B. Sc. Semester II HONOURS Examination-2022

Subject: Electronics Science

Paper: CC 03 (Semiconductor Devices)

Time: 2 Hours **Full Marks: 40**

The figures in the margin indicate full marks.
Candidates are required to give their answers in their own words as far as practicable.

A) Answer any five (05) questions. (2X5 = 10)

1. Mention some uses of typical semiconductors.
2. What is a linearly graded p-n junction?
3. What is diffusion capacitance?
4. Why is the emitter region of a transistor more heavily doped than the base region?
5. Why are junction transistors called bipolar devices?
6. "A BJT is a current-controlled device while a FET is a voltage-controlled device" - Justify.
7. Why must the gate-to-source voltage of an n-channel JFET always be either zero or negative?
8. Why is CMOS called complementary?

B) Answer any two (02) questions. (5x2 = 10)

1. Explain clearly the meaning of hole as referred to in a semiconductor. What is meant by an intrinsic and an extrinsic semiconductor? Is an n-type semiconductor negatively charged?
2. Explain with a circuit diagram the use of a Zener diode as a reference diode.
3. Draw the common-emitter circuit of a junction transistor. Sketch its output characteristics. Indicate the active, saturation and cutoff regions.
4. Sketch the structure of an n-channel depletion type MOSFET. Explain how the depletion region is produced in the channel?

C) Answer any two (02) questions. (10x2 = 20)

1. What are 'Hall Effect' and 'Hall Field'? Explain briefly the physical origin of the Hall effect. Describe an experimental arrangement to measure the Hall coefficient? 2+4+4
2. What is a tunnel diode? Draw the volt-ampere characteristic of such a diode and explain the occurrence of the differential negative resistance in the characteristic. Mention some uses of the tunnel diode. 2+6+2
3. Discuss the mechanism of amplification obtained in a bipolar junction transistor (BJT). What is the origin of the name 'transistor'? 8+2
4. What is a unijunction transistor? Draw and explain its current-voltage characteristics. Show how the device can be used in a relaxation oscillator?. 1+4+5

B. Sc. Semester II HONOURS Examination-2022

Subject: Electronics Science

Paper: CC 03 (Semiconductor Devices)

Time: 2 Hours **Full Marks: 40**

The figures in the margin indicate full marks.
Candidates are required to give their answers in their own words as far as practicable.

A) Answer any five (05) questions. (2X5 = 10)

1. Mention some uses of typical semiconductors.
2. What is a linearly graded p-n junction?
3. What is diffusion capacitance?
4. Why is the emitter region of a transistor more heavily doped than the base region?
5. Why are junction transistors called bipolar devices?
6. "A BJT is a current-controlled device while a FET is a voltage-controlled device" - Justify.
7. Why must the gate-to-source voltage of an n-channel JFET always be either zero or negative?
8. Why is CMOS called complementary?

B) Answer any two (02) questions. (5x2 = 10)

1. Explain clearly the meaning of hole as referred to in a semiconductor. What is meant by an intrinsic and an extrinsic semiconductor? Is an n-type semiconductor negatively charged?
2. Explain with a circuit diagram the use of a Zener diode as a reference diode.
3. Draw the common-emitter circuit of a junction transistor. Sketch its output characteristics. Indicate the active, saturation and cutoff regions.
4. Sketch the structure of an n-channel depletion type MOSFET. Explain how the depletion region is produced in the channel?

C) Answer any two (02) questions. (10x2 = 20)

1. What are 'Hall Effect' and 'Hall Field'? Explain briefly the physical origin of the Hall effect. Describe an experimental arrangement to measure the Hall coefficient? 2+4+4
2. What is a tunnel diode? Draw the volt-ampere characteristic of such a diode and explain the occurrence of the differential negative resistance in the characteristic. Mention some uses of the tunnel diode. 2+6+2
3. Discuss the mechanism of amplification obtained in a bipolar junction transistor (BJT). What is the origin of the name 'transistor'? 8+2
4. What is a unijunction transistor? Draw and explain its current-voltage characteristics. Show how the device can be used in a relaxation oscillator?. 1+4+5

B. Sc. Semester II HONOURS Examination-2022

Subject: Electronics Science

Paper: CC 04 (Applied Physics)

Time: 2 Hours **Full Marks: 40**

The figures in the margin indicate full marks.
Candidates are required to give their answers in their own words as far as practicable.

A) Answer any five (05) questions. (2x5 = 10)

1. Show that the Planck's constant has a dimention of action.
2. Define probability current density.
3. Witedown any two basic postulates of quantum mechanics.
4. Why are eigenvalues of an hermitian operator real?
5. Define fatigue and fracture in the context of mechanical properties of materials.
6. Define relaxation time in a metal.
7. What is superconductivity?
8. What do you mean by Giant Magnetic Resistance?

B) Answer any two (02) questions. (5 X 2 = 10)

1. State generalized Ohom's law. Starting from generalized Ohom's law define resistance.
2. (a) What is phonon? State its properties.
(b) Write down the expression of specific heat of a solid. Hence, compare the contribution from electrons and phonons. Draw a graph of specific heat with temperature. Comment on the low temperature case.
3. Briefly describe Seebeck Effect.
4. State Hooke's Law. Differentiate elastic and plastic deformations.

C) Answer any two (02) questions. (10 X 2 = 20)

1. (a) State de Broglie's postulate on the wave like property of particles. Calculate in MeV the energy of a proton having de Broglie wavelength of 10^{-15} m.
(b) Briefly describe an experiment which demonstrates the wave like property of mater.
(2+3)+5

2. Discuss the origin of magnetic moment. Differentiate dia, para, ferro and antiferro magnetism based on their physical origin and relevant parameters. What is Curie's temperature.
2+6+2

3. State and explain the second law of thermodynamics. From it define entropy. "Entropy at equilibrium state is maximum"-explain.
4+3+3

4. Consider a particle in a onedimensional box having infinite potential at the walls. Write down the necessary Schroedinger wave equation for this system. Hence solve it to obtain energy levels.
10

B.Sc. Semester I (Honours) Examination-2021

Subject: Electronic Science

Paper: CC-I (Basic Circuit Theory and Network Analysis)

Time: 2 Hours **Full Marks: 40**

Answer any **EIGHT** questions. 5X8=40

1. Distinguish between ideal voltage source and ideal current source. Two capacitors C_1 and C_2 are connected in series. Calculate the equivalent capacitance from first principle.
2. Distinguish between self induction and mutual induction. Calculate the energy stored in a coil connected in an electrical circuit carrying a current i.
3. Draw a typical star network of three resistors R_1 , R_2 and R_3 . Find its equivalent delta network.
4. State and explain KCL and KVL of network analysis. What are mesh and node analysis?
5. A capacitor C in uncharged condition is joined to a dc voltage source E through a resistor R at time $t=0$. Find the voltage across the capacitor as a function of time $v_C(t)$ for $t>0$. What is time constant of the circuit?
6. Define instantaneous, peak, rms and average values of a sinusoidal voltage written in conventional notations. Give their mathematical notations. What is complex impedance of a series LCR ac circuit?
7. What do you mean by instantaneous power and average power of an ac circuit? Define power factor. Find the power factor of a series circuit of L and R connected with an ac source $A\sin\omega t$.
8. Study the frequency response of parallel LCR ac circuit. Define bandwidth and quality factor of the circuit.
9. State and prove superposition theorem and maximum power transfer theorem.
10. Write notes on any two of the following:
    (a)Electrolytic capacitor, (b)Variable inductors, (c) Impedance parameters.

B. Sc. Semester I (Honours) Examination 2020 (CBCS)

Subject: Electronic Science

Paper CC- I (Theory)

Time: 2 hours **Full Marks: 40**

Candidates are required to give their answers in their own words as far as practicable

1. Write a short note on the method of measuring resistance with a digital multi-meter and with color coding.
2. Derive the expression of root mean square value of a Sinusoidal voltage signal.
3. Derive the expression of charging time of a RC series circuit.
4. A sinusoidal AC voltage signal is sent through a resistance R. Derive the expression of the average power delivered to the resistance in terms power factor.
5. Write a short note on the frequency response characteristics of a LC parallel circuit.
6. Design a high pass electronic filter with Resistances and Capacitances. Hence obtain the expression of Cut-off frequency.
7. State and prove Maximum Power Transfer Theorem in an Electronic Network.
8. With a proper circuit diagram discuss Norton's theorem in Electronics. Hence write its importance.
9. Derive the expression of Voltage- Current relationship in an Inductor. Hence find its impedance for an AC signal passing through it.
10. Write a short note mentioning the differences among air capacitor, paper capacitor, and electrolytic capacitor.

B. Sc. Semester I (Honours) Examination 2020 (CBCS)
Subject: Electronic Science
Paper CC- II (Mathematics Foundation for Electronics)

Time: 2 hours **Full Marks: 40**

Candidates are required to give their answers in their own words as far as practicable

Answer any eight of the following questions (all questions carry equal marks): 5×8=40

1. Solve the following *first order differential equation*

$$\frac{dy}{dx} - \frac{2y}{x} = \frac{1}{x^3}$$

2. Discuss a suitable method to solve the Legender's differential equation given by.

$$(1-x^2)\frac{d^2y}{dx^2} - 2x\frac{dy}{dx} + n(n+1)y = 0; \;\; n \text{ is a constant}$$

3. Find out the solution of a *second-order homogeneous linear differential equation* with constant coefficients given by

$$\frac{d^2y}{dx^2} + a\frac{dy}{dx} + by = 0, \;\; a \text{ and } b \text{ are constants}$$

and the roots are real and equal.

4. Determine the *eigen values* and *eigen vectors* of the matrix

$$A = \begin{bmatrix} 0 & 1 & 0 \\ 1 & 0 & 0 \\ 0 & 0 & 0 \end{bmatrix}$$

5. State and explain *Cauchy's Residue Theorem*.

6. Expand the function $f(z) = \frac{1}{z(z-1)}$ in terms of *Laurent's series*

7. Show that the following series

$$\sum_{n=1}^{\infty} \frac{1}{n^p} = \frac{1}{1^p} + \frac{1}{2^p} + \frac{1}{3^p} + \cdots \infty$$

(i) Converges for $p > 1$ and (ii) diverges for $p \leq 1$

8. With suitable example, explain the convergence of a power series.

9. Describe the *Gauss-Seidel Iteration Method* to solve a *system of linear algebraic equations*.

10. Show that $J_{n+1}(x) = \frac{2n}{x} J_n(x) - J_{n-1}(x)$

Where the symbols have their usual meanings.

B. Sc. Semester I (Honours) Examination-2021

Subject: Electronic Science

Paper: CC-II (Mathematics Foundation for Electronics)

Full Marks: 40 **Time: 2 hours**

Answer any *eight* questions **5 × 8 = 40**

1. (i) What do you mean by degree and order of a differential equation? Explain with examples. (ii) Explain Bessel's function of first kind.

2. Find the general solution of the equation: $x^2y''-xy'-3y=x^2\ logx$

3. (i) Solve the system of equations by matrix method: $x+3y=4$, $2x-2y=6$
   (ii) Give an example of a Skew Symmetric Matrix.

4. (i) Find the inverse of the matrix $\boldsymbol{A} = \begin{bmatrix} cos\theta & sin\theta \\ -sin\theta & cos\theta \end{bmatrix}$; (ii) If λ is an eigen value of a matrix $\boldsymbol{B}$, then show that $1/\lambda$ is the eigen value of $\mathbf{B^{-1}}$.

5. (i) Show that $\boldsymbol{A} = \begin{bmatrix} \frac{1}{\sqrt{2}} & \frac{i}{\sqrt{2}} \\ -\frac{i}{\sqrt{2}} & -\frac{1}{\sqrt{2}} \end{bmatrix}$ is a unitary matrix (ii) For two matrices **A** and **C**, If $\boldsymbol{C} = \boldsymbol{AA^T}$, prove that **C** is symmetric.

6. (i) With suitable examples explain (a) Convergent and (b) Oscillatory sequence. (ii) What do you understand by 'limit' of a series?

7. (i) What do you understand by 'D'Alembert's Ratio Test'? Explain with example. (ii) Test the convergence of the infinite series whose nth term is $\frac{1}{n^{2n}}$.

8. (i) Apply integral test and determine the convergence of the series: $\sum_1^\infty \frac{3n}{4n^2+1}$;
   (ii) A series $a_0 + a_1x + a_2x^2 + \cdots\cdots + a_nx^n$ where 'a_n' are all constants is a _____ series in ___. (Fill up the blanks).

9. (i) Express $\frac{2-\sqrt{3}i}{1+i}$ in the form of $a + ib$; (b) With suitable equations explain the Cauchy-Riemann Equations

10. (i) With suitable example explain Trigonometric and Hyperbolic functions (ii) Show that $|\sin(z)|^2 = (\sin x)^2 + (\sinh y)^2$ for all complex numbers $z = x+iy$

B. Sc. Semester-III (Honours) Examination 2020

Subject- Electronic Science

Paper- CC V (Theory)

Full Marks- 40 Time- 2 hours

Candidates are required to give their answers in their own words as far as practicable.

Answer any eight of the following questions (all questions carry equal marks): 5×8=40

1. Discuss the method of a Voltage regulator circuit with a Zener- diode, using proper circuit diagram.

2. With proper circuit diagram discuss the operation of a Full Wave Bridge Rectifier using diodes.

3. With proper circuit diagram discuss the method of developing a clipping circuit using a diode.

4. Write a short note on Thermal Runaway of a Transistor circuit.

5. What do you mean by Voltage divider bias of a Transistor circuit? Discuss its principle of operation with a suitable circuit diagram.

6. Draw the circuit diagram of a CE mode based Transistor amplifier. Hence draw its input and output characteristic curves.

7. With suitable circuit diagram discuss the operation and application of a Darlington Pair circuit.

8. Derive the Barkhausen Criteria for a feedback oscillator.

9. Discussion the operational principle of a Colpitts oscillator with proper circuit diagram.

10. Discuss the operational principle of a single ended Class-A power amplifier with proper circuit diagram.

B. Sc. Semester-III (Honours) Examination 2020

Subject- Electronic Science

Paper- CC VI (Digital Electronics and Verilog/VHDL)

Full Marks- 40 Time- 2 hours

Candidates are required to give their answers in their own words as far as practicable.

Answer any eight of the following questions (all questions carry equal marks): 5×8=40

1. What are different representation schemes of signed decimal integers in binary? Discuss with examples.
2. Design OR, NOR and EX-OR gates using minimum number of NAND gates.
3. What is a MUX? How do realise a three variable logic function using a MUX?
4. What are the special features of a JK-FF? Explain the merits of MSJK-FF.
5. Show with suitable example that SOP and POS representations of logic functions are equivalent.
6. What is a ring counter? Design a 4-bit ring counter using D-FFs.
7. What is ROM? What are the differences between ROM and RAM? Describe the design concept of ROM. Name a few types of ROM.
8. Compare between Verilog and VHDL. How can you describe a typical hardware circuit using VHDL? Answer with suitable example.
9. How is sequential processing done in VHDL? Explain sequential statements LOOP, NEXT and EXIT>
10. Write notes on any two of the following:
    (a) Fan-in and Fan-out
    (b) Binary subtraction circuit
    (c) Hexadecimal number.

B. Sc. Semester-III (Honours) Examination 2020

Subject- Electronic Science

Paper- CCVII (C Programming and Data Structure)

Full Marks- 40 Time- 2 hours

Candidates are required to give their answers in their own words as far as practicable.

Answer any eight of the following questions (all questions carry equal marks): 5×8=40

1. What are basic data types used in C? Discuss with suitable examples.
2. Give a typical C program. Classify different statements you use in the program. Which of these are always used in a C program and why?
3. Write down the syntax of declaration and assignment statements with examples explaining the rules.
4. What are branching statements used in C? Discuss them with examples.
5. How to define a function in C? What are function arguments? Write down the rules of passing values to and returning values from a function. Give examples.
6. What is an array? Write a program in C to assign integer values to the elements of a 3X3 integer array.
7. Write C program to solve the following:

(a) Find the average of 10 given integers. Input the numbers through keyboard.

(b) An array of 15 integers is given. Find the sum of odd and even integers and print them separately.

8. Define a stack and a queue. What is array implementation of stack? Explain the terms infix expression, prefix expression and postfix expression.
9. What is sorting algorithm? Describe bubble sort algorithm and implement it in C.
10. Write short notes on any two of the following:
    (a) Pointer,
    (b) Structure,
    (c) Tree.

B. Sc. Semester III (Honours) Examination, 2020(CBCS)

Subject: Electronic Science

Paper: SEC-1

Time: 2 Hours **Full Marks: 40**

The figures in the margin indicate full marks.
Candidates are required to give their answers in their own words as far as practicable.

Answer any eight questions of the following: $5 \times 8 = 40$

1. Write down the full form of PCB. What is its need? Name different inputs required in PCB design.

2. What basic steps one should follow in designing a complete PCB?

3. What do you mean by routing? What are the parameters one must consider in routing process?

4. Mention the benefits and limitations in surface mount technology.

5. What do you mean by etching?

6. Write short notes on 'Principle of de-soldering' in PCB design technique.

7. Explain why copper coating is needed in PCB design?

8. Name different types of PCB and mention their basic features

9. Explain what type of inspections should be carried out before releasing of PCB from the manufacturing factory.

10. Write short note on PCB materials.

B.Sc. Semester III (Honours) Examination-2021
Subject: Electronic Science
Paper: SEC-1

Time: 2 Hours **Full Marks: 40**

Answer any **EIGHT** questions. 5x8=40

1. Discuss on the advantages of PCB design.
2. What are the basic differences between Schematic and Layout?
3. What is Mil? Why is it used? Mention the flow of complete PCB design.
4. Write short note on pollution control in PCB industry.
5. What do you mean by ‘Vias’ in PCB? What are its different parts?
6. What are different hazards in designing PCB?
7. What are the effects of high frequency in PCB? How they can be avoided?
8. What do you mean by routing? What is the conflict between manual routing and auto routing on high speed signals? How it can be resolved?
9. Write short note on PCB materials.
10. Discuss on the basic principle of photo printing technology in PCB design.

----------x----------