[5131]-11

M.Sc.

ELECTRONIC SCIENCE

EL1UT01 : Foundation of Semiconductor Devices

(2008 Pattern) (Semester - I)

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

Q1) Attempt any <u>two</u>:   **[2 × 8 = 16]**

   a)   Determine the time independent wave solution of a particle in infinite potential well.

   b)   Explain formation of allowed and forbidden energy bands in solids using energy level diagram.

   c)   Explain the operation of reverse biased P_n junction. Obtain relation for junction capacitance.

Q2) Attempt any two: **[2 × 8 = 16]**

   a)   What are the advantages of equivalent electrical models of BJT for circuit analysis? Explain any one model in detail.

   b)   How MESFET is different from JFET? Explain the basic operation of MESFET in detail.

   c)   Draw the cross-sectional view of various MOSFET structures, explain small signal equivalent circuit of common source n-channel MOSFET.

Q3) Attempt any <u>Four</u>:   **[4 × 4 = 16]**

   a)   Explain Heisenberg's uncertainty principle in short.

   b)   What is meant by extrinsic semiconductor? Discuss with example.

   c)   What is base width modulation in BJT?

   d)   Write a short note on shattkey barrier diode.

   e)   What are the frequency limitation factors on JFET.

Q4) Attempt any <u>Four</u>: [4 × 4 = 16]

a) Define miller indices. Sketch the following atomic planes in simple cubic structure;

   (1, 0, 0), (1, 1, 0), (1, 1, 1).

b) Obtain an Einstein relation $\dfrac{D_n}{\mu_n} = \dfrac{kT}{q}$.

c) Write a short note on Light emitting diode.

d) Explain the operation of TRIAC and draw i-v characteristics.

e) Differentiate between JFET and MOSFET.

Q5) Attempt any <u>Four</u>: [4 × 4 =16]

a) Calculate deBroglie wavelength of an electron travelling at velocity of 10^7cm/s.

b) How much percent of the permissible states at level $E = E_F + 0.5$eV is occupied if T = 0K and T = 100K?

c) Explain working of tunnel diode.

d) What is meant by MOSFET Scaling?

e) What is cut-off frequency and beta cut-off frequency? What is the relation between two?

☛ ☛ ☛

[5131]-12
M.Sc.
ELECTRONIC SCIENCE
EL1UT - 02: Analog Circuit Design and Analysis
(2008 Pattern) (Semester - 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 diagram wherever necessary.*
   4) *Use of log-table /non-programmable calculator is allowed.*

Q1) Attempt any two.

   a)   What do you mean by ideal current source? With neat diagram explain the working of widlar current source and wilson current source. **[8]**

   b)   Obtain the inverse laplace transformation for the given functions: **[8]**

   i) $F(s) = \dfrac{5s + 4}{(s-1)(s^2 + 2s + 5)}$

   ii) $F(s) = \dfrac{s - 3}{s^2 + 4s + 13}$

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

Q2) Attempt any two.

   a)   i)   Obtain Laplace transform of following **[4]**

   - sin3t

   - t^3

   ii)   Explain following terms associated with op-amp **[4]**

   - CMRR

   - Slew Rate

b) What is active Filter? State advantages of active filter over passive filter. Design second order highpass filter for a cut-off frequency of 1KHz and passband gain 4. **[8]**

c) i) Explain need of high power op-amp. What are the relevant parameters of a power op-amp? **[4]**

   ii) Explain the working of charge redistribution ADC. **[4]**

Q3) Attempt any two.

a) i) Explain the terms: Transfer function, pole and zero of a network. **[4]**

   ii) Explain working of weighted capacitor DAC. **[4]**

b) i) Explain the causes of instability in op-amp circuits. What are internal and external frequency compensation techniques? **[4]**

   ii) What is the need for a sample and hold circuit? Define aquisition and aperture time. **[4]**

c) i) Explain output stage of op-amp 741. **[4]**

   ii) What is the need for low power design? **[4]**

Q4) Attempt any two.

a) i) Design a m-derived low pass filter having cut-off frequency of 1KHz, design impedance of 400Ω and the resonant frequency 1100 Hz. **[4]**

   ii) Explain series RLC circuit in brief. **[4]**

b) i) Explain in brief the output current boosting techniques for general purpose op-amp with proper circuit diagram. **[4]**

   ii) Draw the circuit diagram of practical integrator circuit. Give designing steps of it. **[4]**

c) i) Explain specification of DAC convertor. **[4]**

   ii) Explain micropower design techniques. **[4]**

Q5) Attempt any four.

    a)   What is programmable op-amp? How its parameters can be programmed?

           [4]

    b)   Explain R-2R Ladder type D/A conversion techniques.   **[4]**

    c)   State applications of ADC'S and DAC'S.   **[4]**

    d)   What is peak defector? Explain working of peak detector circuit using op-amp.   **[4]**

    e)   Explain the working of Half wave precision rectifier circuit.   **[4]**

✿   ✿   ✿

[5131] - 13

M.Sc.

ELECTRONIC SCIENCE

ELIUT03: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 labeled diagrams wherever necessary.

   4)   Use of logarithmic table and non-programmable calculator is allowed.

Q1) a)   Answer any two of the following: **[2×6=12]**

     i)   Draw the block diagram of generalized measurement system. Explain signal manipulation element of it.

     ii)   Give detail classification of instruments with different methods of measurement.

     iii)   List the factors influencing the choice of transducer for the measurement of physical parameter.

   b)   Define the following: **[4]**

     i)   Sensitivity,

     ii)   Accuracy,

     iii)   Resolution and

     iv)   Precision.

Q2) a)   Answer any two of the following: **[2×6=12]**

     i)   Describe Voltmeter and Ammeter loading effect with suitable example.

     ii)   Give detail classification of transducers.

     iii)   State the dynamic characteristics of measurement system.A first order system used to measure signal with frequency context upto 100Hz with amplitude accuracy of 5%. Calculate maximum time constant and phase shift at 50Hz.

   b)   Give applications of LVDT. State advantages and disadvantages of LVDT.**[4]**

Q3) a)   Answer any two of the following: **[2×6=12]**

      i)   Describe working principle of capacitive, inductive and Resistive transducers with suitable example.

      ii)   Write different types of vaccum gages. Explain working principle of kundsen gage.

      iii)   With neat block diagram explain working of general telemetry system. State the types of telemetry systems.

  b)   State different methods of flow measurement. Explain the working principle of turbine flow meter.   **[4]**

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

  a)   Draw the following OPAMP circuits and write their OIP equations.

      i)   Differentiator,

      ii)   Schmitt Trigger,

      iii)   Trans-conductance amplifier and

      iv)   Instrumentation amplifier with three OPAMP.

  b)   With circuit block diagram explain voltage and current telemetry systems.

  c)   Describe working principle of DVM. How different ranges incorporated in DVM.

  d)   Describe different techniques used for magnetic recording. State advantages of FM type magnetic recording.

  e)   Draw the block diagram of sound Level Meter. Explain how it is used for sound pressure level measurement.

  f)   List the different types of strain gages. Derive an expression for gage factor of simple wire type strain gage.

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

  a)   List the temperature transducers. Explain the working principle of resistive temperature transducers.

  b)   A 10KΩ variable resistor has a linearity of 0.1% and the movement of contact arm is 320°. Determine the maximum position deviation in degree and resistance deviation in Ohm. If the instrument is to be used as a potentiometer with a linear scale of 0 to 1.6V. Determine the maximum voltage error.

c)   A compressive force is applied to a structural member.The strain is 5 microstrain.Two separate strain gages are attached to the structural member, one is nickel wire having gage factor of - 12.1 and other is nichrome wire with gage factor of 2. Calculate the value of resistance of the gages after they are strained.The unstrain resistance of the gages is $120\,\Omega$.

d)   A thermister has a resistance of $3980\,\Omega$ at the ice point. and $794\,\Omega$ at $50°C$. The resistance temperature relation is $R_T = aR_o e^{(b/t)}$. Calculate the constant a and b.Also calculate the range of resistance to be measured in case of the temperature varies from $40°C$ to $100°C$.

e)   A simple equal arm voltage sensitive bridge is initially balanced.Three arm consist of ordinary resistors and fourth one is thermistor.Each arm has nominal resistance of $10K\,\Omega$. The bridge is excited with σv dc source. If the temperature change causes a+5% change in thermistor resistance.What output voltage of the bridge? If a–5% change in resistance is caused. What will be the bridge output.

f)   A voltmeter is used to measure the voltage of a circuit. Having an output resistance of $1K\,\Omega$ and the open curcuit voltage is 6v at its 10v scale. Find the error in the measurement.

◉   ◉   ◉

[5131]-21
M.Sc.
ELECTRONIC SCIENCE
EL2-UT 04 : Applied Electromagnetics, RF and Microwave
(2008 Pattern) (Semester - II)

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

Instructions to the candidates:

1) All the question are Compulsory.

2) Figures to the right indicate full marks.

3) Draw neat diagrams wherever necessary.

4) Use of log tables / non-programmable calculators is allowed.

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

  a) What are retarded potentials? Obtain the expressions for retarded potentials.

  b) From Maxwell's equations, obtain wave equations in free space.

  c) What is Gunn effect? Draw the schematic diagram of an n-type GaAs diode. What are the modes of operation of a Gunn diode?

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

  a) From the first principles, obtain the expression for power radiated by a half - wave dipole.

  b) What is a Smithchart? What are its uses? State its important characteristics.

  c) Compare MESFET & MOSFET with reference to the structure, operating principles and applications.

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

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

  b) With the help of a neat diagram explain the working of a magnetron.

c) What are the different types of losses in microstriplines?

d) What is a cavity resonator? What is its use?

e) State Poynting theorem & explain the terms in its equation.

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

a) Define the following terms for an antenna:

i) Gain   ii) Directivity   iii) Aperture.

b) Write a short note on global positioning (GPS).

c) Write a short note on EMI. How can it be controlled?

d) Write a short note on optical waveguides.

e) How are antennas classified based on their structure?

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

a) A transmission line has the following parameters: R= 1Ω/m, G=1 m mho/m, f = 1 GHZ , L = 10 nH/m C=0.2 PF/m. Calculate the characteristic impedance.

b) A coplanar stripline carries a power of 300mW & peak current of 150mA. Determine the characteristic impedance of coplanar stripline.

c) A rectangular waveguide has dimensions of 8 cm × 4 cm and operates in TE_{10} mode. Find the cut-off frequency.

d) A loss-less line has characteristic impedance of 40Ω and has terminal impedance of 80Ω. The line is energised by a generator with output impedance of 50Ω and open circuit voltage of 30V(rms). Find the input impedance and reflection coefficient.

e) A transmission line has characteristic impedance of 60 + j0.35Ω and it is terminated in load impedance of 75 - j50Ω. Find the SWR.

ॐॐॐॐ

[5131]-22

M.Sc.

ElECTRONIC SCIENCE

EL2UT05 : 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)   Describe any two applications of ISDN in short.

b)   With reference to satellite communication, explain the terms uplink and cross link.

c)   With the help of neat diagram, explain the working of base neutralisation.

d)   Explain the working of very small aperture (VSAT) in short.

e)   With the help of circuit diagram, explain the working of diode detector.

f)   Describe any two signal encoding format in short.

Q2) Answer any TWO of the following.   **[2×8=16]**

a)   Draw the circuit diagram of RF tuned amplifier, write its working. Write the advantages and disadvantages of it.

b)   What is quadrature amplitude modulation (QAM)? With the help of diagram, explain the working of QAM (8 or 16).

c)   Draw the block diagram of super heterodyne receiver. Explain the working of each block in short.

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

    a)   With the help of diagram, explain the working of transponder.

    b)   Describe digital subscriber line (DSL) in short.

    c)   Draw the frame structure of SDLC. Explain the function of each field in short.

    d)   With the help of block diagram, explain the working of single side band (SSB).

    e)   Explain the working of automatic gain control circuit.

    f)   Describe the working of dialing system of telephone system.

Q4) Answer any TWO of the following. **[2×8=16]**

    a)   Draw the frame structure of XMODEM. Explain the function of each field of it. Write the importance of it.

    b)   With reference to pulse code modulation, explain the terms

        i)   Sample and hold.

        ii)   Quantisation.

        iii)   Quantisation noise.

        iv)   Encoding.

    c)   What is frequency division multiplexing (FDM)? Draw the block diagram of FDM. Describe its working. Write its advantages over TDM.

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

    a)   Describe any two applications of geostationary satellite.

    b)   For AM, prove that the power contained in the side bands is one third of the total power.

    c)   With the help of block diagram, explain the working of phase shift keying (PSK) modulator.

    d)   Describe the equipment and atmospheric noise in short.

    e)   Describe any one data compression technique in detail. Write the advantages of it in communication.

ζ ζ ζ

[5131]-23

M.Sc.- I
ELECTRONIC SCIENCE
EL2UT06: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.*
3) *Neat diagrams must be drawn wherever necessary.*

Q1) Attempt any two of the following:

a) What is entity in VHDL program. Explain process statement in VHDL and write a VHDL code for 4:1 multiplexer using process statement. **[8]**

b) Write short note on package and library with respect to their declaration, definition, syntax & example. **[8]**

c) What are variables, signals and constants in VHDL? Explain userdefined and predefined VHDL types for them. **[8]**

Q2) Attempt any two of the following :

a) Explain with circuit diagram a keyboard encoder, the key should be displayed till the next key is not pressed. **[8]**

b) Give the design of logic circuit of the processor unit. How will you combine logic arithmetic circuits to form ALU? Illustrate with block diagram. **[8]**

c) i) Implement the following using PLA

$F1= \Sigma m (1,2,4,7,8,11,12,13)$

$F2= \Sigma m (2,3,9,11)$

$F3= \Sigma m (10,12,13,14)$

$F4= \Sigma m(2,4,8)$ **[4]**

ii) Simplify $f(A,B,C,D)=\Sigma (1,2,3,5,7,11,13)$ using K-map. **[4]**

Q3) Attempt any two of the following:

   a)   Design 3 bit synchronous up counter using T-flipflops.   **[8]**

   b)   i)   Explain the following in brief.   **[4]**

            1)   Excitation table   2)   State table

            3)   State diagram   4)   Ripple counter.

        ii)   Draw the state diagram for D, J-K, T, R-S flipflops.   **[4]**

   c)   With proper state table and state diagram, write a VHDL code for traffic light controller using finite state machine(FSM).   **[8]**

Q4) Attempt any two of the following:

   a)   i)   Compare a D flipflop and a latch. Illustrate your answer with proper timing diagram.   **[4]**

        ii)   State the difference between static and dynamic RAM. Explain how data is written in SRAM.   **[4]**

   b)   i)   Define scratch pad memory. How is it different from main memory.**[4]**

        ii)   Write a VHDL code for 2:4 decoder.   **[4]**

   c)   i)   Write the difference between PLA & PAL.   **[4]**

        ii)   What is GAL? Implement $AC + B\overline{C} + \overline{A}BC$ using GAL 16V8 in simple mode.   **[4]**

Q5) Attempt any two of the following:

   a)   Draw and explain FPGA architecture in short.   **[8]**

   b)   i)   Design a 4-bit binary to gray converter using K-map.   **[4]**

        ii)   Write a VHDL code for 4 bit binary to gray converter.   **[4]**

   c)   What do you mean by synchronous counter. Write a VHDL code for 4 bit synchronous up counter.   **[8]**

<p align="center">❧⚜❧⚜</p>

[5131]-31

M.Sc. - II

ELECTRONIC SCIENCE

EL3 UT05 : 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 diagrams wherever necessary.*

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

a) Draw an interface of DC motor and a switch to 8051. Write an assembly/ 'C' program to rotate DC motor clockwise, if switch is closed, rotate it anticlockwise if switch is open.

b) What is an embedded system? Write differences between Microprocessor and microcontroller.

c) Explain the following:
   i) Compiler
   ii) Simulator

d) Explain status register of PIC Microcontroller.

e) Explain serial communication in 8051. Draw data frame used in asynchronous communication.

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

a) Explain interrupts of 8051.

b) Explain input output ports of 8051.

c) Describe watch dog timer.

d) Explain data and program memory organization of PIC Microcontroller.

e) Explain with example addressing modes of AVR microcontroller.

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

a)   Draw programming Model of 8051 and explain it in short.

b)   Draw an interfacing of stepper motor to 8051. Write an assembly / 'C' program to rotate stepper motor clockwise continuously.

c)   Draw and explain architecture of AVR Microcontroller.

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

a)   Write any four features of PIC 16F 877 microcontroller.

b)   Explain hardware development tools.

c)   Explain methods of time delay generation in embedded C for 8051.

d)   Write an assembly /'C' program to transmit "YES" string to computer with band rate 9600, one start bit and one stop bit. (For 8051).

e)   Explain different methods used to download HEX File in flash memory of Microcontroller.

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

a)   Explain harvard and Van-neuman architecture. Compare RISC and CISC processors.

b)   Write an assembly / 'C' program for AVR microcontroller to display "ELECTRONICS" on First line of LCD.

c)   Explain steps used in generation of PWM output using CCP module of PIC Microcontroller. Find values of registers PR2, CCPIRL, DCIB2 : DCIB1 to generate PWM of 1kHz with 75% duty cycle using CCP module. Use XTAL = 10 MHz.

☛   ☛   ☛

[5131]-41

M.Sc.

ELECTRONIC SCIENCE

EL4UT - 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 non-programmable calculator is allowed.

Q1) Solve any Two: **[2 × 8 = 16]**

    a)   Explain Zeigler - Nichols method for process loop tuning.

    b)   Discuss SCADA system in detail. What are its advantages. Give its applications

    c)   Explain any three data handling instructions for PLC.

Q2) Solve any Two: **[2 × 8 = 16]**

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

    b)   What is Proportional control mode? How offset error in P-mode can be reduced? How it can be implemented using opamp.

    c)   With the help of suitable diagrams and equations, explain any four rules or techniques of block diagram reduction.

Q3) Solve any four: **[4 × 4 = 16]**

    a)   Examine the stability of control system having characteristics equation:

$$s^8+5s^6+2s^4+3s^2+1=0$$

    using Routh's Method.

b) Define transfer function. obtain a transfer function for passive RC integrator circuit.

c) Explain three position controller action with the help of appropriate diagram

d) Explain angle and magnitude condition for a point to be on root locus.

e) List the major differences between a modular PLC and a fixed PLC.

.Q4) Solve any four: [4 × 4 = 16]

a) What is meant by single variable and multivariable alarms.

b) Design a PI controller with proportional band 30% and integral goin0.1%(%-s). The 4 to 20 mA input converts 0.4 to 2.0v signal and output to be 0 to 10v.

c) Explain Nyquist stability criterion for stability of control system.

d) What is PLC networking. Explain in brief.

e) Develop a ladder diagram for coffee vending machine.

Q5) Solve any Four: [4 × 4 = 16]

a) Compare open loop system with closed loop system with suitable example.

b) Define the terms; integral wind up and derivative over run.

c) Write a short note on soft PLC.

d) What is the need of feedback, feed forward and adaptive control in process control

e) Inverse Laplace transform of a system in time domain is e^{-5t}, It's input is i (t) = 2. Determine its output c(t).

❧❧❧❧