

Total No. of Questions : 7]

SEAT No. :

PE5563

[Total No. of Pages : 2

[6518]-101

M.Sc. (Part - I)

ELECTRONIC SCIENCE

ELUT-111 : Mathematical Methods in Electronics Using C
(2019 Pattern) (Semester - I)

Time : 3 Hours]

[Max. Marks : 70

Instructions to the candidates:

- 1) Q.1 is compulsory.
- 2) Solve any five questions from Q.2 to Q.7.
- 3) Q.2 to Q.7 carry equal marks.

Q1) Solve any five of the following:

[10]

- a) Determine the degree and order of the equation:

$$5\left(\frac{d^4y}{dt^4}\right)^5 + 7\left(\frac{dy}{dt}\right)^{10} + y^7 - y^5 = t.$$

- b) Determine z-transform of $x[n] = \{3, 1, 2, 5, 7, 0, 1\}$ with its ROC.
c) Write a C statement showing: for infinite loop.
d) Explain fseek() and rewind() function.
e) Find the Laplace transform of $e^{-3t} \cos 5u(t)$ function.
f) Write various data types in C.

Q2) Attempt the following:

- a) i) Determine the stability of following equation.

[4]

$$a(s) = s^3 + 6s^2 + 11s + 6$$

- ii) What is ternary operator in C? Explain with example.

[3]

- b) What are the different types of differential equations? Give example of each.

[5]

Q3) Attempt the following:

- a) i) What are the zeros of Bessel function? Explain its significance.

[4]

- ii) Write a C program to find roots of quadratic equation.

[3]

- b) State convolution theorem. Determine the Laplace transform of $\frac{1}{s^3(s-5)}$ using convolution theorem.

[5]

P.T.O.

Q4) Attempt the following:

- a) i) Write a C program for conversion of temperature in fahrenheit to celcius using the formula. [4]
$$C = (F - 32)/1.8$$
- ii) Convert to Cartesian coordinate $\left[4, \frac{2\pi}{3}, -2\right]$ convert to polar coordinate (1, 1). [3]
- b) Write a C-program to create a file to store information about a person (name, age, salary). [5]

Q5) Attempt the following:

- a) i) What is transfer function? Find the transfer function of first order high pass circuit. [4]
- ii) Explain partial differential equation. [3]
- b) Define convolution. Solve $F(s) = \frac{s^2}{(s^2 + a^2)^2}$. [5]

Q6) Attempt the following:

- a) i) Find the solution for DE $\frac{dy}{dx} = \frac{x+1}{2-y}; y \neq 2$. [4]
- ii) Define z-transform. Find z-transform of unit step function. [3]
- b) Explain the properties of Laplace Transform. [5]

Q7) Attempt any two of the following:

- a) Write short note on: [6]
i) Array
ii) Pointer
- b) Write short note on: [6]
i) Sinusoidal signal
ii) Unit ramp signal
iii) Unit parabolic signal
- c) Write short note on: [6]
Decision making loop statement in C, with suitable example.



Total No. of Questions : 7]

SEAT No. :

PE-5564

[Total No. of Pages : 3

[6518]-102

M.Sc. (Part - I)

ELECTRONIC SCIENCE

ELUT-112 : Analog Circuit Design

(2019 Pattern) (Credit System) (Semester - I)

Time : 3 Hours]

[Max. Marks : 70

Instructions to the candidates:

- 1) *Question 1 is compulsory.*
- 2) *Answer any five questions from Q2 to Q7.*
- 3) *Questions 2 to 7 carry equal marks.*

Q1) Attempt any five of the following :

[10]

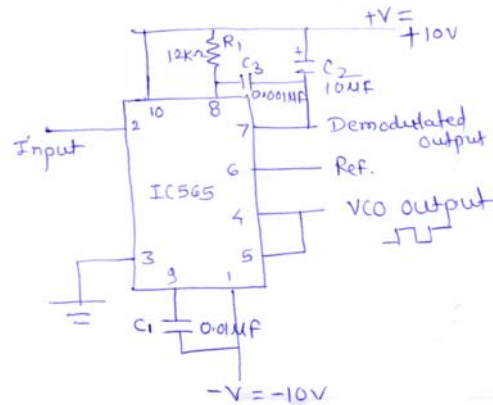
- a) What is difference between avalanche breakdown and zener breakdown?
- b) In common base configuration, the emitter current I_E is 6.28 mA and collector current is 6.20 mA. Determine the common base d.c. current gain.
- c) What are the characteristics of common emitter amplifier?
- d) What are the advantages of ' r_e ' model of transistor?
- e) Draw the graph showing the relation between quality factor and bandwidth of amplifier.
- f) What is frequency range of RC and LC Oscillator?

Q2) a) Explain transformer coupled class A audio power Amplifier. Calculate the effective resistance R'_L seen looking into the primary of a 10 : 1 transformer connected to the output load of 16Ω . **[7]**

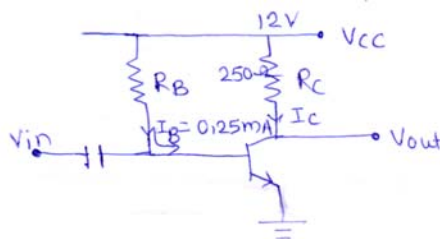
- b) What are the factors which affect the frequency stability of an oscillator? **[5]**

P.T.O.

- Q3) a) i)** What is current amplification factor for CB, CE and CC amplifiers? Derive relationship among them. [4]
- ii)** An N-Channel JFET has $I_{DSS} = 8 \text{ mA}$ and $V_p = -5 \text{ V}$. Determine the minimum value of V_{DS} for pinch off region and drain current I_{DS} for $V_{GS} = -2 \text{ V}$ in the pinch off region. [3]
- b)** Design a second order low pass filter at a high cut off frequency of 1kHz & Gain = 1.586. [5]
- Q4) a) i)** Explain the working of n-channel E-MOSFET with it's construction. What is difference between E-MOSFET and DE MOSFET? [4]
- ii)** What is effect of coupling capacitor on low frequency response of CE amplifier? [3]
- b)** Draw block diagram of PLL and explain function of each block. Determine free running frequency of following circuit. [5]



- Q5) a) i)** Distinguish between D.C. and A.C. load lines with suitable diagram of amplifier. [4]
- ii)** In a collector to base CE amplifier circuit of following figure, calculate R_B and stability factor. Given : $I_B = 0.25 \text{ mA}$, $\beta = 100$, $V_{CEQ} = 8 \text{ V}$, $V_{CC} = 12 \text{ V}$. [3]



- b)** Explain the working of Hartley oscillator. In the Hartley oscillator, $L_2 = 0.4 \text{ mH}$ & $C = 0.004 \text{ µF}$. Freq. of oscillation is 120 kHz. Find the value of L_1 . [5]

- Q6)** a) i) What is reverse recovery time " t_{rr} " of diode? Explain the switching characteristics of junction diode with suitable waveforms. [4]
- ii) Explain the working of practical differentiator circuit. What are applications of it? [3]
- b) What is class C tuned amplifier? Explain the working of class C tuned amplifier with suitable diagram. What are applications of it? [5]

Q7) Write short notes on any two of the following : [12]

- a) High frequency π model for a transistor.
- b) Construction and working of crystal oscillator.
- c) Effect of negative feedback on input impedance, output impedance gain and band width of inverting amplifier.



Total No. of Questions : 7]

SEAT No. :

PE-5565

[Total No. of Pages : 3

[6518]-103

M.Sc. (Part - I)

ELECTRONIC SCIENCE

ELUT-113 : Digital System Design

(2019 Pattern) (Credit System) (Semester - I)

Time : 3 Hours]

[Max. Marks : 70

Instructions to the candidates:

- 1) Questions 1 is compulsory.
- 2) Solve any five questions from Q2 to Q7.
- 3) Questions 2 to 7 carry equal marks.

Q1) Attempt any five of the following :

[10]

- a) What is a verilog module? What are its components?
- b) Write a verilog code for 3 bit binary to Gray code converter.
- c) Draw truth table & Excitation table for J.K flipflop.
- d) Implement using PAL
 $F_1(A, B, C) = \sum m(1, 4, 5, 7)$
 $F_2(A, B, C) = \sum m(1, 2, 3, 6)$
- e) Construct a 4 : 16 decoder using two 3 : 8 decoders.
- f) Convert a J-K flipflop into D-flip flop & T-Flip flop.

Q2) Answer the following :

- a) i) Describe the design flow for Digital system using Hardware Description Languages (HDL's). [4]
- ii) Explain any six types of operators in verilog. [3]
- b) With the help of truth table & k-maps, design a 4-bit prime number detector circuit. [5]

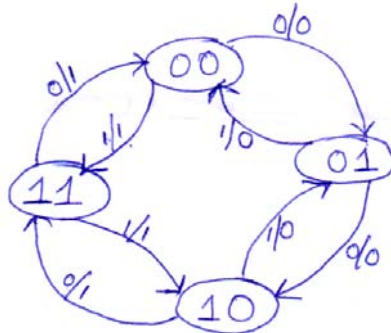
P.T.O.

Q3) Answer the following :

- a) i) Write a note on SRAM cell & explain its read & write operations. [4]
- ii) What are Real Only memories (ROM's). State their types. [3]
- b) Design synchronous counter for sequence $0 \rightarrow 1 \rightarrow 3 \rightarrow 6 \rightarrow 7 \rightarrow 5 \rightarrow 0$ using J-K flip flops. [5]

Q4) Answer the following :

- a) i) With the help of a neat circuit diagram & timing diagram, explain a 4-bit Johnson counter using D-flip flop. [4]
- ii) Draw the next state table for the following state diagram. [3]



- b) What is a function in verilog. Define a function to multiply two 4-bit numbers a & b. The output is on 8-bit value. [5]

Q5) Answer the following :

- a) With the help of a truth table & k-maps, design a 2 input comparator with each input being 2 bits (A_1A_0 & B_1B_0) & has three outputs $A > B$, $A = B$, $A < B$. [7]
- b) With a neat diagram, Explain architecture of CPLD. [5]

Q6) Answer the following :

- a) i) With the help of a truth table & k-maps, design a BCD to excess-3 code converter. [4]
- ii) Write a verilog code for the above BCD to excess-3 code converter using behavioural modelling. [3]
- b) With a neat circuit diagram & timing diagram explain a 3-bit asynchronous down counter using T-flip flop. [5]

Q7) Answer any two of the following :

- a) What is a mealy state machine & a moore state machine. Write a Verilog code for bidirectional stepper motor control using finite state machine. **[6]**
- b) What are different modelling types in verilog. Explain each with example. **[6]**
- c) Draw the circuits for Half adder, full adder using half adder, four bit adder using full adders. **[6]**



Total No. of Questions : 5]

SEAT No. :

PE-5566

[Total No. of Pages : 2

[6518]-104

M.Sc. - I

ELECTRONIC SCIENCE

**ELDT-114 : Basics of Fiber Optic Communication
(2019 Pattern) (Semester - I)**

Time : 2 Hours]

[Max. Marks : 35

Instructions to the candidates:

- 1) *Q. 1 is compulsory.*
- 2) *Solve any three questions from Q.2 to Q.5.*
- 3) *Questions 2 to 5 carry equal marks.*
- 4) *Neat diagrams must be drawn whenever necessary.*
- 5) *Use of calculator is allowed.*

Q1) Attempt any five of the following :

[5 × 1 = 5]

- a) Classify fiber optic based on index profile.
- b) Define Numerical Apperture (NA) of optical fiber.
- c) Define the term dispersion in optical fiber.
- d) State the names of the block used in optical communication block diagram.
- e) What is attenuation in optical fiber?
- f) What is fiber splice?

Q2) Answer the following :

- a) i) What do you mean by total internal reflection? State the conditions to obtain total internal reflection. **[2]**
ii) Explain any two losses in fiber optic cable. **[4]**
- b) Derive the expression for numerical apperture (NA) of fiber optic cable based on ray theory analysis. **[4]**

Q3) Answer the following :

- a) i) State the advantages & disadvantages of fiber optic communication. **[2]**
ii) Explain the reasons for pulse broadening due to material dispersion in optical fibers. **[4]**
- b) Briefly outline the factors which causes intrinsic losses of fiber-fiber joints. **[4]**

P.T.O.

Q4) Answer the following :

- a) i) Explain the term optical repeaters. [2]
- ii) A silica optical fiber with a core diameter large enough to be considered by ray theory analysis has a core refractive index of 1.50 and a cladding refractive index of 1.47. Determine [4]
 - I) Critical angle of core cladding interface.
 - II) Numerical Apperture for the fiber.
 - III) The acceptance angle in the air for the fiber.
- b) Compare between single mode & multimode fiber. [4]

Q5) Write short notes on any Four of the following : [10]

- a) List the misalignment which may occur when joining compatible optical fiber.
- b) Write a short note on cylindrical ferrate connectors.
- c) Compare between meridional ray & skew ray.
- d) Write a short note on fiber buffering.
- e) State the conditions to obtain total internal reflection.
- f) Explain the linear scattering losses in fiber optic cable.



Total No. of Questions : 5]

SEAT No. :

PE-5567

[Total No. of Pages : 2

[6518]-105
M.Sc. (Part - I)
ELECTRONIC SCIENCE
ELDT-114 : Fundamentals and applications of PIC
Microcontroller
(2019 Pattern) (Semester - I)

Time : 2 Hours]

[Max. Marks : 35

Instructions to the candidates:

- 1) *Q. 1 is compulsory.*
- 2) *Solve any three questions from Q.2 to Q.5.*
- 3) *Questions 2 to 5 carry equal marks.*
- 4) *Draw Neat diagram wherever necessary.*
- 5) *Figures to the right indicates full marks.*

Q1) Solve any five of the following :

[5 × 1 = 5]

- a) Write a instruction to set PORTB as input Port.
- b) Which type of architecture is used by PIC 18.
- c) What is the range of program memory in PIC 18F.
- d) What is the meaning of instruction DECFSZF, a
- e) If XTAL = 12 MHz, What is the instruction cycle period in PIC 18F 4520.
- f) What is the addressing mode of instruction CLRF PLUSW 1.

Q2) a) Solve any two of the following :

[2 × 3 = 6]

- i) Write a note on RAM memory organization of PIC.
- ii) Draw data memory map of PIC 18F 4520. Write assembly language program to read data from PORTB, multiply it by 5 and write result to PORTD.
- iii) Write PIC assembly language program to add 5 to WREG 15 times and place the result to PORTC.
- b) Draw the block diagram of PIC 18 and state the features of PIC 18F 4520.

[4]

P.T.O.

Q3) a) Solve any two of the following : **[2 × 3 = 6]**

- i) Write a program to generate a square wave of duty cycle 70% on bit5 of PORTC.
 - ii) Write a program to bring data in from PORTA and send it to PORTC continuously, after subtracting the value g from it.
 - iii) Write a note on stack and explain the steps CPU will perform on execution of CALL instruction.
- b) PIC 18 has how many timers? Explain Timero registers in detail. **[4]**

Q4) a) Solve any two of the following : **[2 × 3 = 6]**

- i) Write a program to monitor bit RB3 continuously, whenever it goes low turn on the buzzer.
 - ii) Write a program to find number of 1's in a given byte.
 - iii) What is RISC architecture? Give the features of RISC as implemented by the PIC.
- b) Draw interface diagram to connect LCD to PIC. Write a program to display SPPU on display. **[4]**

Q5) Solve any four of the following : **[10]**

- a) Explain the different addressing modes of PIC microcontroller.
- b) Write a note on RAM memory organization of PIC.
- c) Write a program to add all the digits of 8 bit ID number and save the result in a file register memory. The result must be in BCD.
- d) Explain any three instructions related to flag bits of PIC.
- e) Write a PIC assembly language program to determine if data on PORTB contains the value 66H. If so write 'Y' to PORTC; otherwise make PORTC = 'N'.
- f) Write a program to interface eight LED array to PIC showing running LED pattern in forward direction.



Total No. of Questions : 8]

SEAT No. :

PE-5468

[Total No. of Pages : 3

[6518]-201

First Year M.Sc.

ELECTRONIC SCIENCE

**ELUT-121 : Applied Electromagnetic Microwaves & Antennas
(2019 Pattern) (Semester - II)**

Time : 3 Hours]

[Max. Marks : 70

Instructions to the candidates:

- 1) *Question No.1 is compulsory.*
- 2) *Solve any five questions from Q.No.2 to Q.No.7*
- 3) *Figures to the right side indicate full marks.*

Q1) Solve any five of the following:

[5×2=10]

- a) State the contribution of Maxwell's to Ampere's law. Also state its significance.
- b) Design a dipole antenna for a frequency of 100 MHz.
- c) State the difference between a circular waveguide and a optical fiber.
- d) "Role of antenna in communication system". Comment.
- e) Draw equivalent circuit of transmission line.
- f) Write the general time domain expression for electric field of plane wave travelling in a conducting medium.

Q2) Answer the following:

- a) Obtain the boundary condition for electric field at the surface boundary between
[7]
 - i) two dielectrics
 - ii) a dielectric and a conductorusing suitable diagrams
- b)
 - i) Write a note on microstrip antenna.
 - ii) "Microstrip antennas are widely used for mobile communication"
Comment.

[5]

P.T.O.

Q3) Answer the following:

- a) With a neat diagram explain the working of magnetron. [7]
- b) The dimensions of a rectangular waveguide are $a = 2.5$ cm and $b = 1$ cm. The signal frequency is 8.6 GHz. Then determine the following [5]
 - i) Possible modes
 - ii) Cut-off frequencies

Q4) Answer the following:

- a) What are cavity resonators? Explain rectangular and cylindrical cavity resonators. What is 'Q' of a cavity? How can it be determined. [7]
- b) Design a 3 director yagi uda antenna for the frequency of 100 MHz. Draw the necessary diagram and comment on how can we increase the directivity of yagi uda antenna. [5]

Q5) Answer the following:

- a) With the help of a neat diagram, discuss Smith chart with respect to its construction and mathematical formulation. Write the steps to find VSWR using Smith chart. [7]
- b) Describe any five antenna parameters. [5]

Q6) Answer the following:

- a) Starting with Maxwell's equation, derive transmission line equation. [7]
A transmission line has R , L , G and C as 5Ω , 1 mH, $0.1\mu S$ and $1\mu F$ respectively. Find characteristics impedance, propagation constant γ , attenuation constant α and phase constant β at frequency $F = 1$ MHz.
- b) The time domain expression for the magnetic field of plane wave travelling in a non-magnetic medium is given by

$$H(x,t) = 0.5 \cos(6\pi \times 10^8 t - 10x) \hat{a}_z \text{ A/m} \quad [5]$$

then find

- i) Direction of wave propagation
- ii) Dielectric constant and intrinsic impedance
- iii) The time domain expression of $\vec{E}$ field
- iv) Average power density

Q7) Attempt any two of the following.

- a) What is Skin depth. Derive the expression for skin depth in a conducting medium.

Sea water has $\sigma = 5 \text{ mho/m}$, $\epsilon_r = 80$, $\mu = \mu_0$. Find the distance upto which an electromagnetic wave attenuates to 10% of its original value at 25 KHz. **[6]**

- b) Write short note on different types of transmission lines. **[6]**

- c) Write short note on Dielectric circular waveguide. **[6]**



Total No. of Questions : 8]

SEAT No.

PE-5469

[Total No. of Pages : 3

[6518]-202

First Year M.Sc.

ELECTRONIC SCIENCE

ELUT-122 : Instrumentation & Measurement Tech.

(2019 Pattern) (Semester - II)

Time : 3 Hours]

[Max. Marks : 70

Instructions to the candidates:

- 1) Question No.1 is compulsory.
- 2) Attempt any 5 questions from question 2 to 7.
- 3) Question 2 to 7 carry equal marks.
- 4) Figure to the right indicate full marks.
- 5) Use of non-programmable calculator is allowed.

Q1) Answer any five of the following: **[10]**

- a) Define noise factor and noise figure.
- b) Write applications of measurement system.
- c) A platinum thermometer has a resistance 100Ω at 25°C
 - i) Find the temperature if thermometer has a resistance of 150Ω .
 - ii) Find its resistance at 65°C . Consider the platinum has a resistance temperature coefficient of $0.00392/^\circ\text{C}$.
- d) Classify transducer based on transduction principle used with two examples of each.
- e) A Wheatstone bridge requires a change of 7Ω in the unknown arm of the bridge to produce a change in deflection of 3 mm of the galvanometer. Determine sensitivity and deflection factor.
- f) What is meant by desired and modifying inputs of measurement system?

Q2) Attempt the following:

- a) Describe LVDT with circuit diagram and output characteristics. State advantages, limitations and applications of LVDT. **[7]**
- b) Explain Null type instruments with example. Distinguish between Null type and Deflection type instrument. **[5]**

Q3) Attempt the following:

- a) With the help of a block diagram explain function of each element of generalized instrumentation system. Write classification of instruments. **[7]**

P.T.O.

- b) A linear resistance potentiometer is 50 mm long and is uniformly wound with a wire having a resistance of $10\text{k}\Omega$. Under normal conditions, the slider is at the center of the potentiometer. Find the linear displacement when the resistance of the potentiometer as measured by a Wheatstone bridge for given cases is:

i) 3850Ω

ii) 7560Ω

Are the two displacements in the same direction. It is possible to measure a minimum value of 10Ω resistance with the above arrangement, find the resolution of the potentiometer in mm. [5]

Q4) Attempt the following:

- a) Discuss time domain analysis of measurement system for step input, impulse input and ramp input. Define dynamic error. [7]
- b) A barium titanium piezoelectric transducer is being used to measure pressure varying sinusoidally at a frequency of 50Hz. Thickness of the crystal is 3 mm, diameter 5 mm, dielectric constant 15 nF/m , modulus of elasticity 120 GPa , constant g for the crystal 15 mV/mPa , resistance of the crystal $1500\text{ G}\Omega$. It is connected through a cable having a capacitance of 100 pF . The amplifier has an input impedance of $2\text{ M}\Omega$ in parallel with a capacitance of 2000 pF . Determine the amplitude ratio e_0/P and phase lag. [5]

Q5) Attempt the following:

- a) Describe different errors occurs in measurement with suitable example. A voltmeter having a sensitivity of $1000\Omega/\text{V}$ reads 100 V on its 150 V scale when connected across an unknown resistor in series with a milliammeter. When the milliammeter reads 5 mA , calculate [7]
- i) Apparent resistance of the unknown resistor.
- ii) Actual resistance of the unknown resistor.
- b) Determine the sensitivity of a link-type load cell Wheatstone's bridge combination if $S_g = 2$, Poisson's ratio $= 0.3$, $E_i = 10\text{ V}$, $A = 5\text{ cm}^2$ and $E = 200\text{ GPa}$. [5]
- i) The sensitivity of the transducer can be increased. If each gauge in the bridge can dissipate 1 W of power, determine maximum sensitivity that can be achieved without endangering the strain-gauge ($R_g = 120\Omega$)
- ii) Determine the voltage $(E_o/E_i)_{\text{max}}$ for the load cell if the fatigue strength of the elastic member is 500 MPa .

Q6) Attempt the following:

- a) Describe turbine meter and electromagnetic flow meter. State advantages and disadvantages. [7]
- b) A first order system is subjected to unit step input. Derive an equation of time response of it. Find dynamic and steady state error. [5]

Q7) Write short notes on any two of the following. [12]

- a) Bimetallic Thermometer
- b) Seismic displacement pickups
- c) Effect of input and output impedance on the measurement



Total No. of Questions : 7]

SEAT No. :

PE-5470

[Total No. of Pages : 3

[6518]-203

First Year M.Sc.

ELECTRONIC SCIENCE

ELUT-123 : Foundation of Semiconductor Devices

(2019 Pattern) (Semester - II)

Time : 3 Hours]

[Max. Marks : 70

Instructions to the candidates:

- 1) Figures to the right indicate full marks.
- 2) Question No.1 is compulsory.
- 3) Attempt any five questions from Q.No.2 to Q.No.7.
- 4) Questions 2 to 7 carry equal marks.
- 5) Use of non-programmable calculator is allowed.

Q1) Attempt any five of the following:

[10]

- a) Comment on “Current gain is high in HBJ compare with homojunction BJT”.
- b) What is electron scattering? How does it influence the behavior of electron and semiconductor crystal?
- c) Calculate the packing fraction of the simple cubic unit cell of volume filled with hard spheres.
- d) Explain the significance of wave function and it's requirements.
- e) What are the compound semiconductor?
- f) n-channel silicon JFET is formed with
 $N_d = 5 \times 10^{16} \text{ cm}^{-3}$, $N_a = 10^{19} \text{ cm}^{-3}$, $d = 1.2 \text{ mm}$, $E_s = 11.7 \times 8.85 \times 10^{-14}$.
and $t = 1.6 \times 10^{-19}$ Calculate the internal pinch-off voltage.

Q2) Attempt the following:

- a) Explain the VPE and MBE methods in details. [7]
- b) Explain the energy-band diagram of MOS capacitor with p-type substrate in accumulation, depletion and inversion modes. [5]

P.T.O.

Q3) Attempt the following:

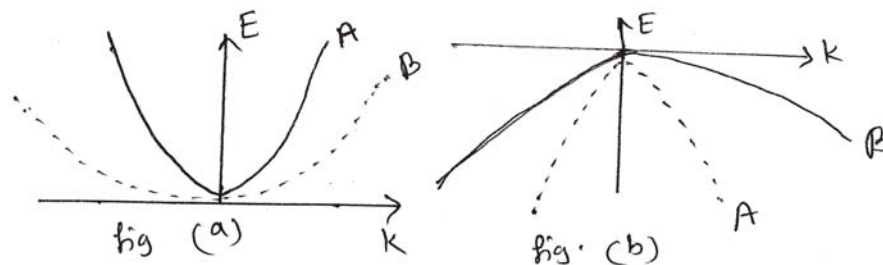
- Distinguishing the response of a p-n junction under no bias and reverse bias condition, draw suitable diagrams at one place showing the width of depletion region, potential barrier, electric field, energy band diagram and particle flow and current flow. [7]
- Calculate the first three energy levels of, plot wave function and probability of finding of an electron in an infinite potential well. Consider an electron in an infinite potential well of width 25 Å. [5]

Q4) Attempt the following:

- Distinguish between Maxwell-Boltzmann (MB), Bose-Einstein (BE) and Fermi-Dirac (FD) statistics. Schematically show that Fermi-Dirac function dependence on temperature. [7]
- Define effective mass and show that

$$m_{eff} = \frac{\hbar^2}{\frac{d^2E}{dk^2}}$$

two possible conduction and valence band are show in the E versus K diagrams. [5]



- Identify the particles for which each of these diagrams is valid.
- Which band will have heavier particle mass in both of figures and why?

Q5) Attempt the following:

- What is Millar indices? Explain the concept of equivalence of planes in crystals. Determine the miller indices of plane which is parallel to x-axis and cuts intercepts of 2 and 1/2 respectively along y and z axes. [7]

- b) Consider an NPN BJT with the following: [5]
Parameters: $I_{En} = 1\text{mA}$, $I_{Ep} = 0.01\text{ mA}$, $I_{Cn} = 0.98\text{ mA}$ and $I_{Cp} = 0.0001\text{ mA}$
- i) Determine the base transport factor (α_T)
 - ii) Determine the emitter injection efficiency (γ)
 - iii) Determine the current (I_E)
 - iv) Determine the current gain (α_{dc})

Q6) Attempt the following:

- a) Using Fermi-Dirac distribution function, obtain an expression for concentration of electron in conduction band and hole in valance band of semiconductor. [7]
- b) List the advantages of polysilicon emitter transistor. Explain its working with suitable diagram. [5]

Q7) Write short note on any two of the following: [12]

- a) Types of bonding in solids with suitable examples.
- b) Density of state. Explain relation between density of state and energy.
- c) Hall effect. Derive the relation for hall coefficient.



Total No. of Questions : 5]

SEAT No. :

PE-5471

[Total No. of Pages : 2

[6518]-204

First Year M.Sc.

ELECTRONIC SCIENCE

ELDT 124 : Fiber Optic Communication Systems

(2019 Pattern) (Semester - II)

Time : 2 Hours]

[Max. Marks : 35

Instructions to the candidates:

- 1) Q 1 is compulsory.
- 2) Solve any three questions form Q 2 to Q 5.
- 3) Draw neat diagram wherever necessary.

Q1) a) Attempt any Five of the following. **[5]**

- i) List the various types of LASERS used in medical surgery
- ii) What is attenuation in OFC?
- iii) What is multiplexing in OFC?
- iv) State the functions of optical wavelength convertor.
- v) State principle of optical power meter.
- vi) What is fiber sensor?
- vii) State the types of WDM.

Q2) a) Attempt any two of the following **[6]**

- i) Explain the working of isolator in OFC.
 - ii) Explain the Raman Amplifier in brief.
 - iii) What is dispersion? Explain it in relation to single mode fiber.
- b) Explain the chromatic dispersion measurement with the help of experimental setup. **[4]**

Q3) a) Attempt any two of the following **[6]**

- i) Explain the rise time budget with suitable example.
 - ii) Explain the measurement process of attenuation with suitable experimental setup.
 - iii) State the principle and working of optical time domain reflectometer.
- b) Consider a EDFA being pumped at 980 nm with 30 mW pump power. If the gain at 1550 nm is 20 dB. What are the maximum input and output

P.T.O.

power. [4]

Q4) a) Attempt any two of the following. [6]

- i) Explain the role of beam splitter in OFC.
 - ii) With the help of experimental setup explain the chromatic dispersion measurement.
 - iii) Explain the operational principles of WDM.
- b) An engineer wants to find the attenuation at 1310 nm of 4.95 km long fiber. The available instrument is a photodetector, which gives an output reading in volts. Using the device in a cutback attenuation setup the engineer measure an output 6.58 V from the photodiode at the far end of fiber. after cutting the fiber 2m from source. The output voltage from the photodetector now reads 2.21 V. What is the attenuation of fiber in dB/km. [4]

Q5) Attempt to any four of the following. [10]

- a) Explain the working of eye pattern.
- b) Explain the fiber dispersion in multi-mode and single mode fiber.
- c) Explain optical multiplexer and de-multiplexer.
- d) Explain the working of line coding in optical links.
- e) List the applications of Laser in industry and medical surgery.
- f) Give working principle of optical power meter.



Total No. of Questions : 5]

SEAT No. :

PE-5472

[Total No. of Pages : 2

[6518]-205

First Year M.Sc.

ELECTRONIC SCIENCE

ELDT-124 : Fundamentals and Applications of AVR
Microcontroller

(2019 Pattern) (Semester - II)

Time : 2 Hours]

[Max. Marks : 35

Instructions to the candidates:

- 1) *Figures to the right side indicate full marks.*
- 2) *Question No.1 is compulsory.*
- 3) *Attempt any three questions from Q.No.2 to Q.No.5.*
- 4) *Q.No.2 to Q.No.5 carry equal marks.*
- 5) *Use of non-programmable calculator is allowed.*

Q1) Solve any five of the following: [5]

- a) What are the advantages and disadvantages of 'C' language over assembly language?
- b) Assume the RAM location 400H has the value of 33H. Write a program to find the sum of location 400H of RAM and 55H. At the end of the program, R21 should contain the sum.
- c) Write a list of serial communication protocols used in Atmega16.
- d) What are the advantages of solid state relay over electromagnetic relay?
- e) List any two SFRs of AVR used serial communication.
- f) LED's are connected to pins of part B. Write an AVR C program that shows the count from 0 to FFH on the LEDs.

Q2) Attempt the following questions.

- a) Draw block diagram interface of temperature sensor and display to Atmega16. Write C program to read temperature sensor and display it on part D. [4]
- b) Give steps in programming the ADC using polling. [2]
- c) Draw and explain the status register of Atmega16 with example explain how flags of status register will affected after addition. [4]

P.T.O.

Q3) Attempt the following questions.

- a) Explain in detail any three addressing modes of AVR Atmega16 with suitable example. [6]
- b) Write a 'C' program to gradually changes the speed of DC motor from 50% to 100%. State the applications of DC motor in embedded system. [4]

Q4) Attempt the following questions.

- a) Draw and explain the architecture of Atmega16 μ c. [4]
- b) With neat diagram compare Von Neumann and Harvard architecture.[2]
- c) Draw the interfacing of DAC 0808 to Atmega16 microcontroller. Write 'C' program to generate stair-step ramp using DAC. [4]

Q5) Write short notes on any four of the following: [10]

- a) What is need of RTC? Draw and explain interfacing of RTC with Atmega16 microcontroller.
- b) Draw interfacing diagram of 16×2 LCD to Atmega16 microcontroller. Give pin description of LCD. State features of 16×2 LCD.
- c) With the help of timing diagram explain how master writes the value 1111000 to a slave with 1001101.
- d) Describe the data memory organization of Atmega16.
- e) Explain the role of interrupt in Atmega16. Comment "Interrupt is necessary or not in micro-controller based system."
- f) Draw and explain pipelining concept in Atmega16.



Total No. of Questions : 7]

SEAT No. :

PE5568

[Total No. of Pages : 2

[6518]-301

M.Sc. - II

ELECTRONIC SCIENCE

ELT 231 : Advanced Communication Systems

(CBCS 2019 Pattern) (Semester - III) (4 Credits) (Paper - I)

Time : 3 Hours]

[Max. Marks : 70

Instructions to the candidates:

- 1) Q.1 is compulsory.
- 2) Attempt any five questions from Q.2 to Q.7.
- 3) Q.2 to Q.7 carry equal marks.

Q1) Attempt any Five of the following :

[10]

- a) What is noise? Write the types of noise.
- b) What is skip distance?
- c) Define the term modulation.
- d) What do you mean by directivity of an antenna?
- e) Calculate frequency deviation for FM signal with modulating frequency of 7kHz and modulation index of 5.
- f) State Kepler's Ist law.

Q2) Attempt the following :

- a) With the help of diagram explain the working of delta modulation and write advantages & disadvantages of it. **[7]**
- b) Write the meaning of keying? Draw and explain frequency shift keying modulator circuit. **[5]**

Q3) Attempt the following :

- a) Give the SDLC protocol with frame format and explain the function of each block in detail. **[7]**
- b) Draw and explain the block diagram of communication system. **[5]**

P.T.O.

Q4) Attempt the following :

- a) Describe how the sky wave propagation takes place with the help of diagram. [7]
- b) With the help of neat block diagram explain satellite transponder. [5]

Q5) Attempt the following :

- a) Discuss smart antenna in detail. Write its advantages and disadvantages.[7]
- b) Explain cellular radio system. [5]

Q6) a) Describe XMODM protocol and write the importance of it. [7]

- b) The maximum peak to peak voltage of an AM wave is 16mV and the minimum voltage is 6mV. Calculate the modulation index. [5]

Q7) Write a short note on any two of the following : [12]

- a) QAM
- b) DSL
- c) Parameters of antenna

x x x

Total No. of Questions : 7]

SEAT No. :

PE-5569

[Total No. of Pages : 2

[6518]-302

M.Sc. (Part - II)

ELECTRONIC SCIENCE

ELT 232 : Mechatronics and Robotics (MAR)

(2019 Pattern) (Semester - III) (4 Credits) (Theory)

Time : 3 Hours]

[Max. Marks : 70

Instructions to the candidates:

- 1) Question 1 is compulsory.
- 2) Solve any five questions from Q.2 to Q. 7.
- 3) Figures to the right indicate full marks.
- 4) Color pencils/pens other than red color are allowed to use.
- 5) Draw neat diagram wherever necessary.
- 6) Use of calculator is allowed.

Q1) Solve any Five of the following :

[5 × 2 = 10]

- a) What is mean by Robotics?
- b) Define DC motors.
- c) What is Hinges?
- d) Define linear motion.
- e) What is need of feedback.
- f) What is mean by mechatronics system?

Q2) Attempt the following :

- a) i) Explain toggle and slider crank in brief. **[3]**
ii) Draw the construction of BJT and explain BJT as a solid state switch with circuit diagram. **[4]**
- b) List and explain any five applications of Robot. **[5]**

Q3) Attempt the following :

- a) i) Define **[3]**
I) Sensors
II) Transducers
III) Actuators
ii) Explain **[4]**
I) Angular velocity
II) Angular acceleration
- b) Explain AC motor construction and working with neat diagram. **[5]**

P.T.O.

Q4) Attempt the following :

- a) i) What is need of trajectory planning? [3]
- ii) Explain PMDC motor. [4]
- b) What is Mutual Inductance? Explain construction and working of relay with neat diagram. [5]

Q5) Attempt the following :

- a) i) What is rotational and translation motion. [3]
- ii) Explain Homogenous transformation matrices. [4]
- b) Explain degree of freedom in detail. [5]

Q6) Attempt the following :

- a) i) What is manipulator? Give one example. [3]
- ii) What is gears? Explain gear trains and gear ratio in brief. [4]
- b) Explain axis angle representation in arbitrary rotation. [5]

Q7) Write short notes on any two of the following. [2 × 6 = 12]

- a) Mechanical building blocks.
- b) Robot with Artificial Intelligence (AI).
- c) Industrial Mechatronics
- d) Euler - Lagrange equation by forming Lagrangian of a system.



Total No. of Questions : 7]

SEAT No. :

PE-5570

[Total No. of Pages : 2

[6518]-303
M.Sc. (Part - II)
ELECTRONIC SCIENCE
ELT-233 : Control System
(2019 Pattern) (CBCS) (Semester - III) (Credit 4)

Time : 3 Hours]

[Max. Marks : 70

Instructions to the candidates:

- 1) *Question 1 is compulsory.*
- 2) *Solve any five questions from Q.2 to Q.7.*
- 3) *Q.2 to Q.7 carry equal marks.*
- 4) *Neat diagram must be drawn whenever necessary.*

Q1) Solve any five of the following :

[10]

- a) Determine transfer function of (RC) Low pass filter.
- b) List advantages of closed loop control system.
- c) What are the different types of control values?
- d) What is control system?
- e) What is PLC?
- f) What is function of error detector?

Q2) Attempt the following :

- a) Explain the application of control system for speed control of dc motor. **[7]**
- b) What is open loop control system? Give examples of it . **[5]**

Q3) Attempt the following :

- a) For unity feedback control 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. **[7]**
- b) Explain the construction and working of a solenoid. **[5]**

P.T.O.

Q4) Attempt the following :

- a) With the help of block diagram explain room temperature control system. [7]
- b) Explain the construction and working of the synchro. [5]

Q5) Answer the following :

- a) Using Routh-Hurwitz criterion determine stability of the system having denominator polynomial. $D(s) = s^3 + 4s^2 + s + 16 = 0$. [7]
- b) Explain the concept of gain margin and phase margin. [5]

Q6) Answer the following :

- a) Explain the working proportional controller circuit. State applications of "P" controller. [7]
- b) Explain the adaptive control system. [5]

Q7) Write short notes on any two of the following :

- a) SCADA system. [6]
- b) Recorders used in control system. [6]
- c) Block diagram reduction rules. [6]



Total No. of Questions : 5]

SEAT No. :

PE-5571

[Total No. of Pages : 2

[6518]-304

M.Sc. (Part - II)

ELECTRONIC SCIENCE

ELT 234 : Fundamentals of Internet of Things

(2019 Pattern) (Semester - III) (Elective)

Time : 2 Hours]

[Max. Marks : 35

Instructions to the candidates:

- 1) Q.1 is compulsory.
- 2) Solve any three questions from Q.2 to Q.5.
- 3) Questions 2 to 5 carry equal marks.
- 4) Color pencil use (other than red color) is not restricted.

Q1) Attempt any Five of the following :

[5]

- a) Give any two applications of the Internet of Things (IoT).
- b) What is longform of ITU-T?
- c) What is longform of RFID?
- d) What is longform of EPCIS?
- e) What is WSN?
- f) Give any two types of sensors used for smart Home.

Q2) Attempt the following :

[10]

- a) i) What is longform and role of QoS? **[2]**
ii) List and explain any four advantages of IoT. **[4]**
- b) What is MQTT? **[4]**

Q3) Attempt the following :

[10]

- a) i) List the names of layers in Four - layer IoT Architecture and explain its role. **[4]**
ii) What is need for IoT management system? **[2]**
- b) Explain Routing Protocols. **[4]**

P.T.O.

Q4) Attempt the following : [10]

- a) i) What is long form and role of ONS? [2]
- ii) List and explain any four advantages of WNS. [4]
- b) Explain any four important measures of web of Things. [4]

Q5) Write short notes on any Four of the following. [10]

- a) IoT Architecture.
- b) Use of Artificial Intelligence for IoT.
- c) Sensor Technology.
- d) Satellite Technology for communication.
- e) Environment characteristics of IoT.
- f) Data Link layer protocol.



Total No. of Questions : 5]

SEAT No. :

PE-5572

[Total No. of Pages : 2

[6518]-305

M.Sc. (Part - II)

ELECTRONIC SCIENCE

ELT-234 : Wireless Communication System - I

(2019 Pattern) (Semester - III) (Credit - 2) (Elective Theory)

Time : 2 Hours]

[Max. Marks : 35

Instructions to the candidates:

- 1) Q. 1 is compulsory.
- 2) Solve any three questions from Q.2 to Q.5.
- 3) Questions 2 to 5 carry equal marks.
- 4) Neat diagrams must be drawn wherever necessary.

Q1) Answer any five of the following :

[5 × 1 = 5]

- a) What is the full form of WLL and WLAN?
- b) What are the functions of a RAKE receiver?
- c) What is spread spectrum?
- d) What is personal area network?
- e) What is cognitive radio?
- f) Define soft handoff.

Q2) Answer the following :

- a) i) What are the advantages and disadvantages of Bluetooth technology for personal area networks. [3]
ii) Write a note on beam forming. [3]
- b) What is GSM? Explain components of GSM architecture. [4]

Q3) Answer the following :

- a) i) What are the features of smart antenna system? Write benefits of smart antennas. [3]
ii) Explain the role of power control in a CDMA system. [3]
- b) Explain the architecture of satellite communication system. [4]

P.T.O.

Q4) Answer the following :

- a) Explain the concept of MIMO-OFDM systems. What are the advantages of MIMO-OFDM systems compared to traditional systems? [6]
- b) What is RFID? What are the types of RFID systems? How RFID systems are classified? [4]

Q5) Write short note on any Four of the following : [10]

- a) 3G wireless networks.
- b) Performance of CDMA system.
- c) Air interface.
- d) GPRS
- e) Multicarrier modulation.
- f) Paging system.



Total No. of Questions : 5]

SEAT No. :

PE-5473

[Total No. of Pages : 2

[6518]-401

S.Y. M.Sc.

ELECTRONIC SCIENCE

ELT-241 : PLC Programming and Applications

(2019 Pattern) (Semester - IV)

Time : 2 Hours]

[Max. Marks : 35

Instructions to the candidates:

- 1) Question No.1 compulsory.
- 2) Solve any three questions from Q.No.2 to Q.No.5
- 3) Q.No.2 to Q.No.5 carry equal marks.
- 4) Neat diagram must be drawn wherever necessary.

Q1) Answer any five of the following: [5]

- a) Which bit of down counter is set when it counts below –32768?
- b) What are the two most common types of PLC programming devices?
- c) List various PLC brands available in market.
- d) Define scan cycle in PLC.
- e) Draw the ladder diagram for NAND gate.
- f) Which instruction is used to reset the counter. Draw its symbol.

Q2) Answer the following.

- a) i) Explain off-delay timer instruction in detail. [3]
- ii) Explain up-counter instruction in detail. [3]
- b) Draw the ladder diagram for car parking system. [4]

Q3) Answer the following.

- a) i) Explain any three comparison instructions used in PLC. [3]
- ii) Draw ladder diagram for XOR, NOT and NOR gates. [3]
- b) Explain any four arithmetic instructions used in PLC. [4]

P.T.O.

Q4) Answer the following.

- a) Draw block diagram of PLC. Write function of each block. [6]
- b) Draw block diagram for bottle filling plant and construct the ladder diagram for same. [4]

Q5) Answer any four questions of the following. [10]

- a) Write a note on structured text.
- b) Write a note on Scan cycle.
- c) List and draw symbol of different types of switches used to provide input to PLC.
- d) State advantages of PLCs over electromagnetic relays.
- e) Write a note on MOV instruction.
- f) Explain Retentive Timer (RTO) instruction.



Total No. of Questions : 8]

SEAT No. :

PE-5474

[Total No. of Pages : 2

[6518]-402

S.Y. M.Sc.

ELECTRONIC SCIENCE

ELT-243 : Technical Writing

(2019 Pattern) (Semester - IV)

Time : 3 Hours]

[Max. Marks : 70

Instructions to the candidates:

- 1) Question No.1 is compulsory.
- 2) Attempt any 5 questions from question 2 to 7.
- 3) Question 2 to 7 carry equal marks.

Q1) Answer any five of the following:

[10]

- a) Define critical thinking as technical communication skill.
- b) What is technical communication?
- c) List any four types of reports.
- d) What is mean by workshop?
- e) Define authors in making of research paper.
- f) What is the purpose of technical written communication?

Q2) Attempt the following:

- a) Write a job application letter to a Mumbai based company for the post of Assistant Manager. [7]
- b) Which Do's and Don'ts one should follow in a group discussion? [5]

Q3) Attempt the following:

- a) What is Thesis? Write structural point for making Thesis and explain each point in brief. [7]
- b) Draw and explain process of Communication. [5]

Q4) Attempt the following:

- a) What is meant by technical presentation? Explain in brief. [7]
 - i) Class room presentation
 - ii) Individual presentation
 - iii) Public speaking
- b) What is Report? Describe parts/structure of report in brief. [5]

P.T.O.

Q5) Attempt the following:

- a) What is Interview? Write its purpose and sequence of interviews. Explain in brief any two types. [7]
- b) Differentiate between General and technical communication. [5]

Q6) Attempt the following:

- a) What is presentation strategies? Explain purpose of theme presentation. [7]
- b) Discuss the flow of communication. [5]

Q7) Write short note on any two of the following. [12]

- a) Paragraph
- b) 7 C's of communication
- c) Group discussion

