

Total No. of Questions : 5]

SEAT No. :

P2675

[5034]-11

[Total No. of Pages :3

M.Sc. I

ELECTRONIC SCIENCE

ELIUT01 : 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 side 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) What is ambipolar transport? Derive the ambipolar transport equation. State application of it.
- b) What is distribution function? Explain Fermi-Dirac probability function at absolute zero and higher temperature.
- c) Explain low frequency small signal two port equivalent circuit of BJT.

Q2) Attempt any two of the following:

[2 × 8 = 16]

- a) Define the following terms:
 - i) lattice
 - ii) basis
 - iii) primitive vector.

For a bcc lattice of identical atoms with a lattice constant of 5Å. Calculate maximum packing fraction and radius of atom. Assume atoms are hard spheres with nearest neighbours touching.

- b) Explain principle of LED with energy level diagram. Why specific materials are used in LED?
- c) Explain depletion mode and enhancement mode of MOSFETS. Show diagrammatically I_D - V_{DS} relationship for n-channel depletion mode MOSFET.

P.T.O.

Q3) Attempt any four of the following:

[4 × 4 = 16]

- a) Define Miller indices of crystal planes. What are its applications?
- b) Describe concept of excess carrier generation and recombination rate across a semiconductor.
- c) Explain concept of built in potential
 - i) under zero bias
 - ii) forward bias and
 - iii) reversed bias
- d) Explain construction and energy level diagram of HBT. What are its special feature over BJT?
- e) Explain the operation of MOS capacitor with suitable diagram.

Q4) Attempt any four of the following:

[4 × 4 = 16]

- a) Explain the position of Fermi-level in extrinsic semiconductor. Draw energy band diagram with suitable equations.
- b) Explain zener effect and avalanche effect in a reverse - biased pn junction.
- c) Explain SCR structure, obtain relationship for switching action of SCR using two - transistor equivalent model.
- d) Following are transistor parameters

$I_E = 1\text{mA}$, $\beta = 100$, $C_{je} = 1\text{ PF}$, total emitter to collector time delay $\tau_{ec} = 103.9\text{ PS}$ at $T = 300\text{ K}$

- Find :
- i) emitter resistance r_e
 - ii) cut off frequency f_T
 - iii) beta cutoff frequency f_β

Given $K = 8.62 \times 10^{-5}\text{ eV/k}$.

- e) Describe internal pinch off voltage and pinch off voltage of JFET, Give suitable mathematical relationships.

Q5) Attempt any four of the following:

[4 × 4 = 16]

- a) Calculate first three energy levels of an electron in an infinite depth potential well of width 6Å.

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

$$m_e = 9.11 \times 10^{-31} \text{ kg.}$$

- b) Explain concept of effective mass.
- c) Draw and explain I-V characteristic of a pn junction diode - obtain expression for ideal - diode equation of pn junction.
- d) Explain Eber-moll model for BJT with equivalent circuit diagram.
- e) Explain small-signal equivalent circuit for MOSFET amplifier. Obtain drain current relationship with V_{gs} .



Total No. of Questions : 5]

SEAT No. :

P2676

[5034]-12

[Total No. of Pages : 3

M.Sc.

ELECTRONIC SCIENCE

**EL1 UT0 2: 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) *Figure to the right indicate full marks.*
- 3) *Draw neat diagrams wherever necessary.*
- 4) *Use of log table/non-programmable calculator is allowed.*

Q1) Solve any Two:

- a) Obtain the inverse Laplace transformation for the given function

$$F(S) = \frac{s + 5}{s(s^2 + 2s + 5)}. \quad [8]$$

- b) Draw the block diagram of operational amplifier and explain function of each block in brief. [8]

- c) i) What is two port network? Explain what are its hybrid parameters. [4]

- ii) What are equalisers? Explain series equaliser in brief. [4]

Q2) Solve any Two:

- a) i) What is an ideal current source? Explain the Wilson current source. What is its advantage? [4]

- ii) Explain supply independent biasing. How it is achieved? [4]

- b) i) Obtain Laplace transform of following functions [4]

1) $f(t) = e^{-at}$

2) $f(t) = \cos wt$

P.T.O.

- ii) Draw pole - zero diagram of a network function [4]

$$F(s) = \frac{4(s+2)s}{(s+1)(s+3)}$$

- c) i) Explain following characteristics of operational amplifier [4]
- 1) Input bias current
 - 2) CMRR
 - 3) Differential and common mode input resistance.
- ii) Explain series RLC circuit in brief. [4]

Q3) Solve any TWO:

- a) Explain the working of a two op-amp practical log amplifier circuit. Obtain necessary equation. Explain temperature compensation technique. [8]
- b) i) With proper circuit diagram, explain R-2R Ladder in brief. [4]
- ii) A 4-bit DIA convertor of type R-2R ladder has digital inputs 1010 and 1110. If $V_{ref} = 5V$, $R_F = 1K\Omega$, $R = 5K\Omega$, Find output voltage for given digital inputs. [4]
- c) i) What is peak detector? With circuit diagram explain peak detector using op-amp. [4]
- ii) Derive an expression for Z-parameters in terms of Y-parameters. [4]

Q4) Solve any TWO:

- a) Explain the shielding and guarding techniques used in op-amp circuit design. [8]
- b) What is an active filter? State advantage of active filters over passive filters. Design 2nd order low pass filter for cut of frequency 1KHz and pass band gain 5. [8]
- c) Explain Σ to Δ converter in brief. [8]

Q5) Solve any Four:

- a) Explain in brief the output current boosting technique for a general purpose OPAMP with proper circuit diagram. **[4]**
- b) State applications of ADC's and DAC's. **[4]**
- c) What is programmable OPAMP? Which of its parameters can be programmed? How? **[4]**
- d) Explain with block diagram the working of successive approximation ADC. **[4]**
- e) Draw the practical integrator circuit diagram and explain practical design considerations of it. **[4]**



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SEAT No. :

P2677

[5034]-13

[Total No. of Pages : 3

M.Sc.

ELECTRONIC SCIENCE

**EL1UT03 : 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) Give the types of measurement systems. Describe any one type with suitable example.
- ii) What is static calibration? Give steps considered in performing static calibration.
- iii) Describe selection criteria of transducer for the measurement of given physical parameter. List the factors influencing the choice of transducer.

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

- i) Resolution
- ii) Precision
- iii) Hysteresis and
- iv) Threshold.

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

- i) What is loading effect? Explain voltmeter and Ammeter loading effect with suitable example.

P.T.O.

- ii) Describe the generalized mathematical model of measurement system. Give operational transfer function of measurement system.
 - iii) Explain zero-order instrument with suitable example.
- b) State the advantages and limitations of potentiometric transducer. [4]

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

- i) State different techniques used in flow measurement. Write working principle of -
 - 1) Hot wire anemometer and
 - 2) Ultrasonic flow meter.
- ii) State different methods (gages) used for vacuum measurement. Explain working principle of thermal conductivity gage.
- iii) Give different methods of data transmission. Explain with block diagram of general telemetry system. State different types of telemetry systems.

b) What is wave analyzer? Define the following terms - [4]

- i) VSWR
- ii) ISWR and
- iii) SWR

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

- a) Draw neat block diagram of basic strip chart recorder, explain different moving mechanisms used in it.
- b) Draw the following OPAMP circuits and write their out put equations.
 - i) Trans impedance amplifier
 - ii) Voltage follower with gain
 - iii) Zero crossing detector and
 - iv) Differential amplifier.

- c) A 6.25 mm long RTO with a steady gain of 0.3925°C and a time constant of 5.5 sec experiences a step change of 75°C in temperature. Before temperature change it has a stable 100Ω resistance. Write the time domain equation for resistance and find its value after 15 sec of the application of step input.
- d) Define absolute and relative error of measurement. A voltage has a true value of 7.5V. An analog instrument with scale range of 0-10V gives reading of 7.35V. What is the value of absolute error and correction? Express the error as a fraction of true value and FSD.
- e) Draw the neat block diagram of DFM. Explain frequency measurement mode in detail.
- f) Describe different methods used in magnetic recording. State their advantages.

Q5) Answer any four of the following:

[4 × 4 = 16]

- a) Describe DC signal conditioning system with neat block diagram.
- b) State different methods for measurement of unknown force. Explain the force measurement using bonded strain gage.
- c) List the temperature transducers. Explain thermocouple temperature transducer. State advantages of it.
- d) An amplifier is used to measure the output of LVDT whose gain is 250. The LVDT o/p is 2 mV when the core moves through a distance of 0.5mm. Calculate the sensitivity of LVDT and that of the whole setup.
The millivoltmeter scale has 100 divisions, the scale can be read to $\frac{1}{5}^{\text{th}}$ of a division. Calculate the resolution of the instrument in mm.
- e) Explain FDM and TDM methods of telemetry. State advantages of them.
- f) Describe advantages of digital indicating instruments over analog type.



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SEAT No. :

P2678

[5034]-21

[Total No. of Pages : 3

M.Sc. (Electronic Science)

**EL2 - UT04: APPLIED ELECTROMAGNETICS, RF & MICROWAVE
(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.*
- 4) *Use of log tables/non-programmable calculator is allowed.*

Q1) Attempt any two of the following:

[2 × 8 = 16]

- a) Obtain the expression for reflection coefficient for a uniform plane wave incident normally on the plane between two dielectrics. Hence find the transmission coefficient 'T'.
- b) Draw the elementary section of a transmission line and obtain the transmission line equations in voltage form and current form.
- c) Explain the structure and working of a tunnel diode with suitable energy band diagrams. Draw the I-V characteristics of the tunnel diode and explain the nature of characteristics.

Q2) Attempt any two of the following

[2 × 8 = 16]

- a) Describe, with proper diagrams, different methods of excitations of TE and TM modes in rectangular waveguides.
- b) Starting with Maxwell's equation, obtain the expression for poynting theorem in frequency domain.
- c) A lossy dielectric has intrinsic impedance of $100 \angle 60^\circ$ at a certain frequency ω . If the magnetic field component is

$$\vec{H} = 10e^{-\alpha x} \cos\left(\omega t - \frac{1}{2}x\right) \hat{a}_y \text{ A/m}, \text{ Find } \vec{E}, \alpha.$$

P.T.O.

Q3) Answer any four of the following:

[4 × 4 = 16]

- a) With a neat diagram explain the working of a reflex Klystron.
- b) Find the radiation resistance of a Hertzian dipole antenna if its length is $dl = \frac{\lambda}{10}$.
- c) Write a short note on patch antenna.
- d) How can an antenna be used to measure distant temperature?
- e) A certain Ga As MESFET has the following parameters : $g_m = 50 \text{ mmho}$
 $C_{gs} = 0.50 \text{ pF}$.

Determine its cutoff frequency.

Q4) Answer any four of the following:

[4 × 4 = 16]

- a) What is single stub matching? What is the procedure to do single stub matching?
- b) Describe the steps used in fabrication of MMIC.
- c) What do you mean by skin depth? Show that skin depth is $\delta = \sqrt{\frac{2}{\omega\mu\sigma}}$.
- d) If $\gamma = j\omega\mu(\sigma + j\omega\epsilon)$ and $\gamma = \alpha + j\beta$,
Find the expression for α and β .
- e) A plane - wave in a non-magnetic medium has $\beta = 2$. Find its ω and λ .

Q5) Answer any four of the following:

[4 × 4 = 16]

- a) An airfilled rectangular waveguide has dimensions 8×4 cm, and operates in dominant TE_{10} mode. Its cutoff frequency is 2.5 GHz. Find the phase velocity of the wave in the guide at a frequency of 4 GHz.
- b) Describe the process for determination of characteristic impedance of a given transmission line.
- c) What are cavity resonators? What is Q of a cavity? How can it be determined?
- d) A loss less transmission line has inductance per unit length of $1\mu\text{H/m}$ and capacitance per unit length of 10PF/m . Find its characteristic impedance.
- e) A transmission line has reflection coefficient of $0.35 \angle -15^\circ$ Find the standing wave ratio.



Total No. of Questions : 5]

SEAT No. :

P2679

[5034]-22

[Total No. of Pages :2

M.Sc.

ELECTRONIC SCIENCE

EL2 UT-0 5: 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) Answer any four of the following

[4 × 4 = 16]

- a) With the help of diagram, explain the working of FM generation using Varactor diode.
- b) Draw the structure of HDLC. Explain each field of it in short.
- c) Explain the terms selectivity of the receiver and image frequency in short.
- d) Write short note on error detection and error correction.
- e) What is wide band amplifier? Describe any two applications of it.
- f) What is noise figure? Explain its importance in communication system.

Q2) Answer any TWO of the following:

[2 × 8 = 16]

- a) What is pulse code modulation (PCM)? Draw the block diagram of it and explain its working.
- b) What is time division multiplexing? With the help of neat block diagram, explain its working. Write its advantages and disadvantages.
- c) Draw the circuit diagram of balanced modulator. Write its working. Draw and explain the graphical characteristics of it.

P.T.O.

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

- a) List the transmission media. With the help of diagram, explain any one of them.
- b) Explain the sampling theorem and write the importance of it in communication.
- c) Describe internal and external noise in short.
- d) With the help of diagram, explain the working of RF tuned amplifier.
- e) Explain the role of limiter in FM receivers.
- f) With the help of block diagram, write the working of frequency shift keying. (FSK)

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

- a) What is delta modulation? With the help of neat diagram, explain the working of adaptive delta modulation. Write the advantages of adaptive over delta modulation.
- b) Draw the architecture of ISDN. Explain the function of each block/component in short. Describe any one application of ISDN in detail.
- c) Draw the block diagram of high level amplitude modulation transmitter. Explain the working of each block in short.

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

- a) Describe typical data communication link with special reference to DTE and DCE.
- b) Explain the local loop of land line telephone in short.
- c) With the help of diagram, explain the working of collector neutralisation.
- d) Write the mathematical analysis of amplitude modulator. Write any two advantages of FM over AM.
- e) With reference to bluetooth technology, explain the terms piconet and scatternet in short.



Total No. of Questions : 5]

SEAT No. :

P2680

[5034]-23

[Total No. of Pages : 3

M.Sc. - I

ELECTRONIC SCIENCE

**EL2 - UT0 6 : Digital System Design Using VHDL
(2008 Pattern) (Semester - II)**

Time : 3 Hours]

[Max. Marks : 80

Instructions to 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 procedure in VHDL? Write Syntax for defining a procedure. Write a procedure to add two 4-bit numbers and a carry and returns 4-bit sum and a carry. **[8]**
- b) Explain different types of ROM with special reference to data storage principle of any one. **[8]**
- c) Design an automobile alarm system that detects status of door, the ignition, the seat belts, the head lights. An alarm should be switched 'ON' when **[8]**
 - i) If the head lights are ON while ignition is off.
 - ii) The door is open while ignition is ON.
 - iii) The seat belts are not fastened when ignition ON.

Q2) Attempt any two of the following:

- a)
 - i) Compare a signal and a variable in VHDL with reference to their declaration, assignment, scope and behaviour. **[4]**
 - ii) Write a VHDL code for full adder using behavioral modelling. **[4]**

P.T.O.

- b) A combinational circuit is defined by [8]

$$F1 = \Sigma m(3,5,7)$$

$$F2 = \Sigma m(4,5,7,)$$

Implement the circuit with PLA having 3 inputs, three product terms and two outputs.

- c) Design a synchronous counter to generate the following sequence 0,2,4,5,0..... using T-flip-flops. [8]

Give all steps involved in design and draw the final hardware diagram.

Q3) Attempt any two of the following

- a) Explain in detail different classes of VHDL operators. Which operators have highest precedence?

If A = "110", B = "111", and C = "011000" then write a result of the following statements. [8]

- i) ((A and (not B)) OR (C ROR 2))
ii) A Srl 3

- b) Explain with block diagram CPLD, also explain with diagram typical macrocell of CPLD. [8]
- c) Write down VHDL code for ALU having four arithmetic and four logical operations. [8]

Q4) Attempt any two of the following:

- a) Draw the circuit diagram of bipolar static RAM cell. Draw timing diagram of read cycle of static RAM. Define memory access time and complete read cycle time of RAM. [8]
- b) What do you mean by parity? Design an even parity generating circuit for three bit data using k-map. Write VHDL code for even parity generator for seven bit data. [8]

- c) What is FSM? What are types of FSM? Write VHDL code using FSM for decade up counter. [8]

Q5) Attempt any two of the following

- a) Design a four bit parallel adder using full adders. Explain look ahead carry generator. [8]
- b) i) Write a VHDL code for full adder. [4]
- ii) Write a VHDL code for four bit parallel adder using module defined in (i) as a component. [4]
- c) Write a VHDL code for four-bit binary up/down counter using process. [8]



Total No. of Questions : 5]

SEAT No. :

P2681

[5034]-31

[Total No. of Pages : 2

M.Sc. - II

ELECTRONIC SCIENCE

EL3 - 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 diagrams wherever necessary.*

Q1) Attempt any four of the following.

[4 × 4 = 16]

- a) Write an assembly/'C' program to rotate stepper motor clockwise continuously. (For 8051).
- b) Explain program status word (PSW) of 8051.
- c) Draw an interfacing of DC motor to 8051. Write an assembly/ 'C' program to rotate it clockwise and anticlock wise with some delay before change of direction.
- d) Explain timer 0 for PIC micro controller. Write delay function in C to generate 1 sec. delay.
- e) Write short note on programmer as hardware development tool.

Q2) Attempt any FOUR of the following:

[4 × 4 = 16]

- a) Explain TMOD register of 8051.
- b) Explain serial communication in 8051.
- c) Explain logic analyzer and general purpose evaluation boards.
- d) Explain port registers of PIC microcontroller.
- e) Write an assembly 'C' program for AVR.

Micro controller to generate RAMP wave using DAC.

P.T.O.

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

- a) Explain with neat schematic diagram, 8051 target board. List the components used in designing target board.
- b) Draw an inter facing of 4 × 4 matrix keyboard to 8051. Write a procedure to read a key.
- c) Explain with neat diagram architecture of AVR microcontroller.

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

- a) Explain interrupts in AVR microcontroller.
- b) Write an assembly/'C' program for PIC microcontoller to generate sequence wave on a pin of PORTB.
- c) Write an assembly/'C' program for AVR microcontroller to convert ASCII digits '4' and '7' to packed BCD and display it an PORTB.
- d) Write an assembly/'C' program that continiously gets 8-bit data from PO and send it to P1, While simulteneously generating 5KHz square wave of 50% duty cycle on pin P2.1. Assume XTAL = 11.0592 MHz.
- e) Explain -Linker and compiler.

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

- a) Explain with example addressing modes of 8051.
- b) Write an assembly/'C' program to display "M.Sc." on first line of LCD. (For PIC microcontroller).
- c) Write short note on
 - i) I2C
 - ii) SPI



Total No. of Questions : 5]

SEAT No. :

P2682

[5034]-41

[Total No. of Pages : 2

M.Sc. (Electronic Science)

**EL4UT - 06 : CONTROL SYSTEMS THEORY AND APPLICATION
(2008 Pattern) (Semester - IV)**

Time : 3 Hours]

[Max. Marks : 80

Instructions to the candidates:

- 1) *All questions are compulsory.*
- 2) *Figures to the right indicates full marks.*
- 3) *Use of non-programmable calculator is allowed.*

Q1) Solve any TWO

[2 × 8 = 16]

- a) Giving a neat diagram explain feedback control system. Discuss each block function in detail.
- b) What is block diagram? How it can be used for the analysis of control system? Explain any four rules of block diagram reduction.
- c) Explain frequency response method of control system analysis.

Q2) Solve any TWO

[2 × 8 = 16]

- a) What is PLC processor scanning? Explain the program sweep for series go-30 PLC.
- b) What is meant by PID control mode? How it can be implemented using opamp. List the applications of PID control.
- c) Draw the block diagram of PLC architecture and explain each block of PLC. Why isolation is used to input and output blocks?

Q3) Solve any Four

[4 × 4 = 16]

- a) For $G(s) = \frac{K}{s(s+4)}$, test a point $s = -2 + j5$ for its existence on root locus and find the value of K.
- b) Evaluate the stability of control system having following characteristics equation
 $s^5 + s^4 + 2s^3 + 2s^2 + 3s + 15 = 0$

P.T.O.

- c) Write a short note on annunciator.
- d) Explain the operation of synchro-servo motor.
- e) What is meant by quarter amplitude criterion? Discuss in short.

Q4) Solve any Four **[4 × 4 = 16]**

- a) Explain the working of ON-OFF controller using LM 35 temperature sensor.
- b) Justify “Traffic signal system is open loop system”.
- c) Explain the terms control lag and dead time in process control application.
- d) State the advantages and disadvantages of Nyquist plot method.
- e) Draw a ladder diagram to realize two input EX-OR Gate.

Q5) Solve any Four **[4 × 4 = 16]**

- a) Compare Continuous Control and discrete state control with suitable example.
- b) Explain the nature of bodeplot for
 - i) Poles at origin
 - ii) Simple Pole and
 - iii) Simple zero
- c) An integral controller is used for speed control with a set point 12 rpm with range of 10 to 15 rpm. Initial controller output is 22%. The constant $K_I = -0.15\%$ Controller output per second per percentage error. If speed jumps to 13.5 rpm, calculate the controller. Output after z seconds for constant ep. where K_I is integral gain and e_p is error.
- d) Describe OFF_delay timer instruction of PLC.
- e) Write a short note on solenoid.

