explain in brief the basic working of IMPATT diode with neat diagram.

b) Explain in brief the effect of CD player on airplane navigation system.

c) An antenna has a field pattern given by $E(\theta) = \cos^2\theta$ for $0^0 \le \theta \le 90^0$. Find the half power beamwidth (HPBW).

d) Explain TE_{10}, TE_{20} mode excitation method in Rectangular waveguide. Draw neat diagrams.

e) Derive wave equations in time domain, using Maxwell's equation.

f) What is an EMI shielding? Why it is required?

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

a) Compare between waveguide and Transmission line .

b) Explain Radiation Mechanism of an antenna.

c) Give applications of LF, VHF, UHF, EHF bands.

d) A certain GaAs MESFET has the following parameters channel height a = 0.1μm.

Electron concentration Nd= 8×10^{17} cm^{-3}

Relative dielectric constant $\epsilon_r = 13.10$

Calculate the Pinch - off voltage

e) Write a short note on GPS.

f) Explain types of microstrip line.

Total No. of Questions : 5]

SEAT No. :

P1229

[Total No. of Pages : 2

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M.Sc. -I

ELECTRONIC SCIENCE

ELZUT 05 : Communication Electronics

(2008 Pattern) (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) State the elements involved in communication system. Explain function of each element in brief.

b) Compare low level full carrier AM transmitter and high level full carrier AM transmitter.

c) Explain working of multistage tuned amplifier.

d) With the help of neat labled diagram explain role of limiter in FM receiver.

e) Draw diagram and explain FSK modulator in brief.

f) What is ISDN? Explain ISDN address structure in short.

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

a) What is compensation? Explain any one technique of compensation with the help of diagram.

b) With the help of block diagram explain working of Pulse Code Modulator (PCM) in detail.

c) State the advantages of SSB amplitude modulated transmission. Explain the phase shift method of SSBAM generation.

P.T.O.

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

a) Explain any two most common forms of baseband digital signal.

b) Draw neat diagram and explain working of diode detector used for AM generation.

c) Explain working of stagger tuned amplifier.

d) Write a brief note on:

i) Manchester code

ii) Capture and threshold effects of FM.

e) Explain the need of XMODEM protocol. Describe the fields of the frame. How many data bytes are sent with each frame ?

f) What is VSAT? State its applications.

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

a) i) What is companding? What are its advantages in digital communication?

ii) What is TDM? Explain role of TDM in telephony.

b) i) Write a brief note on SDLC protocol.

ii) Compare ASK, FSK, PSK.

c) State different spread spectrum techniques. Explain any one of them in brief.

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

a) Explain need of RF amplifier in FM receiver.

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

c) With the help of mathematical analysis, prove that bandwidth of AM signal is twice the signal frequencies.

d) Explain the terms:

i) Equipment noise

ii) Atmospheric noise.

e) What is IrDA?

f) Explain QAM in brief.

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Total No. of Questions : 5]

SEAT No. : ____

P1230

[Total No. of Pages : 2

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M.Sc. - I

ELECTRONIC SCIENCE

EL 2 UT - 06 : Digital System Design Using VHDL

(2008 Pattern) (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.***

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

a) Explain different design flow steps for digital system design using VHDL.

b) List different operators in VHDL.

IF a = "00011000", b = "0110", c "00110001" then write result of following statements.

$x \Leftarrow$("0000"& (not b))or (c ror 2);

y $\Leftarrow$(a srl 1);

c) Compare procedure and function in VHDL. Write procedure bcd_ssd to convert 4-bit bcd number to seven segment code for common anode seven segment display. Write a call to this procedure in architecture of your VHDL code.

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

a) i) Design 2 to 4 priority encoder.

ii) Design two bit magnitude comparator.

b) Design one digit bcd adder to add two bcd numbers using 4-bit parallel adder.

c) i) Write VHDL code for 4 to 1 multiplexer using case, statement.

ii) Write VHDL code for 8 to 1 multiplexer using above 4 to 1 multiplexer as a component.

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

a) Design 4-bit binary to gray code converter.

b) Design half subtractor

P.T.O.

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

a) Write excitation table for JK Flip Flop. Design 3-bit synchronous up counter using JK Flip Flops?

b) Write VHDL code for stepper motor controller using FSM.

c) Explain with neat diagram 3-bit up-down ripple counter.

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

a) Explain with neat diagram bus organization for four processor registers.

b) What is programmable logic array? Draw block diagram of PLA. implement the following using PLA.
w (A, B, C) = Σm(l, 2, 4, 6)
w (A, B, C) =Σm(0, 1, 6, 7)
w (A, B, C) = Σm (2, 6)

c) Write VHDL code for 4-bit ALU.

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

a) Draw diagram of basic SRAM memory cell. Explain read and write operation in SRAM. Compare SRAM and DRAM.

b) Explain with neat diagram architecture of FPGA. Compare FPGA and CPLD.

c) Explain different types of ROM with reference to storage principle.

Total No. of Questions : 5]

SEAT No. : ____

P1231

[Total No. of Pages : 2

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M.Sc. - II

ELECTRONIC SCIENCE

EL 3 UT 05 : Embedded Systems

(2008 Pattern) (Semester-III)

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 different I/O ports and their functions for 8051 microcontroller.

b) Explain Rs232 communication standard. Explain with circuit diagram how 8051 can be interfaced to serial port of computer.

c) Explain in short software and hardware development tools used in embedded system development.

d) Explain with neat diagram program and data memory organization of AVR microcontroller.

e) Draw interfacing of stepper motor to PORTO. Write C program for 8051 to rotate stepper motor clockwise continiously.

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

a) List special function registers used in serial communication. Write C program for 8051 to display "SPPU PUNE" on hyper terminal, use 9600 Baud rate, XTAL = 11.0592 MHz.

b) Draw interfacing of 8-bit DAC 0808 to PORTO of 8051 micro controller. Write C program to generate triangular wave.

c) List features of on chip ADC of PIC microcontroller. Write ALP/C program for PIC microcontroller to read ADC channel O and display data on PORTD.

d) Draw interface of 8KB of RAM and 8KB of ROM to 8051. Write memory map.

e) Write a note on different methods of programming flash memory of microcontroller.

P.T.O.

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

a) Explain with block diagram timer O of PIC microcontroller. Write procedure to generate delay using Timer O.

b) Explain I 2 C communication protocol. Explain with timing diagram I 2 C write operation.

c) Explain addressing modes of AVR microcontroller with suitable examples.

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

a) Explain interrupt structure of 8051. Write C program using Timer O interrupt to generate 10 KHz square wave on P2.1. XTAL = 12MHz. Duty cycle = 50%.

b) Write Features of PIC microcontroller.

c) Write the steps to configure CCP module of PIC microcontroller for PWM generation. Find the values of PR2, CCPR1L and CCP1 CON <5:4> bits for 2.5 KHz PWM frequency with 75% duty cycle. Assume XTAL= 10 MHz. Prescaler =4.

d) Draw interfacing of 16×2 LCD to 8051. Write C program to display "INDIA" on First line.

e) Write short note on:

i) Watch Dog Timer

ii) SPI communication

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

a) Draw interfacing of two common anode seven segment displays to PORTC and PORTD of AVR microcontroller. Write C program for 2 digit BCD counter.

b) i) Explain with circuit diagram general purpose evaluation board for 8051. Show crystal connections power on reset circuit, interfacing of 8 LEDs to PORTO.

ii) State the advantages of using 'C' for 8051 programming state different ways to create delay in 8051 C programming. Explain the factors that affect delay size.

c) i) Explain different components of embedded system.

ii) Compare Harvard and Van-Neuman architecture.

Total No. of Questions : 5]

SEAT No. : ____

P1232

[Total No. of Pages : 2

[5438]-41

M.Sc. - II

ELECTRONIC SCIENCE

EL 4 UT-06 : Control Systems : Theory and Applications

(2008 Pattern) (Semester-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) ***Use of log table/calculator is allowed.***
4) ***Neat diagrams must be drawn wherever necessary.***

Q1) Solve any Two. **[2×8=16]**

a) Explain the concept of block diagram. What are its advantages and limitations? Explain critical rules for block diagram reduction.

b) i) Define transfer function. Explain its features and advantages.

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

c) i) Explain feedforward control mechanism.

ii) Explain derivative mode-what is its advantage and limitation?

Q2) Solve any two. **[2×8=16]**

a) i) Explain adaptive control strategy.

ii) Give at least eight symbols of elements used in PLC programming.

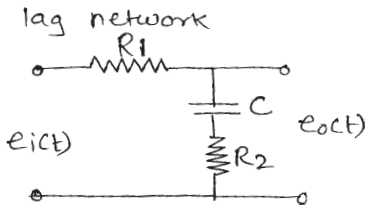
b) Explain the concept of stability. How can you predict stability of a control system from location of its closed loop poles in the S-Plane?

c) Define root locus. Explain angle and magnitude conditions. What is their use?

P.T.O.

Q3) Solve any Two : **[2×8=16]**

a) i) Obtain the transfer function of following lag network.



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

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

b) What is process loop tuning? Explain open loop transient response method for process loop tuning. What is the limitation of this method?

c) i) Explain the difference between conventional ladder logic and PLC ladder logic.

ii) What are the dumb programming terminals and smart or stand alone programming terminals?

Q4) Solve any Two: **[2×8=16]**

a) Give block diagram of PLC memory. How is application memory organized? Discuss memory map of Allen Bradley SLC 500 PLC.

b) Explain I/O interaction with input and output status files in PLC.

c) i) How is event sequence description obtained with the help of narrative statements? Explain it for bottle filing plant.

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

Q5) Solve any Four: **[4×4=16]**

a) Write short note on annunciator.

b) What is watch dog timer? What are its functions?

c) Explain the counter instruction (HSC).

d) How would you choose a correct PLC processor for a particular application?

e) Describe construction and working of solenoid.

f) Explain the use of laplace transform in control system analysis.