Total No. of Questions : 5] **[Total No. of Pages : 2**

P1265

[3629]- 1
M.Sc.
ELECTRONIC SCIENCE
EL1 UT01 - : Principle of Semiconductor Devices
(Sem. - I) (2004 Pattern)

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

Instructions to the candidates:

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

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

a) Differentiate between metals, semiconductors and insulators on the basis of energy band diagrams.

b) Mathematically discuss position of Fermi level for n-type and p-type semiconductor. Comment on variation of E_F with doping concentration and temparature.

c) Draw a cross section of a conventional integrated circuit npn BJT. Explain basic principle of operation of transistor.

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

a) How bonds of allowed and forbidden energies are formed in crystal? Discuss with appropriate diagrams.

b) Discuss reverse bias generation current in p-n diode. Obtain the relation for ideal total reverse bias current density.

c) Describe internal pinch-off voltage and pinch-off voltage with necessary diagram and mathematical equations in case of JFET.

Q3) Solve any four : **[4 × 4 = 16]**

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

b) Explain variation of fermi energy, E_F with doping concentration and temperature.

c) Explain the physical mechanism of diffusion capacitance.

d) Explain hybrid-pi equivalent circuit of BJT.

P.T.O.

e) Consider a silicon and assume that incident wavelength, $\lambda = 1.00\ \mu m$. At this wavelength, the absorption coefficient for silicon is 100. Calculate the thickness of semiconductor that will absorb 90% of incident photon energy.

Q4) Solve <u>any four</u> : **[4 × 4 = 16]**

a) Consider an electron in an infinite potential well of width $5A^o$. Calculate first three energy levels of an electron in infinite potential well.

b) What is effective mass? State its importance in semiconductor.

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

d) Explain metal-semiconductor work function difference with the help of diagram.

e) Consider the interface between GaAs and air calculate

i) Reflection coefficient, Γ and

ii) Critical angle, θ_c, at GaAs - air interface. Index of refraction for GaAs is 3.66.

Q5) Solve <u>any four</u> : **[4 × 4 = 16]**

a) Describe the procedure for finding volume density of atoms in a crystal.

b) Assuming Boltzmann approximation, obtain relation for n_o and p_o in terms of fermi energy.

c) Write a short note on MOS technology.

d) Describe substrate bias effects on threshold voltage of MOSFET.

e) Consider GaAs at temperature 300K. Assume photon intensity at a particular point is $I_\vartheta\ (u) = 0.05\ W/cm^2$ at a wavelength $\lambda = 0.75\ \mu m$. At this wavelength, absorption coefficient for GaAs is $\alpha = 0.7 \times 10^4\ cm^{-1}$. Calculate generation rate of electron-hole pairs.

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Total No. of Questions : 5] **[Total No. of Pages : 2**

P1266

[3629]- 2
M.Sc.
ELECTRONIC SCIENCE
EL1 UT02 - : Analog Circuits : Design and Analysis
(2004 Pattern) (Sem.-I)

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

Instructions to the candidates:

1) ***All questions are compulsory.***
2) ***Draw neat diagrams wherever necessary.***
3) ***Figures to the right indicate full marks.***

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

a) List the design process steps of electronic system. Explain any two of them in short.

b) Draw the circuit of peak detector. Write its working.

c) Explain any four parameters of op-amp in short.

d) Draw and explain low frequency equivalent circuit of a common drain FET amplifier.

e) Explain the effect of negative feedback on frequency response and distortion.

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

a) Draw a common emitter amplifier circuit, and ac equivalent circuit. Explain the designing steps of common emitter BJT amplifier.

b) i) What is synchronous and stagger tuning?
ii) Explain narrow band approximation in the design of tuned amplifier.

c) i) Explain the working of switched capacitor resistor.
ii) Draw any one circuit of variable shift clamper. Explain its working.

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

a) Draw low frequency ac equivalent circuit of a common emitter BJT amplifier and derive the expression for break frequencies.

b) Write the advantages and disadvantages of active filter over passive. Draw and explain the ideal and practical filter characteristics of LPF, HPF, and band reject filter.

P.T.O.

c) i) Draw the circuit of quadrature oscillator and explain it in short.
ii) Draw the circuit of integrator using op-amp. Derive the expression for output voltage in time domain.

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

a) Describe the step response for a wideband amplifier.

b) What is an ideal current source. Draw and explain the working of Wilson current source.

c) Explain the working of Wien bridge oscillator in short.

d) Draw the block diagram of any two types of feedback configurations and explain them in short.

e) Explain the working of Butterworth second order low pass filter.

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

a) Describe any two methods to improve rise time response without loss of gain for amplifier.

b) Design a three op-amp instrumentation amplifier for a gain of 50. Which parameter decide its common mode performance.

c) i) Explain the low frequency ac model of practical diode.
ii) Draw and explain the working of phase shift oscillator using op-amp.

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Total No. of Questions : 5] **[Total No. of Pages : 2**

P349

[3629]-21
M.Sc.
ELECTRONIC SCIENCE
EL2 UT 03 : Applied Electromagnetics, RF, Microwave
(Old Course) (Semester - II)

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

Instructions to the candidates:

1) ***All questions are compulsory.***
2) ***Use of non-programmable calculator is allowed.***
3) ***Draw a neat diagrams wherever necessary.***

Q1) Solve any two : **[8 × 2 = 16]**

a) A plane electromagnetic wave is incident normally on plane boundary between the dielectric media with no surface charge density and surface current density. Obtain the expression for reflection coefficient and transmission coefficient.

b) Define reflection coefficient and transmission coefficient. Establish the relationship between the two in the case of two wire transmission line.

c) Describe the phenomenon of negative resistance region of Gunn diode. State the different modes of operation of Gunn diode.

Q2) Solve any two : **[8 × 2 = 16]**

a) What are end fire antennas? With the help of neat diagrams explain at least three types of end fire antennas? Which antenna is used for space communication.

b) Draw a schematic of cylindrical magnetron and explain its operating principle in detail.

c) What are microwave circulators? Explain with diagram how can 4-port circulator be constructed using magic tee and phase shifters or gyrator. Explain the working of the same.

P.T.O.

Q3) Write a short notes on any four of the following : **[4 × 4 = 16]**

a) Retinal optical fibre.

b) Termination schemes in high speed digital systems.

c) RF plasma etching.

d) Modified Ampere's law.

e) Retarded potential.

Q4) Solve any four : **[4 × 4 = 16]**

a) Determine the directivity of
   i) isotropic antenna and
   ii) short dipole antenna

b) Describe the different types of losses in microstriplines.

c) What is electromagnetic bone healing? Explain in short.

d) Define at least four antenna parameters.

e) How different modes can be excited in circular wave guides.

Q5) Solve any four : **[4 × 4 = 16]**

a) A transmission line has the following parameters:
   R = 2 Ω/m, G = 0.5 mmho/m, f = 1 GHz, L = 8nH, C = 0.23 pF

   Calculate :
   i) Characteristics impedance
   ii) Propagation constant.

b) Give the applications of microwave in its various frequency bands.

c) List the advantages and disadvantages of GaAs MOSFETs with those of Silicon MOSFETs.

d) Discuss Power-frequency limitations of microwave power transistors.

e) Obtain an expression for "Brewster angle". Explain its significance.

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Total No. of Questions : 5] **[Total No. of Pages : 2**

P350

[3629]-22
M.Sc. - I
ELECTRONIC SCIENCE
EL2 UT 04 : Design and Implementation of Digital Circuits
(Old) (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 : **[16]**

a) What do you mean by parity? Design a parity generator circuit to add an eight bit to 7 bit word with even parity. Show that how it operate if 7 bit word is 1001111.

b) Design a BCD to Gray code converter using decoder and logic gates.

c) What is parallel adder? Name a 4 bit integrated circuit used as parallel adder. What is look ahead carry in parallel adder? How does it speed up the addition?

Q2) Attempt any Two : **[16]**

a) Design a counter to generate sequence 0, 2, 4, 5, 0 ..... and repeat.

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

c) Draw the block diagram of coffee rending machine. Explain the steps of designing.

Q3) Attempt any TWO : **[16]**

a) Draw the block diagram of processor registers and ALU connected through common bus and explain its design in brief.

b) What is PLD and CPLD? Explain with the help of suitable example.

c) Explain PLA and state various applications of PLA. Discuss any one in brief.

P.T.O.

Q4) Attempt any TWO : **[16]**

a) Draw any configurable logic block of FPGA and discuss it in brief.

b) Discuss read operation of static RAM. Explain timing parameters associated with it.

c) What is ROM? Discuss data storage principle of various types of ROMS.

Q5) Attempt any TWO : **[16]**

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

b) Explain data flow and structural modeling in VHDL.

c) Write VHDL code for 4 to 1, 8 bit multiplexer using

i) Conditional assignment statement.
ii) Using case statement.

Total No. of Questions : 5] **[Total No. of Pages : 2**

P351

[3629]-23
M.Sc.
ELECTRONIC SCIENCE
EL2 UOT03 : Communication Electronics
(Old Course) (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 and labelled diagrams wherever necessary.***

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

a) What are types of noise? Which are the physical sources of random noise?

b) What are merits and demerits of amplitude modulation? Which are suitable applications of AM?

c) Describe voltage controlled modulator.

d) Draw and explain simple data communication system by telephone line.

e) Explain telemetry with block diagram. How is it advantageous?

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

a) Draw the block diagram of commercial FM radio receiver and explain the working of each block.

b) Describe pulse width modulation of an sine wave with triangular wave generation. Draw the necessary wave forms.

c) Describe with block diagram a single channel transponder in communication satellite.

Q3) Solve any two : **[2 × 8 = 16]**

a) What is modem? Write short notes on telephone modem and cable modem.

b) What are the advantages of SSB Amplitude modulated transmission? Explain the phase-shift method of SSB AM generation.

P.T.O.

c) Draw the block diagram of communication system. Explain the basic elements in it.

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

a) Explain the function of antenna in receiver. List popular antennas.

b) Distinguish between analogue exchange and digital exchange.

c) Describe Foster and Seeley phase discriminator for FM detection.

d) Discuss the advantages and disadvantages of digital communication with analogue communication.

e) Find the lock range and capture range for a PLL using f_o = 10.7 MHz, R_o = 1.8K, R_f = 2.2K (Filter resistance).
V_{cc} = 12V, C_f = 0.0047 μF. (Filter capacitance)

Q5) Solve any four : **[4 × 4 = 16]**

a) Explain the Digital Subscriber Line (DSL) and its types.

b) Explain the basic principle of ISDN and types of connections to the network provided by it.

c) Explain the diode type balanced modulator used for suppressing the carrier.

d) Write short note on digital T_1 carrier.

e) Calculate modulation factor and % modulation with data : E_{max}(pp) = 77V. E_{min}(pp) = 37V. Also calculate

i) Carrier voltage E_c

ii) Message signal voltage.

Total No. of Questions : 5] **[Total No. of Pages : 2**

P351

[3629]-23
M.Sc. - I
ELECTRONIC SCIENCE
EL2 UOT04 : Instrumentation
(Old Course) (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) Explain the significance of accuracy, precision and resolution in a measurement system.

b) List basic requirements of a transducer. Explain any two in detail.

c) What is the effect of electric current on human body? Explain microcurrent shock in brief.

d) Draw schematic block diagram of a heterodyne spectrum analyzer. Explain it in brief.

e) Write short note on soil salinity tester.

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

a) Explain with diagram capacitive transducer used for pressure measurement. State advantages and disadvantages of this transducer.

b) A digital voltmeter of range 100 μV to 100 mV has logarithmic conversion gain 1 volt/decade. If there is 1% change in the input from 100 mV to 101 mV, find out output change voltage at log amplifier.

c) In a medical Defibrillator device when a 70 μF capacitor is charged to 5000 volts, find out energy stored in capacitor and power of pulse in 8 ms sent towards victim.

d) Draw circuit of series and shunt type Q meter. Explain working of any one in brief.

e) Discuss use of wave form generator as an excitation source in testing of electronic measuring system.

P.T.O.

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

a) Explain the principle of X-Y recorder. Differentiate between strip chart recorder and X-Y recorder.

b) List laboratory methods to determine moisture content in grains. Explain any one method in brief.

c) Discuss the performance characteristics of LVDT. State applications of LVDT.

d) Why signal conditioning is necessary in electronic measurement system? State different types of signal conditioning and explain any one in detail.

e) What is pH of a solution? Explain pH measurement by using glass electrode method.

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

a) What are filter circuits? State advantages of active filters. How we achieve all the responses from universal active filter?

b) A platinum resistance thermometer has a resistance of 120 ohm at 20ºC. Calculate -

i) The resistance at 50ºC,

ii) Temperature if resistance is 100 ohm.
(Given :- α for platinum is 0.0039/ºC)

c) Define actuators. Explain with one example magnetic relay as an actuator.

d) Explain the working of boot strapped circuit. State its application in instrumentation system.

e) Discuss dynamic accuracy for First order and Second order instruments.

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

a) Define absolute and relative humidity. Explain method to measure relative humidity.

b) Discuss in brief electrical safety of medical equipments.

c) Explain basic principles of flame photometry. State limitations of it.

d) What are wave analyzers and spectrum analyzers? Explain their use in instrumentation system design.

e) Draw functional block diagram of Digital Storage Oscilloscope. Explain the memory block in it.

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Total No. of Questions : 5] **[Total No. of Pages : 2**

P352

[3629]-201
M.Sc. - I
ELECTRONIC SCIENCE
EL2 UT04 : Applied Electromagnetics, RF and Microwave
(New 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 necessary diagram, wherever necessary.***
4) ***Log- book/Calculator is allowed.***

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

a) Obtain field equations for TE wave propagating through rectangular wave guides. If the wave guide is filled with ferrite, which type of modifications are required?

b) Starting with Maxwell's equations, obtain an expression for intrinsic impedance of a medium. Explain the importance of intrinsic impedance of free space in wireless communication.

c) Explain the classification/type of antennas. Discuss horn antenna with respect to directivity, band width and field pattern.

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

a) Obtain an expression for cutoff frequency of a rectangular wave guide.

b) Explain the different basic parameters of an antenna. Which of the parameters plays an important role in designing of the antenna.

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

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

a) State Poynting Vector Theorem. Explain the physical significance of Poynting Vector.

b) Write a short note on double stub matching.

P.T.O.

c) Explain the concept of vector potential. Why is it introduced? State its usefulness with example.

d) Explain in short with a case study, the effect of CD player on navigation system of an airplane.

e) Write a short note on Reflex Klystron.

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

a) Show that the Skin depth is given by $\delta = \sqrt{\frac{2}{\omega\mu\sigma}}$

b) Write short note on Smith Chart.

c) Define characteristic impedance of a transmission line in connection with open circuit and short circuit impedances.

A co-axial line has an open circuit $Z_{oc} = 150 \angle 25° \Omega$ and short circuit $Z_{sc} = 37.5 \angle -35° \Omega$. Find the characteristic impedance of this line.

d) Write a short note on Patch Antenna.

e) Explain in brief RF heating.

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

a) Discuss in brief the principle of operation and construction of optical wave guide.

b) Write a short note on retarded potential.

c) What is series Tee? Explain in short.

d) Explain in brief terminator and ferrite attenuator.

e) A fiber glass circuit board has effective relative permitivity of 4.5 unit. Estimate the velocity of propagation and propagation delay of the lines rounded by a dielectric material with relative permitivity $\in_r$.

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Total No. of Questions : 5] **[Total No. of Pages : 2**

P353

[3629]-202
M.Sc.
ELECTRONIC SCIENCE
EL2UT05 : Communication Electronics
(2008 Pattern) (New Course) (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) State sampling theorem. Explain the important points about it in short.

b) Write the mathematical analysis of amplitude modulation and comment on the bandwidth of signal.

c) Explain any one neutralisation method in short.

d) Explain the working of pulse amplitude modulation in short.

e) Explain the working of typical data communication link with special reference to DTE and DCE.

f) With the help of diagram, explain the working of local loop of landline telephone.

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

a) i) Draw and explain the working of tuned RF amplifier.
ii) Explain the working of slope detector.

b) Explain the concept of delta modulation. With the help of diagram explain adaptative delta modulation working in detail.

c) With the help of diagram explain the working of FSK modulator and detector in short.

P.T.O.

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

a) Describe the internal and external noise in short.

b) Explain the working of superhetrodyne receiver.

c) With the help of neat diagram explain the working of FDM in short.

d) Draw a basic format of SDLC and write the significance of each field in short.

e) Explain the terms uplink, downlink, crosslink and propagation delay with reference to satellite communication.

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

a) Explain the following term with reference to PCM.
   i) Quantisation.
   ii) Quantisation noise.
   iii) Componding.
   iv) Encoding.

b) Write the importance of XMODEM protocol. Draw the frame structure of XMODEM and explain it in short.

c) What is ISDN? Explain any two applications of it. Write the features of ISDN services in short.

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

a) Explain the working of reactance modulator.

b) Write short note on image frequency rejection.

c) Explain any one method of error detection/correction in digital communication.

d) Comment "bit oriented protocols are popular than character oriented".

e) What is VSAT? Describe its application.

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P354

[3629]-203
M.Sc.
ELECTRONIC SCIENCE
EL2 UT06 : 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 : **[16]**

a) What is VHDL? Write structural description of 4-bit adder. Explain its simulation.

b) Using K-map simplification design BCD to seven segment decoder for common anode using 4 : 16 decoder.

c) Using JK Flip Flops implement the circuit to have the counting sequence 1, 3, 0, 5, 2, 7, 9.

Q2) Attempt any TWO of the following : **[16]**

a) What is a processor? Explain in detail processor organization and bus organization.

b) Compare amongst PROM, EPROM and E^2PROM with reference to principle of programming and data erase technique.

c) What is an encoder? Design octal to binary encoder. Explain its truth table.

Q3) Attempt any TWO of the following : **[16]**

a) What is boundary scan? Why it is needed? Explain basic boundary scan architecture.

b) How to declare one dimensional and multi dimensional array in VHDL. Explain unconstrained array type.

P.T.O.

c) What is a register in digital system? How they are specified for interregister data transfer? Explain hardware implementation to transfer data from register 'B' to register 'A'.

Q4) Attempt any TWO of the following : **[16]**

a) Design a multiplier for unsigned binary numbers. Explain it with proper stategraph and block diagram.

b) Design a telephone keypad scanner using PLD. Assume 12 keys including 0 to 9, $*$, #. Draw the necessary stategraph for it.

c) List the types of RAM. Explain Flash memory in detail.

Q5) Attempt any TWO of the following : **[16]**

a) Explain functions and procedures in VHDL.

b) Implement the following function using PLA.

$$A(x, y, z) = \sum m(1, 2, 4, 6)$$
$$B(x, y, z) = \sum m(0, 1, 6, 7)$$
$$C(x, y, z) = \sum m(2, 6)$$

c) Draw function architecture of FPGA. Explain the method of designing a digital system with FPGA.

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Total No. of Questions : 5] **[Total No. of Pages : 2**

P355

[3629]-401
M.Sc.
ELECTRONIC SCIENCE
EL4 UT 06 : Control Systems: Theory and Applications
(New Course) (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) ***Neat diagrams must be drawn wherever necessary.***

Q1) Solve any <u>two</u> :

a) In connection with a feedback control system explain the following terms. **[8]**

– Process load– Process lag– Control lag
– Self regulation– Process loop tuning

b) i) Elaborate the role of Laplace transforms in analysis of control systems. **[4]**

ii) Give the procedure for determination of transfer function of a control system. **[4]**

c) i) Explain the concept of stability of a control system. **[4]**

ii) Transfer function of a system is given by

$$T(s)=\frac{(s+5)}{s(s+3)(s+4)(s^2+7s+12)}$$

Determine poles, zeroes, characteristic equation and pole-zero plot in s–plane. **[4]**

Q2) Solve any <u>two</u> :

a) How can the Bode plots be used to predict stability? How are the system Bode plots affected by proportional, integral and derivative modes? **[8]**

b) i) What is root locus? What are angle and magnitude conditions? **[4]**

ii) What are the advantages of Routh's criterian? **[4]**

c) Explain the rules for block diagram reduction. **[8]**

P.T.O.

Q3) Solve any <u>two</u> :

a) Explain the principle of ON-OFF control. Give the design of a circuit for ON-OFF controller. State its applications. **[8]**

b) Giving a block diagram explain the working of PLC. How is PLC memory organised? **[8]**

c) i) Explain proportional control mode. What is offset error? **[4]**

ii) Explain with examples continuous and discontinuous control modes. **[4]**

Q4) Solve any <u>two</u> :

a) What is PLC Processor Scanning? Explain the program sweep for General Electric series 90–30 PLC. **[8]**

b) Explain the control system for bottle filling plant. Give event sequence and ladder diagram. **[8]**

c) Explain the following counter instructions.
– High Speed Counter (HSC) – Count up (CTU)
What is counter element? **[8]**

Q5) Solve any <u>two</u> :

a) i) Explain the copy instruction (COP) **[4]**

ii) How would you program the sequencer output instruction? **[4]**

b) i) Why is it necessary to add documentation to a PLC program? What information does it contain? **[6]**

ii) Why is a control system absolutely stable if its closed loop poles are located in left half of S-plane? **[2]**

c) Write short notes on any <u>two</u> : **[8]**

i) Annunciators.

ii) Recorders.

iii) Control valves.

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Total No. of Questions : 5] **[Total No. of Pages : 2**

P719

[3629]- 31
M.Sc.
ELECTRONIC SCIENCE
EL3 UT05 - DSP Systems and Applications
(Sem. - III) (2004 Pattern)

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

Instructions to the candidates:

1) ***All questions are compulsory.***
2) ***Figures to the right indicate full marks.***
3) ***Draw neat diagrams wherever necessary.***

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

a) i) A DSP system is described by the linear difference equation
$y(n) = 0.2x(n) - 0.5x(n-2) + 0.4x(n-3)$
If the digital input sequence {–1, 1, 0, –1} is applied to this DSP system, determine the corresponding digital output sequence.

ii) Convert the analog filter into a digital filter whose system function is $H(s) = \frac{s + 0.2}{(s + 0.2)^2 + 9}$ use the impulse invariant technique. (Assume T = 1 sec.)

b) What are different ways of representing discrete time system? Explain any one in detail.

c) Define amplitude, phase and frequency spectrum of a signal. Explain the terms single sided and double sided spectrum with respect to a signal.

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

a) i) List different peripherals, interfaces incorporated in a typical DSP. Explain their role.

ii) Explain the following with reference to DSP

1) Barel shifter.
2) MAC.
3) ALU.
4) Program sequencer.

b) Compare analog and digital signal processing with reference to advantages. List the applications of DSP.

c) Explain Von Neuman, Harvard and super Harvard architecture. Which architecture is used in DSP?

P.T.O.

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

a) Explain with suitable example correlation of DT signals. Discuss cross correlation and autocorrelation sequences.

b) What are digital filters? What are different design techniques available for FIR filters. List advantages of FIR over IIR filters.

c) i) Explain the term 'real time' and 'non real time' DSP systems. Give suitable examples of each.

ii) Compare fixed point and floating point DSP processor.

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

a) What is cross correlation? Determine cross correlation for the following sequences.

$x(n) = \{1, 0, 0, 1\}$

$h(n) = \{4, 3, 2, 1\}$

b) i) For the analog transfer function $H(s) = \dfrac{1}{(s+1)(s+2)}$ determine H(z) using impulse invariant technique. Assume T = 1sec.

ii) Determine the casual signal $x(n)$ having the z-transform

$$X(z) = \frac{1}{(1+z^{-1})(1-z^{-1})^2}$$

c) Calculate DFT of a sequence $x(n) = \{1, 1, 0, 0\}$ and check the validity of your answer by calculating its IDFT.

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

a) The transfer function of analog filter is $H(s) = \dfrac{3}{(s+2)(s+3)}$ with $T_s = 0.1$sec. Design the digital IIR filter using BLT.

b) A digital communication link carries binary coded words representing sample of a input signal $x(t) = 3\cos 600\pi t + 2\cos 1800\pi t$. The link is operated at 10,000 bits/sec and each input sample is quantized at 1024 different voltage levels. Calculate sampling frequency, folding frequency and Nyquist rate of sampling for $x(t)$ in Hz.

c) Discuss analysis of quantization errors in analog to digital converter. Obtain relation for SQNR(dB).

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Total No. of Questions : 5] **[Total No. of Pages : 2**

P720

[3629]- 101
M.Sc.
ELECTRONIC-SCIENCE
EL1 UT01 - Foundation of Semiconductor Devices
(Sem. - I) (New 2008 Pattern)

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) Explain how and why energy bands are formed in a solid crystal. State the importance of forbidden gap.

b) What is Fermi-Dirac probability function? Explain it for Fermi energy, and its dependence on temperature.

c) How is a diode reverse-biased? Explain its I-V characteristics. Using energy band diagram, explain zener breakdown effect.

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

a) What is the importance of equivalent circuit models in electronics? Explain Eber-Moll model for BJT device. Draw and explain its equivalent circuit in detail.

b) Explain the current-voltage characteristics of a J-FET. Why do we get large common-emitter current gains in this transistor?

c) What are the advantages of MOSFETs over JFETs? Explain the small dimension effects with respect to threshold voltage and width.

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

a) Differentiate between amorphous, polycrystalline and single-crystal solids.

b) What is effective mass? Explain its conceptual importance in semiconductor theory.

c) State Poisson's equation in terms of charge density and number of charge carriers. What is the importance of this equation in depletion approximation?

P.T.O.

d) Define transconductance for a JFET. State its importance.

e) What are schottky contacts? How do they differ from ohmic contacts?

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

a) Write short note on C-V characteristics of a p-n junction diode.

b) Given a Silicon sample doped with 10^{17} Arsenic atoms. Determine Fermi level E_F relative to intrinsic level E_i. Also find equilibrium electron concentration no at 300K.

c) Find resistivity of intrinsic Ge at 300K. Given $\mu_n = 3900 cm^2/V\text{-}sec$, $\mu_p = 1900 cm^2/V\text{-}sec$, $n_i = 2.5 \times 10^{13}$.

d) What is C-MOS technology? Explain the operation of C-MOS inverter integrated circuit.

e) Explain the frequency limitation factors and define the cutoff frequency in JFET.

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

a) Why is Silicon preferred than Germanium and Gallium Arsenide as a substrate?

b) What is the junction capacitance of a reverse-biased p-n junction? Explain.

c) Explain the switching characteristics of a BJT. Explain its active and saturation regions.

d) Differentiate between depletion mode and enhancement mode MOSFET.

e) Write a note on Heterojunction bipolar transistor.

Total No. of Questions : 5] **[Total No. of Pages : 2**

P721

[3629]- 102
M.Sc.
ELECTRONIC SCIENCE
EL1 UT02 : Analog Circuit Design and Analysis
(Sem. - I) (2008 Pattern) (New Course)

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

Instructions to the candidates:

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

Q1) Solve any two :

a) i) What is a two port network? Obtain expressions for its admittance and hybrid parameters. **[4]**

ii) What are poles and zeroes of a network function? What is their significance? **[4]**

b) i) What are equalisers? Explain shunt equaliser. **[4]**

ii) Draw the pole-zero diagram for $F_{(s)} = \frac{2s+3}{s^2+3s}$. Find inverse Laplace transform for F(s). **[4]**

c) Explain following for an op-amp - Full power response - Gain error - Common mode error and limitations - Open loop frequency response. **[8]**

Q2) Solve any two :

a) i) What is an ideal current source? Explain the working of a current mirror circuit. **[4]**

ii) For a Widlar current source find the proper value of R_2 to give an output current $I_{C2} = 12\mu A$. Assume that $V_{CC} = 30V$, $R_1 = 29.3K\Omega$, $V_{BE(on)} = 0.7V$ and base currents are negligible. **[4]**

b) i) Draw the circuit diagram of output stage of op-amp 741. Explain its working. **[4]**

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

c) Explain device mismatch effects in differential amplifiers. **[8]**

Q3) Solve any two :

a) i) Explain in brief matching considerations in transistor current sources. **[4]**

ii) What is Nyquist diagram? How can it be used to check stability of a feedback amplifier? State Nyquist criterian for stability. **[4]**

P.T.O.

b) What are the applications of log and antilog amplifiers? Giving necessary equations and setting up procedure explain the working of a practical antilog amplifier circuit. **[8]**

c) i) Explain how you would estimate the errors due to offset voltage and bias current in a differentiator circuit. Why is it called a noise amplifying circuit? **[4]**

ii) Show how you would use a single op-amp to generate the relationship $e_0 = -\int_0^t (e_1 + 2e_2 + 10e_3)\,dt$. Find component values if the integrating capacitor has a value 1μf. Assume ideal op-amp action. **[4]**

Q4) Solve <u>any two</u> :

a) i) Explain the working of a bandgap voltage reference circuit. **[4]**

ii) What is the need for low power design. Give the parameter values of a typical micropower op-amp. **[4]**

b) i) Explain op-amp parameters of interest in design of low voltage/current amplifiers. Compare values of these parameters for a general purpose op-amp with those for a special purpose op-amp. **[6]**

ii) Explain what is meant by frequency compensation. **[2]**

c) i) Discuss the working of a circuit for boosting the output voltage of a general purpose op-amp. In such a circuit why should the op-amp be used with higher than unity gain frequency compensation? **[6]**

ii) Derive the ideal performance equation for a non-inverting amplifier. **[2]**

Q5) Solve <u>any four</u> :

a) Explain the performance specifications for A/D converters. **[4]**

b) Give the working for weighted capacitor DAC. **[4]**

c) How do high resolution DACS achieve monotonicity? Explain voltage mode segmentation. **[4]**

d) Explain pipeline ADC architecture. **[4]**

e) What is oversampling? Explain first order Σ – Δ ADC. **[4]**

f) What is the full scale output voltage of a 6-bit binary ladder if '0' = 0V and '1' = +5V. Find the output voltage of a 6-bit binary ladder with following inputs. → 110001 → 111000. **[4]**

Total No. of Questions : 5] **[Total No. of Pages : 3**

P722

[3629]- 103
M.Sc.
ELECTRONIC SCIENCE
EL1 UT 03 : Instrumentation and Measurement Techniques
(2008 Pattern) (New Course) (Sem. - I)

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

Instructions to the candidates:

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

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

a) State different characteristic parameters of measurement system with suitable example explain accuracy of measurement system.

b) What is loading effect? Describe how to minimize loading effect in the measurement system with suitable example.

c) Give comparison between deflection type and null type instrument.

d) What is dynamic response of measurement system? Describe steady state and transient response.

e) A voltmeter having seroitivity of 1000 Ω/V reads 100 V on its 150 V scale when connected across unknown resistance, in series with current meter it reads 5mA current. Calculate :

i) Apprant resistance of unknown.
ii) Actual resistance of unknown.
iii) Error due to loading effect of voltmeter.

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

a) Describe selection criteria of transducer for measurement of any physical parameter.

b) State different types of strain gauge and their configurations. List different applications of straingauge. Explain any one application.

c) A resistance wire strain gauge with gauge factor 2 is bonded to a steel structural member subjected to a stress of 100 MN/m^2 and E = 200 GN/m^2. Calculate percentage change in the value of resistance of a strain gauge due to applied stress.

P.T.O.

d) How potentiometer is used for linear and angular displacement measurement? What are the advantages and limitations of potentiometric transducer?

e) State applications of LVDT. A steel cantilever is 0.25m long and 20mm wide and 4mm thick. Calculate :

i) The deflection of free end when a force of 25N is applied at the end ($E = 200GN/m^2$).

ii) An LVDT with a sensitivity of 0.5V/mm is used. The voltage is measured on a 10V voltmeter having 100 division two tenth of a division can be read with certainty. Calculate the minimum and maximum force that can be measured with this arrangement.

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

a) Describe the method of measurement of force using piezo-electric transducer. State the limitations of it.

b) With constructional details, explain working of thermal conductivity gauge used for very low pressure measurement.

c) Explain the working principle of ultrasonic flow meter and electromagnetic flow meter. State applications of both.

d) Explain different types of distortion caused by an amplifier.

e) A chromel-Alumel thermocouple gives an emf of 33.3mV when measuring at temperature of 800°C with reference temperature of 0°C. The resistance of the meter coil is Rm = 50Ω and current of 0.1mA gives full-scale deflection. The resistance of junction and leads Re = 12Ω. Calculate.

i) Series resistance if a temperature of 800°C is to be give full scale deflection.

ii) The error due to rise of 1Ω in Re.

iii) The error due to rise of 10°C in the coppercoil of the meter. (The resistance temperature co-efficient of coil is 0.00426/°C)

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

a) Describe resistance temperature detector (RTD). List the materials used for RTD construction. State the limitations of RTD.

b) What do you mean by signal analysis? Describe the difference frequency distortion analyzer with the help of block diagram.

c) Describe DC signal conditioning system with neat block diagram.

d) Describe working of following opamp circuits.

i) Schmitt Trigger.
ii) Differential amplifier
It includes the o/p voltage relation.

e) Draw the block diagram of sound level meter. Explain its working that is used for sound pressure level measurement.

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

a) Define the term 'Telemetry'. Explain why it is necessary in an instrumentation system.

b) Describe land line telemetry system in detail. State applications of it.

c) Describe with block diagram the chart recorder state applications of chart recorders.

d) Draw the generalized block diagram of DFM. State different mode of operation (measurement). Explain period measurement showing the appropriate signal path setting in the above diagram.

e) Describe different technique used for magnetic recording with their advantages.

Total No. of Questions : 5] **[Total No. of Pages : 2**

P723

[3629]- 301
M.Sc. - II
ELECTRONIC SCIENCE
EL3 UT05 - : Embedded Systems
(Sem. - III) (New Course)

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

Instructions to the candidates:

1) ***All questions are compulsory.***
2) ***Figures to the right indicate full marks.***
3) ***Draw neat diagram wherever necessary.***

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

a) Describe the timer modes in short of 8051.

b) With the help of neat diagram, explain 4 × 4 keyboard interfacing technique.

c) Draw the diagram of timer/counter control logic of 8051 and explain its working in short.

d) Write short note on RISC and CISC architecture.

e) Write a program in 'C' to monitor P1.4 continuously when it becomes low, send 55H to port P0, otherwise AAH to port P0.

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

a) Describe SCON register of 8051 microcontroller.

b) Draw the interfacing of DAC to 8051. Write a 'C' program which will generate a ramp waveform.

c) Describe data transfer and arithmetic groups of instructions of 8051 with suitable example.

d) Write short note on I^2C or SPI communication standard.

e) Explain on-chip RAM memory map of 8051.

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

a) Write an assembly language program to toggle all the bits of port P1 after every 200ms for 8051 microcontroller with crystal frequency 11.0592 MHz.

P.T.O.

b) Explain any four addressing modes of 8051 with suitable example.

c) Write an assembly language program for 8051 to transfer a message "YES" serially at 9600 baud rate, 8 bit data, 1 start and 1 stop bit continuously.

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

a) Write the features of AVR microcontroller.

b) Write short note on program memory organization of PIC 16 F 877 A.

c) Explain the timer counter control register ($TCCR_x$) of AVR microcontroller.

d) Explain different port registers of AVR microcontroller.

e) Explain different ways of resetting PIC microcontroller.

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

a) Explain LCD interfacing to AVR microcontroller. Write a 'C' program to display a string on first line.

b) Explain the use of watchdog timer of AVR microcontroller. Describe watchdog timer control register (WDTCR). Write a suitable 'C' code for the same.

c) Draw the block diagram of PIC 16 F 877 A and explain it in short.