Total No. of Questions : 5]

SEAT No. :

P1766

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M.Sc.

ELECTRONIC SCIENCE

EL1UTO-1 : 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 Two of the following: **[2×8=16]**

a) What is the importance of pure crystal in the manufacturing of silicon devices? Describe any one method to produce electronic grade pure crystal.

b) What is meant by Fermi-diruc distribution function? How Fermi level is defined for semiconductor? Explain how Fermi level is changed using doping of the impurity in semiconductor.

c) Explain the construction of MOSFET. How threshold voltage is defined? Elaborate small dimension effects.

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

a) With the help of energy bond diagram, explain the working of pn junction during forward and reverse biased condition.

b) Mathematically explain the frequency limitations of the bipolar junction transistor.

c) Explain basic JFET operation. Draw the I-V characteristics of JFET for small Vos values. Explain the pinch-off of JFET.

P.T.O.

Q3) Attempt any four: **[4×4=16]**

a) How lattice planes are represented by Miller indices?

b) Define effective mass. What is the importance of effective mass in semiconductor.

c) What is meant by built-in potential in case of pn junction? Why it can not be measured externally?

d) Write a short note on heterojunction bipolar transistor.

e) Explain ideal Capacitance-Voltage characteristics of MOS.

Q4) Attempt any four: **[4×4=16]**

a) What is the physical significance of wave function?

b) How Fermi level is changed with respect to temperature?

c) Write a short note on photodiode.

d) With the help of neat diagram explain the operation of SCR.

e) List the advantages and disadvantages of MOSFET.

Q5) Attempt any four: **[4×4=16]**

a) Calculate the first three energy levels of an infinite potential well. Consider an electron in an infinite potential well of width 5Å.

b) A sample of silicon is doped with 10^{16} Boron atoms/cm^3. The sample dimension are L = 10^{-1} cm, W = 10^{-2} cm, d = 10^{-3} cm, Ix = 1 mA and Bz = 5×10^{-2} Tesla. Notations have usual meaning. Determine Hall Voltage and Hall field.

c) Explain the working of DIAC and its characteristics.

d) Explain channel length modulation in JFET.

e) Explain switching characteristics of BJT.

Total No. of Questions :5]

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P1767

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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 <u>two</u> :

a) What is mean by two - part network? Explain the impedence and admittance parameters for two part network. **[8]**

b) Draw block diagram of op - amp and explain function of each block. **[8]**

c) i) For the given network function, draw the pole - zero diagram and hence obtain i(t) **[4]**

$$I(s) = \frac{3s}{(s+1)(s+3)}$$

ii) Obtain Laplace transform of following functions **[4]**

1) cos(wt)

2) unit step function u(t)

P.T.O.

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

a) Draw trans - diode configuration for Log amplifier considering all practical aspects, explain working of temperature compensated log amplifier. **[8]**

b) What is ideal current source? With neat circuit diagram, explain the working of current mirror circuit and Wilson current source. **[8]**

c) Determine the inverse Laplace transform for given functions : **[8]**

i) $F(s) = \frac{4}{s^2 + 64}$

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

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

a) i) Draw neat circuit diagram of instrumentation amplifier using three op-amp, and obtain an expression for its output voltage. **[4]**

ii) Explain the shielding techniques used in op-amp circuit design. **[4]**

b) i) What is temperature independent biasing? Explain working of zener diode bias reference. **[4]**

ii) What is an equilizer? Explain shunt equilizer. **[4]**

c) i) A 741 inverting amplifier with gain A = –4 is driven by a ± 12v peak to peak triangular wave. Sketch and label wave forms at input, output and inverting input. **[4]**

ii) Compare the performance of inverting and non - inverting amplifiers with regards to **[4]**

1) Types of feedback used.

2) Input and output impedence.

3) Phase relation.

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

a) i) Draw circuit diagram of full wave precision rectifier and explain its working. **[4]**

ii) Explain $\sum - \Delta$ converter. **[4]**

b) i) Write short note on "micropower design technique". **[4]**

ii) Explain one application of ADC and DAC. **[4]**

c) i) Write short note on "High - power op - amp". **[4]**

ii) With circuit diagram, explain working of peak - detector circuit using op - amp. **[4]**

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

a) i) Design second order low pass active filter with pass band gain 2 and cut off frequency 2KHz in non - inverting mode. **[4]**

ii) Draw circuit diagram of binary weighted resistor DAC and explain it. **[4]**

b) i) Explain the need of low - power design. **[4]**

ii) Write a short note on "pipelined converter". **[4]**

c) i) Explain the working of successive approximation ADC. **[4]**

ii) Explain performance specifications of DAC. **[4]**

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Total No. of Questions :5]

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P1768

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M.Sc.

ELECTRONIC SCIENCE

EL1UT-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 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) List the elements of measurement system. State the different methods of measurement. Give detail classification of instruments.

ii) State the characteristics of measurement system. Explain any two with suitable example.

iii) What is loading effect? Explain the importance of input and output impedance with suitable example.

b) What is noise? State the sources of noise. Define noise factor and noise figure. **[4]**

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

i) What is steady state and transient response? State and define dynamic characteristics of measurement system.

ii) What is importance of primary sensing elements in case of mechanical systems? List the force and pressure sensing primary elements.

iii) Give detail classification of transducers with suitable example.

P.T.O.

b) State different types of resistance, potentiometers. A linear potentiometer is 50 mm long uniformly wound with a wire having resistance of 10 kΩ. Under normal conditions, the slider is at the centre of the potentiometer. Find the linear displacement when the resistance of the potentiometer as measured by a wheatstone bridge are 3850Ω and 7560Ω. Are the two displacements in the same direction. **[4]**

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

i) What is strain gauge? List the types of strain gauges. Derive an expression for gauge factor of simple wire type strain gauge.

ii) Explain working principle of RTD. List the materials used for RTD. A platinum RTD has a resistance of 100Ω at 25°C. Find its resistance at 65°C. Platinum has a temperature co-efficient of 0.003921°C. Calculate the temperature if the resistance of RTD is 150Ω.

iii) Explain the principle of the following for inductive transducer.

1) Change of self inductance,

2) Change of mutual inductance and

3) Production of eddy currents.

b) Draw neat circuit diagram of LVDT, explain its working principle. State advantages of LVDT. **[4]**

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

a) State types of wave analyzer. Draw neat block diagram of heterodyne wave analyzed. Define frequency, phase and cross-over distortion.

b) What is signal conditioning? Draw the following signal conditioning circuits using OPAMP and write their output equations.

i) Integrator,

ii) Differential amplifier,

iii) Voltage follower and

iv) Transimpedance amplifier.

c) What is Telemetry? With circuit block diagram explain voltage and current telemetry systems.

d) Explain land line telemetry and RF telemetry systems.

e) With neat circuit block diagram, explain working of DFM.

f) State different types of recorders. With block diagram, explain working of X-Y recorder.

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

a) List the transducers used for temperature measurement. Give working principle of radiation pyrometer method of temperature measurement.

b) Explain working principle of Piezo-electric transducer. Give the different modes of operation of Piezo-electric crystal. A Piezo-electric crystal having dimensions of 5 mm × 5 mm × 1.5 mm and voltage sensitivity of 0.055 V-m/N is used for force measurement. Calculate the force, if the voltage developed is 100V.

c) A steel cantilever is 0.25 m long. 20 mm wide and 4 mm thick. Calculate the deflection at the feed end, when a force of 25 N is applied to feed end. Modulus of elasticity of steel is 200 GN/m^2. An LVDT with sensitivity of 0.5 V/mm is used. The voltage is read on 10V voltmeter having 100 divisions. Two tenth of division can be read with certainty. Calculate the minimum and maximum value of force that can be measured with this arrangement.

d) Describe thermocouple temperature transducer. State different types of compensating circuits. Why these compensating circuits required with thermocouple temperature measurement system.

e) Explain working principle of electromagnetic flow meter. State advantages and disadvantages of it.

f) What is sound pressure level? Describe working of sound level meter with neat block diagram.

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Total No. of Questions :5]

SEAT No. :

P1769

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M.Sc.

ELECTRONIC SCIENCE

EL2UT-04: Applied Electromagnetics, RF and Microwave

(2008 Pattern) (Semester - II)

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

Instructions to the candidates:

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

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

a) Define TE, TM and TEM modes? Draw a graphical sketch to show electric and magnetic Field lines in a hollow cylindrical waveguide for TE_{11} and TE_{01} mode.

b) With reference to antenna explain following terms :

i) Radiation pattern.

ii) Gain.

iii) Radiation power density.

iv) Directivity.

c) Explain the operation of a Gunn diode and mention any two modes of operation.

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

a) What do you mean by matched transmission line? Explain different techniques for impedance matching.

b) With the help of labeled diagram, describe the features of Yagi - Uda and axial mode helix antenna. Which one is widely used in space application? Why?

c) With the help of neat diagram, explain the working principle of klystron and its applications.

P.T.O.

Q3) Attempt any four of the Following : **[4×4]**

a) Write Maxwell's electromagnetic equations in differential and integral form.

b) An air filled rectangular wave guide of inside diamension 7×3.5cm operates in the dominant mode TE_{10} find :

i) Cuttoff frequency

ii) The phase velocity of the wave in the guide at frequency of 3.5GHz.

c) Write short note on Patch Antenna.

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

e) Explain absorption of electromagnetic waves by atmosphere.

f) A uniform plane wave propagating in a medium has E = $2e^{-\alpha z}$ sin $(10^8t - \beta z)a_y$ v/m. If the medium is characterized by $\Sigma r = 1$, $\mu_r = 20$ and $\sigma = 3$ mahos/m. Find α and β.

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

a) Write short note on directional couplers.

b) What are the sources of EMI? How can EMI controlled.

c) An antena radiates isotropically over a half space above a perfectly conducting ground plane if E = 50 mv/m (rms) at a distance of 1 km find

i) Power radiate.

ii) Radiation resistance if antenna terminal current I = 3.5A.

d) Explain important characteristics of smith chart.

e) Show that the skin depth in case of good conductor is represented by

$$\delta = \sqrt{\frac{2}{\mu\omega\sigma}}$$

f) Consider Fiber glass circuit board with $E_{eff} = 2.8$ and ECL technology with T = 0.5ns. Calculate speed of propagation (in m/s and ps/cm) and knee frequency.

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

a) Explain different types of losses in microstrip lines.

b) What do you mean by retarded potential? Explain it in brief.

c) Derive general Expression for reflection coefficient for E and H fields when an electromagnetic wave is incident normally on the boundary separating two different perfectly dielectric media.

d) A certain Si JFET has the following parameters : channel height a = 0.1um, Electron concentration Nd = $8\times10^{17}cm^{-3}$, Relative dielectric constant $\varepsilon_r = 11.80$. Calculate the pinch off voltage.

e) Explain parabolic dish antenna in short.

f) Write short note on GPS.

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Total No. of Questions : 5]

SEAT No. :

P1770

[Total No. of Pages : 2

[5231]-22
M.Sc. - I
ELECTRONIC SCIENCE
EL2 UT 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) Answer any four of the following: **[4 × 4 = 16]**

a) Describe the working of multistage tuned amplifier.

b) Explain working of phase shift method of SSB AM generator.

c) What is sampling theorem? Describe importance of it in communication.

d) Draw the block diagram of Adaptive delta modulation and describe working of it.

e) What is 3G? State advantages and disadvantages of it.

f) Explain the working of amplitude shift keying (ASK) modulator with diagram.

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

a) What is time division multiplexing (TDM)? With the help of block diagram, explain working of TDM. State advantages of it.

b) Describe SDLC and HDLC basic format.

c) Draw the diagram of cascode tunning and explain its working. Give advantages of it.

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

a) With proper block diagram, explain the working of FM transmitter in short.

P.T.O.

b) Explain thermal noise and atmospheric noise in short.

c) Write short note on "DSL".

d) What is transponder? Give its use in satellite communication.

e) With the help of block diagram, explain the working of pulse code modulation (PCM).

f) Draw neat diagram of any one method of neutralisation and explain it in short.

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

a) i) Write the mathematical analysis of frequency modulator.

ii) For amplitude modulation, prove that power contained in carrier is two third of total power of the signal.

b) Write short notes on:-

i) ISDN

ii) VSAT

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

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

a) With the help of block diagram, explain high level amplitude modulation transmitter.

b) Explain any one code error detection techniques.

c) Explain "blue tooth technology".

d) Explain "XMODEM protocol" in short.

e) With reference to satellite communication, explain the terms down link and cross link.

f) Explain advantages of FM over AM.

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Total No. of Questions : 5]

SEAT No. :

P1771

[Total No. of Pages : 2

[5231]-23
M.Sc. - I
ELECTRONIC SCIENCE
EL2UT 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) What are variables and signals in VHDL? List different sequential statements used in VHDL. Write VHDL code for full adder.

b) What is function in VHDL? Write a function to convert binary number to gray.

c) Explain design flow for digital system design using VHDL.

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

i) In Design of bcd to seven segment decoder for common cathode seven segment display. Obtain expressions for a, b, c, d outputs.

ii) What is parallel adder? What is look ahead carry in parallel adder? How does it speed up the addition?

iii) What is parity generator? Explain even parity generator and checker for 7 - bit word.

b) Attempt any ONE of the following: **[1 × 4 = 4]**

i) Write VHDL code for 1 to 4 demultiplexer using data flow modeling.

ii) Write VHDL code for 4-bit magnitude comparator.

P.T.O.

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

a) Design mod 6 synchronous up counter using T flip flops.

b) Compare synchronous and asynchronous counter. Draw logic diagram of 3-bit ripple up counter using T flip flops. Draw timing diagram.

c) Write VHDL code for trafficlight controller using FSM.

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

a) Write VHDL code for 4-bit ALU.

b) What is scratchpad memory? Draw and explain the diagram of processor using scratchpad memory.

c) What is PAL? Design 3-bit gray to binary code using PAL.

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

a) What is DRAM? Show with neat diagram cell arrangement in 16 × 1 DRAM. What is function of $\overline{RAS}$ and $\overline{CAS}$ in DRAM.

b) Draw architecture of CPLD. List features of typical CPLD. Compare CPLD and FPGA.

c) What are different signals associated with ROM? Explain data storage principle in ROM, PROM, EPROM and EEPROM.

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Total No. of Questions : 5]

SEAT No. :

P1772

[Total No. of Pages : 2

[5231]-31

M.Sc. - II

ELECTRONIC SCIENCE

EL3UT05 : 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) What is an embedded system? List components of embedded system. List 8-bit microcontrollers used in embedded system.

b) Explain interfacing of 8-bit DAC with 8051.

c) Explain the following:

i) Assembler ii) Simulator

d) Explain ADC module of PIC16F877 microcontroller.

e) Explain different port registers of AVR microcontroller.

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

a) Explain organization of internal data and program memory of 8051.

b) Draw block diagram to interface 8kB of data RAM with 8051. Write memory map of the system.

c) Explain hardware and software combination tools.

d) Explain any four features of PIC microcontroller.

e) Write an assembly / 'C' program to flash 55H and AAH alternately. Eight LEDs are connected to PORTD of AVR microcontroller.

P.T.O.

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

a) Draw functional block diagram of 8051 and explain it in short.

b) List different communication standards. Explain RS. 232 communication standard.

c) Explain in detail development steps of embedded system design.

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

a) With the help of neat diagram, explain Harvard and Van-Neuman architecture.

b) Write a note on WDT (Watch dog timer).

c) Draw an interface of electromagnetic relay to 8051. Write an assembly / 'C' program for 8051 to turn relay ON and OFF continiously.

d) Write an assembly / 'C' program for PIC microcontroller to get a byte of data from PORTC, add the value 5 to it and send it to PORTB continiously.

e) Write note on C data types for 8051. Write C program to send values of –4 to 4 to PORT1 of 8051.

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

a) Draw and explain an architecture of PIC microcontroller.

b) Write an assembly / 'C' program for 8051 to display "ELECTRONICS" on first line of LCD.

c) With the help of diagram, explain data and program memory organization of AVR microcontroller.

Total No. of Questions :5]

SEAT No. :

P1773

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M.Sc. - II

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 logtable/calculator is allowed.***
4) ***Neat diagrams must be drawn wherever necessary.***

Q1) Solve any two: **[2×8=16]**

a) Give a neat block diagram and explain the working of feedback control system. State the different controller modes and their applications.

b) i) Give the procedure for obtaining the transfer function of the system.

ii) Construct a ladder diagram for bottle filling plant.

c) i) Explain feed forward control strategy.

ii) Compare continuous control and discrete state process control.

Q2) Solve any two: **[2×8=16]**

a) Explain block diagram reduction rule.

b) i) Explain use of Laplace transform in control system analysis.

ii) For unity feedback system,

$$G(s)=\frac{K}{s(1+0.4s)(1+0.25s)}$$

Find range of values of k, marginal values of k and frequency of sustained oscillations.

c) i) Define the term transfer function. State its advantages and limitations in the study of control system.

ii) Give advantages and limitations of Routh's method for checking stability of control system.

P.T.O.

Q3) Solve any two: **[2×8=16]**

a) Comment on the following statements :

i) Derivate mode can not be used alone.

ii) In the limit of very high gain, proportional mode works like ON - OFF control mode.

b) Give special features of proportional, integral, proportional - integral and proportional - derivate control modes. Give circuit for PID controller and equation for its output. What is derivative over run?

c) Explain Zigler - Nichols method for process loop tuning.

Q4) Solve any two: **[2×8=16]**

a) Explain PLC counter instructions. How are they used?

b) i) Write a short note on annunciator.

ii) Explain ON - Delay timer instruction.

c) i) What is the use of Watchdog - timer in PLC?

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

Q5) Solve any four: **[4×4=16]**

a) Explain the construction and working of solenoid valve.

b) Explain the selection criteria of PLC processor for an application.

c) Explain the meaning of 'user defined files' in a PLC processor.

d) Write a short note on indicator and alarm.

e) Explain how to document a PLC file system.

f) Describe local expansion and remote I/O expansion for a PLC.

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