ANALOG AND DIGITAL ELECTRONICS (CS301ES)
COURSE PLANNER

I. COURSE OVERVIEW:

The course has been designed to introduce fundamental principles of analog and digital electronics.The students completing this course will understand basic analog and digital electronics, including semiconductor properties, operational amplifiers, combinational and sequential logic and analog-to-digital digital-to-analog conversion techniques. Finally, students will gain experience in with the design of analog amplifiers, power supplies and logic devices.

II. PREREQUISITS:

1. Basic Electronics
2. Number Systems

III. COURSE OBJECTIVES:

1.	To introduce components such as diodes, BJTs and FETs.
2.	To know the applications of components.
3.	To give Understand of various types of amplifier circuits.
4.	To learn basic techniques for the design of digital circuits and fundamental concepts used in the design of digital systems.
5.	To understand the concepts of combinational logic circuits and sequential circuits.

IV. COURSE OUTCOMES:

S.No.	Description	Bloom's Taxonomy Level
1.	Know the characteristics of various components.	Knowledge, Understand (Level1, Level2)
2.	Understand the utilization of components.	Apply, Create (Level 3, Level 6)
3.	Design and analyze small signal amplifier circuits.	Analyze (Level 4)
4.	Learn Postulates of Boolean algebra and to minimize combinational functions.	Knowledge, Understand (Level1, Level2)
5.	Design and analyze combinational and sequential circuits.	Analyze (Level 4)
6.	Know about the logic families and realization of logic gates.	Knowledge, Understand (Level1, Level2)

V. HOW PROGRAM OUTCOMES ARE ASSESSED:

Program Outcomes (PO)		Level	Proficiency assessed by
PO1	**Engineering Knowledge**: Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.	3	Assignments
PO2	**Problem Analysis**: Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.	2	Examples
PO3	**Design/ Development of Solutions**: Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.	3	Assignments, Exercises
PO4	**Conduct Investigations of Complex Problems**: Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.	-	-
PO5	**Modern Tool Usage**: Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modeling to complex engineering activities with an Understand of the limitations.	-	-
PO6	**The Engineer and Society**: Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice.	-	-
PO7	**Environment and Sustainability**: Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.	-	-
PO8	**Ethics**: Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.	-	-
PO9	**Individual and Team Work**: Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.	1	Oral Discussions
PO10	**Communication**: Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.	2	Document Preparation, Presentation
PO11	**Project management and finance**: Demonstrate knowledge and Understand of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.	3	Assignments
PO12	**Life-Long Learning**: Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.	2	Assignments

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High) - : None

VI. HOW PROGRAM SPECIFIC OUTCOMES ARE ASSESSED:

Program Specific Outcomes		Level	Proficiency assessed by
PSO 1	**Foundation of Mathematical Concepts:** To use mathematical methodologies to crack problem using suitable mathematical analysis, data structure and suitable algorithm.	2	Lectures, Assignments
PSO 2	**Foundation of Computer System:** The ability to interpret the fundamental concepts and methodology of computer systems. Students can understand the functionality of hardware and software aspects of computer systems.	1	Tutorials
PSO 3	**Foundations of Software Development:** The ability to grasp the software development life cycle and methodologies of software systems. Possess competent skills and knowledge of software design process. Familiarity and practical proficiency with a broad area of programming concepts and provide new ideas and innovations towards research.	-	-

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High) - : None

VII. SYLLABUS:

UNIT – I: Diodes and Applications: Junction diode characteristics: Open circuited p-n junction, p-n junction as a rectifier, V-I characteristics, effect of temperature, diode resistance, diffusion capacitance, diode switching times, breakdown diodes, Tunnel diodes, photo diode, LED.
Diode Applications - clipping circuits, comparators, Half wave rectifier, Full wave rectifier, rectifier with capacitor filter.

UNIT – II: BJTs: Transistor characteristics: The junction transistor, transistor as an amplifier, CB, CE, CC configurations, comparison of transistor configurations, the operating point, self-bias or Emitter bias, bias compensation, thermal runaway and stability, transistor at low frequencies, CE amplifier response, gain bandwidth product, Emitter follower, RC coupled amplifier, two cascaded CE and multistage CE amplifiers.

UNIT-III: FETs and Digital Circuits: FETs: JFET, V-I characteristics, MOSFET, low frequency CS and CD amplifiers.
Digital Circuits: Digital (binary) operations of a system, OR gate, AND gate, NOT, EXCLUSIVE OR gate, De Morgan Laws, NAND and NOR DTL gates, modified DTL gates, HTL and TTL gates, output stages, RTL and DCTL, CMOS, Comparison of logic families.

UNIT – IV: Combinational Logic Circuits: Basic Theorems and Properties of Boolean Algebra, Canonical and Standard Forms, Digital Logic Gates, The Map Method, Product-of-Sums Simplification, Don't-Care Conditions, NAND and NOR Implementation, Exclusive-OR Function, Binary Adder-Subtractor, Decimal Adder, Binary Multiplier, Magnitude Comparator, Decoders, Encoders, Multiplexers.

UNIT – V: Sequential Logic Circuits: Sequential Circuits, Storage Elements: Latches and flip flops, Analysis of Clocked Sequential Circuits, State Reduction and Assignment, Shift Registers, Ripple Counters, Synchronous Counters, Random-Access Memory, Read-Only Memory.

TEXT BOOKS:

1. Integrated Electronics: Analog and Digital Circuits and Systems, 2/e, Jaccob Millman, Christos Halkias and Chethan D. Parikh, Tata McGraw-Hill Education, India, 2010.
2. Digital Design, 5/e, Morris Mano and Michael D. Cilette, Pearson, 2011.

REFERENCE BOOKS:

1. Electronic Devices and Circuits, Jimmy J Cathey, Schaum's outline series, 1988.
2. Digital Principles, 3/e, Roger L. Tokheim, Schaum's outline series, 1994.

NPTEL Web Course: https://nptel.ac.in/courses/108102095, https://nptel.ac.in/courses/117106086

NPTEL Video Course: https://nptel.ac.in/courses/108102095, https://nptel.ac.in/courses/117106086

GATE SYLLABUS: Digital Logic:

Boolean algebra. Combinational and sequential circuits. Minimization. Number representations and computer arithmetic (fixed and floating point).

VIII. COURSE PLAN (WEEK-WISE):

Session	Week	Unit	Topics	Course Learning Outcomes	Teaching Methodology	Reference
1	1	1	**Unit-I**: Introduction	**Know** the physics of P-N junction.	Chalk and Talk	**T1, T2**
2			Open circuited P-N junction	**Understand** the open circuited P-N junction.	Chalk and Talk	**T1, T2**
3			P-N junction as a rectifier	**Understand** how the diode acts as rectifier and study the characteristics of rectifiers.	Chalk and Talk	**T1, T2**
4			V-I Characteristics	**Understand** the V-I characteristics of P-N junction.	Chalk and Talk	**T1, T2**
5	2		Effect of temperature, diode resistance	**Understand** the temperature effects and diode resistance	Chalk and Talk	**T1, T2**
6			Diffusion Capacitance, *****. Drift Capacitance***	**Know** about drift and diffusion capacitances.	Chalk and Talk	**T1, T2**
7			Diode switching times	**Understand** diode switching times.	Discussion	**T1, T2**
8			Breakdown diodes	**Understand** the concept of breakdown in diodes and study the operation and characteristics of Zener diode.	Chalk and Talk	**T1, T2**
9	3		Tunnel diode	**Understand** the operation, characteristics and applications of tunnel diode	Chalk and Talk	**T1, T2**
10			Photo diode, LED	**Understand** the operation, characteristics and applications of photo diode and LED.	Chalk and Talk	**T1, T2**

11			Clipping circuits, Comparators	**Explain** clipping circuits, comparators.	Chalk and Talk, PPTs	**T1, T2**
12			Half wave rectifier	**Understand** how the diode acts as rectifier and study the characteristics of rectifiers.	Chalk and Talk, PPTs	**T1, T2**
13	4		Full wave rectifier	**Understand** how the diode acts as rectifier and study the characteristics of rectifiers.	Chalk and Talk, PPTs	**T1, T2**
14			Rectifier with capacitor filter	**Understand** the general conditions for filters and study the rectifier with capacitor filter.	Chalk and Talk, PPTs	**T1, T2**
15			Revision			
16			**Mock Test-I**			
17	5	**2**	**<u>Unit-II</u>**: Transistor characteristics: The junction transistor	**Understand** the basics of transistors.	Chalk and Talk, PPTs	**T1, T2**
18			Transistor as an amplifier	**Study** the operation of transistor as an amplifier.	Chalk and Talk, PPTs	**T1, T2**
19			CB, CE, CC Configurations	**Study** the characteristics of CB,CE,CC configurations.	Chalk and Talk, PPTs	**T1, T2**
20			CB, CE, CC Configurations	**Study** the characteristics of CB,CE,CC configurations.	Chalk and Talk, PPTs	**T1, T2**
21	6		Bridge Class			
22			Comparison of transistor configurations	**Compare** various configurations of transistors.	Chalk and Talk	**T1, T2**
23			Operating point, Self-bias or Emitter bias	**Understand** the concept of operating point and purpose of biasing.	PPTs, discussions	**T1, T2**
24			Bias Compensation, Thermal Runaway and Stability	**Study** about bias compensation, thermal runaway and stability.	Chalk and Talk	**T1, T2**
25	7		Transistor at low frequencies	**Explain** the operation of transistor at low frequencies.	Chalk and Talk	**T1, T2, R1**
26			CE Amplifier Response, Gain Bandwidth Product	**Explain** the operation of CE amplifier, study its frequency response and gain bandwidth product.	Chalk and Talk, PPTs	**T1, T2, R1**
27			Bridge Class			
28			Emitter Follower	**Understand** the operation of emitter follower.	Chalk and Talk	**T1, T2**
29	8		RC Coupled Amplifier, Two Cascaded CE and Multistage CE Amplifiers	**Explain** the operation of RC coupled two cascaded CE and multistage CE amplifiers.	Chalk and Talk	**T1, T2**
30		3	**<u>Unit-III</u>**: JFET, V-I Characteristics	**Understand** the operation, V-I characteristics of JFET.	Chalk and Talk, PPTs	**T1, T2**
31			MOSFET	**Understand** the operation, V-I characteristics of MOSFFET.	Chalk and Talk, PPTs	**T1, T2**
32			Bridge Class			

33	9		Low frequency CS and CD Amplifiers	**Understand** the operation of low frequency CS and CD amplifiers.	Chalk and Talk, PPTs	**T1, T2**
34			Digital (binary) operations of a system, *****. Boolean Laws***, De Morgan Laws	**Understand** the arithmetic operations carried by digital systems.	Chalk and Talk, PPTs	**T1, T2**
35			OR, AND, NOT, EX-OR, NAND and NOR DTL Gates, Modified DTL Gates	**Understand** the OR, AND, NOT, EX-OR, NAND and NOR DTL gates and modified DTL gates.	Chalk and Talk, PPTs	**T1, T2**
36			***I Mid Examinations (Week 9)***			
37	10	**3**	OR, AND, NOT, EX-OR, NAND and NOR DTL Gates, Modified DTL Gates	**Understand** the OR, AND, NOT, EX-OR, NAND and NOR DTL gates and modified DTL gates.	Chalk and Talk, PPTs	**T1, T2**
38			HTL and TTL Gates, Output Stages	**Understand** the HTL and TTL gates and their out put stages.	Chalk and Talk, PPTs	**T1, T2**
39			RTL, DCTL and CMOS	**Understand** the RTL, DCTL and CMOS gates.	Chalk and Talk, PPTs	**T1, T2**
40			Comparison of Logic Families	**Compare** various logic families.	Chalk and Talk, PPTs	**T1, T2**
41	11		Bridge Class			
42		**4**	**Unit-IV**: Introduction to Combinational Logic Circuits	**Understand** the design and analysis of combinational logic circuits.	Chalk and Talk, PPTs	**T1, T2**
43			Basic Theorems and Properties of Boolean Algebra	**Learn** Boolean algebra and logical operations in Boolean algebra.	Chalk and Talk, PPTs	**T1, T2**
44			Canonical and Standard Forms		Chalk and Talk, PPTs	**T1, T2**
45	12		Bridge Class			
46			Digital Logic Gates	**Identify** basic building blocks of digital systems.	Chalk and Talk, PPTs	**T1, T2**
47			The Map Method	**Analyze** to avoid the redundant terms in Boolean functions	Chalk and Talk, PPTs	**T1, T2**
48			Product-of-Sums Simplification, Don't-Care Conditions		Chalk and Talk, PPTs	**T1, T2**
49	13		NAND and NOR Implementation	**Design** functions using universal gates.	Chalk and Talk, PPTs	**T1, T2**
50			Exclusive-OR Function	**Understand** the EX-OR function.	Chalk and Talk, PPTs	**T1, T2**
51			*****. Binary Adders***	**Understand** the design and analysis of combinational logic circuits.	Chalk and Talk, PPTs	**T1, T2**
52			Bridge Class			
53	14		Binary Adder-Subtractor, Decimal Adder	**Understand** the design and analysis of combinational logic	Chalk and Talk, PPTs	**T1, T2**

54			Binary Multiplier, Magnitude Comparator	circuits.	Chalk and Talk, PPTs	**T1, T2**
55			Decoders	**Analyze** the design of decoders, encoders and multiplexers.	Chalk and Talk, PPTs	**T1, T2**
56			Encoders			
57			Multiplexers			
58			Bridge Class			
59	16	**5**	**Unit-V**:Sequential Circuits	**Understand** the design and analysis of sequential logic circuits.	Chalk and Talk, PPTs	**T1, T2**
60			Storage Elements: Latches and flip flops	**Understand** construction of latches and flip flops.	Chalk and Talk, PPTs	**T1, T2**
61	17		Analysis of Clocked Sequential Circuits, State Reduction and Assignment	**Analyse** the clocked sequential circuits and perform state reduction and assignments.	Chalk and Talk, PPTs	**T1, T2**
62			Shift Registers	**Understand** the design and analysis of shift registers.	Chalk and Talk, PPTs	**T1, T2**
63			Bridge Class			
64			Ripple Counters, Synchronous Counters	**Understand** the design and analysis of various counters.	Chalk and Talk, PPTs	**T1, T2**
65	18		Random-Access Memory, Read-Only Memory	**Understand** the concept of memory.	Chalk and Talk, PPTs	**T1, T2**
65			Revision	**Revise** above topics.	PPTs	**T1, T2**
			II Mid Examinations (Week 18)			

IX. MAPPING COURSE OUTCOMES LEADING TO THE ACHIEVEMENT OF PROGRAM OUTCOMES AND PROGRAM SPECIFIC OUTCOMES:

Course Outcomes	Program Outcomes												Program Specific Outcomes		
	PO 1	**PO2**	**PO 3**	**PO 4**	**PO 5**	**PO 6**	**PO 7**	**PO 8**	**PO 9**	**PO 10**	**PO 11**	**PO 12**	**PSO1**	**PSO2**	**PSO3**
CO1	3	2	3	-	-	-	-	-	1	-	-	2	2	1	-
CO2	3	2	2	-	-	-	-	-	-	-	-	2	2	-	-
CO3	3	2	3	-	-	-	-	-	-	2	3	-	-	-	-
CO4	3	2	2	-	-	-	-	-	-	2	1	-	2	-	-
CO5	3	2	3	-	-	-	-	-	1	-	3	-	-	1	-
CO6	3	2	2	-	-	-	-	-	-	-	3	2	-	-	-
Average	3	2	2.5	-	-	-	-	-	1	2	2.5	2	2	1	-
Average (Rounded)	3	2	3	-	-	-	-	-	1	2	3	2	2	1	-

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High) - : None

X. JUSTIFICATIONS FOR CO-PO MAPPING:

Mapping	Low (1), Medium (2), High(3)	Justification
CO1-PO1	3	Students will be able to Students will be able to understand open circuited P-N junction.
CO1-PO2	2	Students will be able to understand how the diode acts as rectifier and study the characteristics of rectifiers.
CO1-PO3	3	Students will be able to understand the V-I characteristics of P-N junction.
CO1-PO9	1	Students will be able to understand the temperature effects and diode resistance
CO1-PO12	2	Know about drift and diffusion capacitances.
CO1-PSO1	2	Students will be able to understand diode switching times.
CO1-PSO2	2	Students will be able to understand the concept of breakdown in diodes and study the operation and characteristics of Zener diode.
CO2-PO1	3	Students will be able to understand the operation, characteristics and applications of tunnel diode
CO2-PO2	2	Students will be able to understand the operation, characteristics and applications of photo diode and LED.
CO2-PO3	2	To explain clipping circuits and comparators.
CO2-PO12	2	Students will be able to understand how the diode acts as rectifier and study the characteristics of rectifiers.
CO2-PSO1	2	Students will be able to understand the general conditions for filters and study the rectifier with capacitor filter.
CO3-PO1	3	To study the operation of transistor as an amplifier.
CO3-PO2	2	To study the characteristics of CB,CE,CC configurations.
CO3-PO3	3	Compare various configurations of transistors.
CO3-PO10	2	Understand the concept of operating point and purpose of biasing.
CO3-PO11	3	Study about bias compensation, thermal runaway and stability.
CO4-PO1	3	Explain the operation of transistor at low frequencies.
CO4-PO2	2	Explain the operation of CE amplifier, study its frequency response and gain bandwidth product.
CO4-PO3	2	Understand the operation of emitter follower.
CO4-PO10	2	Explain the operation of RC coupled two cascaded CE and multistage CE amplifiers.
CO4-PO11	1	Students will be able to understand the operation, V-I characteristics of JFET.
CO4-PSO1	2	Students will be able to understand the operation, V-I characteristics of MOSFFET.
CO5-PO1	3	Students will be able to understand the operation of low frequency CS and CD amplifiers.
CO5-PO2	2	Students will be able to understand the arithmetic operations carried

		by digital systems.
CO5-PO3	3	Students will be able to understand the OR, AND, NOT, EX-OR, NAND and NOR DTL gates and modified DTL gates.
CO5-PO9	1	Students will be able to understand the design and analysis of combinational logic circuits.
CO5-PO11	3	Students will be able to analyze the design of decoders, encoders and multiplexers.
CO5-PSO2	1	Students will be able to understand the EX-OR function.
CO6-PO1	3	To design functions using universal gates.
CO6-PO2	2	Students will be able to understand the design and analysis of sequential logic circuits.
CO6-PO3	2	Students will be able to understand construction of latches and flip flops.
CO6-PO11	3	Analyse the clocked sequential circuits and perform state reduction and assignments.
CO6-PO12	2	Students will be able to understand the concept of memory.

XI. QUESTION BANK (JNTUH) :

UNIT - I
Long Answer Questions:

S.No.	Question	Blooms Taxonomy Level	Course Outcome
1.	Explain the formation of PN junction diode.	Remember	1
2.	Discuss the operation of PN junction diode as rectifier.	Understand	1
3.	Define biasing. Briefly describe the operation of PN diode under forward and reverse bias conditions.	Understand	1
4.	Sketch the V-I characteristics of p-n junction diode for forward bias voltages. Distinguish between the incremental resistance and the apparent resistance of the diode?	Evaluation	1
5.	Explain the temperature dependence of VI characteristics of PN diode?	Comprehension	1
6.	Derive an expression for total diode current starting from Boltzmann relationship in terms of the applied voltage?	Knowledge	1
7.	Explain the V-I characteristics of Zener diode and distinguish between Avalanche and Zener Break downs?	Understand	1
8.	Explain the concept of diode capacitance. Derive expression for transition capacitance?	Understand	1
9.	Define depletion region at p-n junction? What is the effect of forward and reverse biasing of p-n junction on the depletion region? Explain with necessary diagrams?	Remember	1
10.	Explain the tunneling phenomenon. Explain the characteristics of tunnel diode with the help of necessary energy band diagrams?	Understand	1

11.	What is the photo diode? Explain its principle of operation and applications in detail?	Remember	1
12.	Explain the construction and working of LED?	Understand	1
13.	Discuss the applications of diode as clipper circuits.	Remember	1
14.	Briefly explain the operation of a comparator.	Remember	1
15.	Draw the block diagram of a regulated power supply and explain its operation?	Understand	1
16.	Draw the circuit of a half-wave-rectifier and find out the ripple factor, % regulation? Efficiency and PIV?	Analyze	1
17.	Draw the circuit of bridge rectifier and explain its operation with the help of input and output waveforms?	Analyze	1
18.	With suitable diagrams, explain the working of centre-tapped full wave rectifier. Derive expressions for V_{DC}, I_{DC}, V_{rms} and I_{rms} for it?	Understand	1
19.	Explain the relative merits and demerits of all the rectifiers?	Understand	1
20.	Mention the need for filter circuits in rectifiers. Explain the working of capacitor filter.	Understand	1

Short Answer Questions:

S.No.	Question	Blooms Taxonomy Level	Course Outcome
1.	Define Electronics?	Remember	1
2.	Explain about forward bias of diode?	Understand	1
3.	Explain about reverse bias of diode?	Understand	1
4.	Write the applications of diode?	Comprehension	1
5.	Draw the V-I characteristics of diode?	Comprehension	1
6.	List the differences between ideal diode and practical diode?	Remember	1
7.	Define diffusion capacitance?	Knowledge	1
8.	Define transition capacitance?	Remember	1
9.	Define static resistance?	Remember	1
10.	Define dynamic resistance	Remember	1
11.	Write the equation of diode current	Remember	1
12.	Define cut-in voltage?	Remember	1

13.	Write the differences between avalanche and zener breakdown mechanisms?	Knowledge	1
14.	Define zener breakdown mechanism?	Remember	1
15.	Define depletion region?	Remember	1
16.	Explain the temperature dependence of VI characteristics of PN diode?	Understand	1
17.	Define doping?	Remember	1
18.	Explain about extrinsic semiconductor	Understand	1
19.	Explain about unbiased PN junction?	Understand	1
20.	Write down the expression for diode current?	Knowledge	1
21.	Define drift current?	Remember	1
22.	List the applications of Zener diode?	Analyze	1
23.	Define forbidden energy gap?	Remember	1
24.	With appropriate circuit diagram explain the DC load line analysis of semiconductor diode?	Analyze	1
25.	Define Peak Inverse voltage of a diode?	Remember	1
26.	What is the principle of operation of photodiode?	Knowledge	1
27.	Give the principle of operation of Light Emitting Diode?	Analyze	1
28.	Define diffusion current?	Remember	1
29.	List the applications of LED.	Analyze	1
30.	Define photodiode?	Remember	1

UNIT - II
Long Answer Questions:

S.No.	Question	Blooms Taxonomy Level	Course Outcome
1.	With a neat diagram explain the various current components in an NPN bipolar junction transistor & hence derive general equation for collector current, I_C?	Understand	2
2.	Define Early-effect; explain why it is called as base-width modulation? Discuss its consequences in transistors in detail?	Remember	2
3.	How transistor acts as an amplifier?	Remember	2

4.	Draw the input and output characteristics of a transistor in common emitter configurations?	Comprehension	2
5.	Draw the input and output characteristics of a transistor in common base configurations?	Evaluate	2
6.	Draw the input and output characteristic of a transistor in common collector configurations?	Comprehension	2
7.	Explain the constructional details of Bipolar Junction Transistor?	Understand	2
8.	Derive the relation among α, β and γ?	Evaluation	2
9.	What is thermal runaway in transistors? Obtain the condition for thermal stability in transistors?	Remember	2
10.	Analyze general transistor amplifier circuit using h parameter model. Derive the expressions for A_I, A_V, R_i, R_o, A_{Is}, A_{Vs}.	Analyze	2
11.	Draw the circuit of an emitter follower, and derive the expressions for A_I, A_V, R_i, R_o in terms of CE parameters.	Remember	2
12.	Write the analysis of a CE amplifier circuit using h parameters. Derive the expressions for A_I, A_V, R_i, R_o, A_{Is}, A_{Vs}.	Analyze	2
13.	Define h-parameter of a transistor in a small signal amplifier. What are the benefits of h-parameters?	Remember	2
14.	Compare the different types of coupling methods used in multistage amplifiers.	Remember	2
15.	Sketch two RC-coupled CE transistor stages. Show the middle and low frequency model for one stage. Write the expressions for current gains.	Remember	2
16.	Explain about different methods of Inter stage coupling in amplifiers. When two stages of identical amplifiers are cascaded, obtain the expressions for overall voltage gain, current gain and power gain.	Understand	2

Short Answer Questions:

S.No.	Question	Blooms Taxonomy Level	Course Outcome
1.	What is meant by operating point Q?	Comprehension	2
2.	Draw the symbols of NPN and PNP transistor?	Comprehension	2
3.	Explain the operation of BJT and its types?	Understand	2
4.	Explain the breakdown in transistor?	Understand	2
5.	Explain the transistor switching times?	Understand	2
6.	Define Transistor current?	Remember	2
7.	Define early effect or base width modulation?	Remember	2
8.	Explain about transistor amplifier?	Understand	2
9.	Define current amplification factor?	Remember	2
10.	When does a transistor act as a switch?	Comprehension	2
11.	Explain about the various regions in a transistor?	Understand	2

12.	Draw the small signal model of a CE configuration?	Knowledge	2
13.	Draw the output characteristics of NPN transistor in CE configuration?	Comprehension	2
14.	Define h_{ie} and h_{fe} in CE configuration?	Remember	2
15.	Define hoe and h_{re} in CB configuration?	Remember	2
16.	Define saturation region?	Remember	2
17.	Write the relation between I_C, β, I_B and I_{CBO} in a BJT?	Knowledge	2
18.	Define cutoff region?	Remember	2
19.	Define active region?	Remember	2
20.	Describes the various current components in a BJT?	Knowledge	2
21.	Define amplifier?	Remember	2
22.	Draw the hybrid model of a CB configuration?	Knowledge	2
23.	List the classification of amplifiers.	Remember	2
24.	List the classification of amplifiers based on frequency of operation	Remember	2
25.	Define various hybrid parameters.	Remember	2
26.	Draw the hybrid equivalent model of CE Amplifier	Understand	2
27.	In a multistage amplifier, what is the coupling method required to amplify dc signals?	Remember	2
28.	Write the expression for lower 3 – dB frequency of an n – stage amplifier with non – interacting stages.	Remember	2
29.	Two stages of amplifier are connected in cascade. If the first stage has a decibel gain of 40 and second stage has an absolute gain of 20 then what is the overall gain in decibels.	Evaluate	2
30.	Why the overall gain of multistage amplifier is less than the product of gains of individual stages.	Understand	2
31.	What are the main characteristics of a Darlington amplifier?	Understand	2
32.	Why direct coupling is not suitable for amplification of high frequency	Understand	2

UNIT - III
Long Answer Questions:

S.No.	Question	Blooms Taxonomy Level	Course Outcome
1.	Explain the operation of FET with its characteristics and explain the different regions in transfer characteristics?	Comprehension	3
2.	Define pinch-off voltage and trans conductance in field effect	Comprehens	3

	transistors?	ion	
3.	With the help of neat sketches and characteristic curves explain the construction & operation of a JFET and mark the regions of operation on the characteristics?	Application	3
4.	Explain how a FET can be made to act as a switch?	Knowledge	3
5.	Bring out the differences between BJT and FET. Compare the three configurations of JFET amplifiers?	Knowledge	3
6.	Create a relation between the three JFET parameters, μ, r_d and g_m?	Creating	3
7.	How a FET can be used as a voltage variable Resistance (VVR)?	Remember	3
8.	Explain the construction & operation of a P-channel MOSFET in enhancement and depletion modes with the help of static drain characteristics and transfer characteristics?	Understand	3
9.	Sketch the drain characteristics of MOSFET for different values of V_{GS}& mark different regions of operation.	Comprehension	3
10.	Explain the principle of CS amplifier with the help of circuit diagram. Derive the expressions for A_V, input impedance and output Impedance?	Understand	3
11.	Write the expressions for mid-frequency gain of a FET Common Source?	Knowledge	3
12.	Discuss the high frequency response of CD Configuration?	Knowledge	3
13.	What is the effect of external source resistance on the voltage gain of a common source amplifier? Explain with necessary derivations?	Remember	3
14.	Draw the small-signal model of common drain FET amplifier. Derive expressions for voltage gain and output resistance?	Analyze	3
15.	a) Solve the subtraction with the following unsigned binary numbers by taking the 2's complement of the subtrahend: i.100 – 110000 ii. 11010 - 1101. b) Construct a table for 4 -3 -2 -1 weighted code and write 9154 using this code .Write short notes on binary number systems.	Apply	4
16.	a) Solve arithmetic operation indicated below. Follow signed bit notation: i. 001110 + 110010 ii. 101011 - 100110. b) Explain the importance of gray code?	Apply	4
17.	Solve (3250 - 72532)10using 10's complement?	Apply	4
18.	As part of an aircraft's functional monitoring system, a circuit is when the \gear down" switch has been activated in preparation for landing. Red LED display turns on if any of the gears fail to extend properly prior to landing. When a landing gear is extended, its sensor produces a LOW voltage. When a landing gear is retracted, its sensor produces a HIGH voltage. Design a circuit to meet this requirement? required to indicate the status of the landing gears prior to landing. Green LED display turns on if all three gears are properly extended	Understand	4
19.	Solve (a) Divide 01100100 by 00011001 (b) Given that (292)10 =(1204)b determine `b'	Apply	4
20.	Solve (a) What is the gray code equivalent of the Hex Number 3A7 (b) Find the biquinary number code for the decimal numbers from 0 to 9 (c) Find 9's complement (25.639)10	Apply	4

21.	Solve (a) Find (72532 - 03250) using 9's complement. (b) Show the weights of three different 4 bit self complementing codes whose only negative weight is - 4 and write down number system from 0 to 9.	Apply	4

Short Answer Questions:

S.No.	Question	Blooms Taxonomy Level	Course Outcome
1.	Write the expressions for mid-frequency gain of a FET Common Source?	Knowledge	3
2.	Discuss the high frequency response of CD Configuration?	Knowledge	3
3.	What is the effect of external source resistance on the voltage gain of a common source amplifier? Explain with necessary derivations?	Remember	3
4.	Draw the small-signal model of common drain FET amplifier. Derive expressions for voltage gain and output resistance?	Analyze	3
5.	Draw the small-signal model of common source FET amplifier.	Analyze	3
6.	Why FET is called a voltage operated device?	Evaluation	3
7.	List the important features of FET?	Knowledge	3
8.	Write short notes on millers theorem?	Knowledge	3
9.	Give the classifications of FETs and their application areas?	Knowledge	3
10.	Define pinch off voltage?	Comprehension	3
1.	Draw the structure of an n-channel JFET?	Knowledge	3
12.	Define rd and Gm?	Remember	3
13.	Draw the static characteristics curves of an n-channel JFET?	Comprehension	3
14.	Draw the drain characteristics of depletion type MOFET?	Knowledge	3
15.	Draw the small signal model of JFET?	Knowledge	3
16.	Draw the transfer characteristics for P-channel JFET?	Comprehension	3
17.	Draw the Drain V-I characteristics for p-channel JFET?	Knowledge	3
18.	Explain about ohmic and saturation regions?	Understand	3
9.	Draw the drain characteristics of an n-channel enhancement type MOSFET?	Knowledge	3
20.	**Write** short notes on binary number systems?	Understand	4
21.	**Discuss** 1's and 2's complement methods of subtraction?	Understand	4
22	**Discuss** octal number system?	Understand	4
23.	**State** and prove transposition theorem?	Knowledge	4
24.	**Explain** how do you convert AOI logic to NAND logic?	Understand	4
25.	**Write** a short note on five bit BCD codes?	Understand	4

UNIT - IV

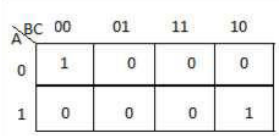
Long Answer Questions:

S.No.	Question	Blooms Taxonomy Level	Course Outcome
1.	A combinational circuit has 4 inputs(A,B,C,D) and three outputs(X,Y,Z)XYZ represents a binary number whose value equals the number of 1's at the input state the minterm expansion for the X,Y,Z ii. state the maxterm expansion for the Y and Z	Knowledge	6
2.	A combinational circuit has four inputs (A,B,C,D), which represent a binarycoded-decimal digit. The circuit has two groups of four outputs -S,T,U,V(MSB digit) and W,X,Y,Z.(LSB digit)Each group represents a BCD digit. The output digits represent a decimal number which is five times the input number. Illustrate the minimum expression for all the outputs?	Apply	6
3.	Summarize the following Boolean expressions using K-map and implement them using NOR gates: (a) F (A, B, C, D) = AB'C' + AC + A'CD' (b) F (W, X, Y, Z) = W'X'Y'Z' + WXY'Z' + W'X'YZ + WXYZ.	Understand	6
4.	Design BCD to Gray code converter and realize using logic gates?	Understand	6
5.	Design EX-OR using NAND gates?	Understand	6
6.	compile the following expression using Karnaugh map (B 'A + A'B +AB')	Understand	6
7.	Design a circuit with three inputs(A,B,C) and two outputs(X,Y) where the outputs are the binary count of the number of "ON" (HIGH) inputs?	Understand	6
8.	Implement the INVERTER gate, OR gate and AND gate using	Understand	6
9.	NAND gate, NOR gate?		6
10.	Design a circuit with four inputs and one output where the output is 1 if the input is divisible by 3 or 7?	Understand	6
11.	Implement the Boolean function F = AB + CD + E	Understand	6
12.	Implement the Boolean function F = AB + CD + E using NAND gates only?	Understand	6
13.	Summarize the Boolean function F(w, x, y, z) = Σ(1, 3, 7, 11, 15) +d(w, x, y, z) = Σ(0. 2, 5)	Understand	6
14.	Construct the logic diagram of a full subtractor using only 2-input NAND gates?	Apply	5
15.	Construct the logic diagram of a full subtractor using only 2-input NAND gates?	Apply	5
16.	Use a multiplexer having three data select inputs to solve the logic for the function F = Σ (0, 1, 2, 3, 4, 10, 11, 14, 15)	Apply	5
17.	Identify all the prime implicants and essential prime implicants of the following functions Using karnaugh map. F(A,B,C,D) =	Knowledge	5

	Σ(0,1,2,5,6,7,8,9,10,13,14,15).		
18.	Design a combinational circuit that generates the 9's complement of BCD digit?	Understand	5
19.	Design a combinational circuit to find the 2's complement of given binary number and realize using NAND gates?	Understand	5
20.	Design a logic circuit to convert gray code to binary code?	Understand	5
21.	Design circuit to detect invalid BCD number and implement using NAND gate only?	Understand	5
22.	Explain the design procedure for code converter with the help of example?	Understand	5
23.	Construct half subtractor using NAND gates?	Apply	5
24.	Design an 8-bit adder using two 74283?	Understand	5
25.	Explain the working of carry look-ahead generator?	Understand	5
26.	Explain carry propagation in parallel adder with neat diagram?	Understand	5
27.	Explain the circuit diagram of full subtractor and full adder?	Understand	5
28.	Construct and explain the working of decimal adder?	Apply	5

Short Answer Questions:

S.No.	Question	Blooms Taxonomy Level	Course Outcome
1.	Define K-map? Name its advantages and disadvantages?	Knowledge	6
2.	Write the block diagram of 2-4 and 3-8 decoders?	Understand	6
3.	Define magnitude comparator?	Knowledge	6
4.	Describe what do you mean by look-ahead carry?	Understand	6
5.	Summarize the Boolean functionx'yz + x'yz' + xy'z' + xy'zusing K-map?	Understand	6
6.	Explain how combinatorial circuits differ from sequential circuits?	Understand	6
7.	Explain what are the IC components used to design combinatorial circuits with MSI and LSI?	Understand	6
8.	Design the two graphic symbols for NAND gate?	Understand	6
9.	Design the two graphic symbols for NOR gate?	Understand	6
10.	Summarize the Boolean function x'yz + x'yz' + xy'z' + xy'z without using K- map?	Understand	6
11.	Explain the properties of EX-OR gate?	Understand	6
12.	Solve the function of fig with AND-OR INVRET implementations?	Apply	6

			
13.	Solve the following using NAND gates? a) (A+B)(C+D) b) A.B+CD(ABI+CD)	Apply	6
14.	Sketch the following equation using k-map and realize it using NAND gate? Y=∑m(4,5,8,9,11,12,13,15)	Apply	6
15.	Solve Y=ABI+CD+(AIB+CIDI) using NAND gate?	Apply	6
16.	State that AND-OR network is equivalent to NAND-NAND network?	Knowledge	6
17.	Show both NAND and NOR gates are called Universal gates?	Apply	6
18.	Sketch the following logic function using k-map and implement it using logic gates? Y(A,B,C,D)= ∑m(0,1,2,3,4,7,8,9,10,11,12,14)	Apply	6
19.	Summarize the rules and limitations of K-map simplification?	Understand	6
20.	Analyze the steps for simplification of POS expression?	Apply	6

UNIT - V

Long Answer Questions:

S.No.	Question	Blooms Taxonomy Level	Course Outcome
1.	Explain the design of Sequential circuit with an example. Show the state reduction, state assignment?	Understand	5
2.	Write short notes on shift register? Mention its application along with the Serial Transfer in 4-bit shift Registers?	Understand	5
3.	Design a 4-bit BCD Ripple Counter by using T-FF?	Understand	5
4.	Define BCD Down Counter and Draw its State table for BCD Counter?	Knowledge	5
5.	Explain the state reduction and state assignment in designing sequential circuit. Consider one example in the above process?	Understand	5
6.	Design a sequential circuit with two D flip-ops A and B. and one input x. when x=0,the state of the circuit remains the same. When x=1,the circuit goes through the state transition from 00 to 11 to 11 to 10 back to 00.and repeats?	Understand	5
7.	Design a Modulo-12 up Synchronous counter Using T-Flip Flops and draw the Circuit diagram?	Understand	5
8.	Explain the Ripple counter design. Also the decade counter design?	Understand	5
9.	Design a 3 bit ring counter? Discuss how ring counters differ from twisted ring counter?	Understand	5

10.	Design a left shift and right shift for the following data 10110101?	Understand	5
11.	Design Johnson counter and state its advantages and disadvantages?	Understand	5
12.	Explain with the help of a block diagram, the basic components of a Sequential Circuit?	Understand	5
13.	Explain about RS and JK flip-flops?	Understand	5
14.	Define T–Flip-flop with the help of a logic diagram and characteristic table?	Knowledge	5
15.	Define Latch. Explain about Different types of Latches in detail?	Knowledge	5
16.	Explain in detail about RAM and types of RAM?	Understand	5
17.	Illustrate the features of a ROM cell?	Apply	5
18.	Explain in detail about ROM and types of ROM?	Understand	5
19.	Explain coincident memory decoding?	Understand	5
20.	Describe what is meant by memory expansion? Mention its limits?	Understand	5

Short Answer Questions:

S.No.	Question	Blooms Taxonomy Level	Course Outcome
1.	Differentiate combinational and sequential logic circuits?	Apply	5
2.	Explain basic difference between a shift register and counter?	Understand	5
3.	Illustrate applications of shift registers?	Apply	5
4.	Define bidirectional shift register?	Knowledge	5
5.	Describe dynamic shift register?	Knowledge	5
6.	Convert a JK Flip Flop to T	Understand	5
7.	Classify the basic types of counters?	Understand	5
8.	Differentiate the advantages and disadvantages of ripple counters?	Apply	5
9.	Convert a JK Flip Flop to SR	Understand	5
10.	Explain what is a variable modulus counter?	Understand	5
11.	Design and explain gated latch logic diagram?	Understand	5
12.	Define race around condition? How it can be avoided?	Knowledge	5
13.	Convert a JK Flip Flop to D	Understand	5
14.	Convert a SR Flip-Flop to JK	Understand	5

15.	List the types of RAM.	Knowledge	5
16.	State the features of a ROM cell?	Understand	5

OBJECTIVE QUESTIONS:

UNIT-I

1. The conventional current in a PN junction diode flows: [ ]
   (a) From positive to negative (b) From negative to positive
   (c) In the direction opposite to the electron flow. (d) Both (a) and (c) above
2. The cut in voltage (or knee voltage) of a silicon diode is [ ]
   (a) 0.2V (b) 0.6V (c) 0.8 V (d) 1.0V
3. When a diode is reverse biased, it is equivalent to [ ]
   (a) An OFF switch (b) an ON switch
   (c) A high resistance (d) none of the above
4. The resistance of a diode is equal to [ ]
   (a) Ohmic resistance of the P- and N- semiconductors (b) Junction resistance
   (c) Reverse resistance (d) Algebraic sum of (a) and (b) above
5. For a silicon diode, the value of the forward - bias voltage typically [ ]
   (a) Must be greater than 0.3V (b) Must be greater than 0.7V
   (c) Depends on the width of the depletion region
   (d) Depends on the concentration of majority carriers
6. When forward biased, a diode [ ]
   (a) Blocks current (b) conducts current
   (c) Has a high resistance (d) drops a large voltage.
7. A PN junction diode's dynamic conductance is directly proportional to [ ]
   (a) The applied voltage (b) the temperature
   (c) The current (d) the thermal voltage
8. The forward region of a semiconductor diode characteristic curve is where diode appears as [ ]
   (a) Constant current source (b) a capacitor
   (c) An OFF switch (d) an ON switch
9. At room temperature of25 °C, the barrier potential for silicon is 0.7 V. lts value at 125° C is[]
   (a) 0.5V (b) 0.3V (c) 0.9V (d) 0.7V
10. Junction breakdown of a PN junction occurs [ ]
    (a) With forward bias (b) with reverse bias
    (c) Because of manufacturing defect (d) None of these
11. Reverse saturation current in a silicon PN junction diode nearly doubles for every [ ]
    (a) 2° C rise in temperature (b) 5° C rise in temperature
    (c) 6° C rise in temperature (d) 10° C rise in temperature

12. The transition capacitance of a diode is 1nF and it can withstand a reverse potential of 400V. A capacitance of 2nF which can withstand a reverse potential of 1 kV is obtained by connecting [ ]
    (a) two 1nF diodes in series
    (b) six parallel branches with each branches comprising there 1nF diodes in series
    (c) two 1nF diodes in series
    (d) three parallel branches with each branch comprising 1nF diodes in series
13. A zener diode [ ]
    (a) has a high forward-voltage rating
    (b) has a sharp breakdown at low reverse voltage
    (c) is useful as an amplifier
    (d) has a negative resistance
14. A tunnel- diode is [ ]

    (a) a very heavily-doped PN junction diode
    (b) a high resistivity PN junction diode
    (c) a slow switching device
    (d) used with reverse bias
15. The light-emitting diode (LED) [ ]
    (a) is usually made from silicon
    (b) uses a reverse-biased junction
    (c) gives a light output which increases with the increase in temperature
    (d) depends on the recombination of holes and electrons
16. LED's do not require [ ]
    (a) heating (b) warm-up time
    (c) Both (a) and (b) above (d) non of above
17. The sensitivity of a photodiode depends upon [ ]
    (a) light intensity and depletion region width
    (b) depletion region width and excess carrier life time
    (c) Excess carrier life time and forward bias current.
    (d) Forward bias current and light intensity.
18. LEDs are commonly fabricated from gallium compounds like gallium arsenide and gallium phosphide because they [ ]
    (a) Are cheap (b) are easily available
    (c) Emit more heat (d) emit more light.
19. A LED is basically a _____ P-N junction. [ ]
    (a) forward-biased (b) reverse-biased
    (c) lightly-doped (d) heavily-doped
20. As compared to a LED display, the distinct advantage of an LCD display is that it requires [ ]
    (a) No illumination (b) extremely-bias
    (c) No forward-bias (d) a solid crystal
21. Before illuminating a P-N junction photodiode, it has to be [ ]
    (a) Reverse-biased (b) forward-biased
    (c) Switched ON (d) switched OFF.
22. A LED emits visible light when its _____ [ ]
    (a) P-N junction is reverse-biased (b) depletion region widens
    (c) Holes and electrons recombine (d) P-N junction becomes hot.
23. In LED, light is emitted because [ ]
    (a) Recombination of charge carriers takes place
    (b) Diode gets heated up

(c) Light falling on the diode gets amplified
(d) Light gets reflected due to lens action.

24. GaAs, LEDs emit radiation in the [ ]
(a) Ultraviolet region (b) violet - blue green range of the visible region
(c) Visible region (d) infra-red region

UNIT-II

1. The "cut-in" voltage of a silicon small-signal transistor is [ ]
(a) 0V (b) 0.2V (c) 0.5V (d) 0.8V
2. When the collector junction in transistors is biased in the reverse direction and the emitter junction in the forward direction, the transistor is said to be in the [ ]
(a) Active region (b) cut-off region
(c) Saturation region (d) none of them.
3. The transistor is said to be in saturation region when [ ]
   a. both collector and emitter junctions are forward biased
   b. both collector and emitter junctions are reversed biased ·
   c. emitter junction is forward biased, but the collector junction is reverse biased
   d. emitter junction is reverse biased, but the collector junction is forward biased
4. For a silicon transistor in the common emitter configuration the cut-off condition is achieved by applying a minimum reverse voltage across the emitter junction of the order of [ ]
(a) 0V (b) 0.7 V (c) 1.5V (d) 5V
5. A transistor connected in common base configuration has [ ]
(a) a high input resistance and a low output resistance
(b) a low input resistance and high output resistance
(c) a low input resistance and a low output resistance
(d) a high input resistance and a high output resistance
6. Which of the following is not a time varying quantity? [ ]
(a) v_{ce} (b) V_{CE} (c) v_{CE} (d) V_{ce}
7. In the Ebbers-Model of a bipolar transistor, the parameter is the [ ]
   a. Forward transmission from emitter to collector
   b. Reverse transmission from collector to emitter
   c. Common base current gain
   d. Both (a) and (c) above
8. The value of trans-conductance of a bipolar transistor for a collector current of 1.5 mA is [ ]
(a) 0.05Ω (b) 0.05 x 10^3 Ω (c) 37.5 Ω (d) None of the above
9. The resistance $r_{bb'}$ in the low frequency hybrid-π model of a bipolar transistor represents [ ]
   a. Base spreading resistance
   b. A.C. resistance for forward biased emitter-base junction
   c. The effect of feedback between the emitter-base junction and collector-base junction due to Early effect
   d. None of the above
10. The capacitance C_e in the high frequency hybrid-π model of a bipolar transistor represents the [ ]
(a) Depletion region capacitance (b) Emitter diffusion capacitance
(c) Emitter-base junction capacitance (d) Sum of the (b) and (c) above

11. For a common emitter amplifier having a small un bypassed emitter resistance (R_E) the input resistance is approximately equal to [ ]
(a) R_E (b) h_{fe} (c) h_{fe} R_E (d) R_E /h_{fe}

12. The voltage gain of a common base amplifier is [ ]
(a) zero (b) less than unity (c) unity (d) greater than unity

13. For a common base transistor amplifier having input resistance (R_i) and output resistance (R_0), which of the following statements holds good [ ]
(a) R_i is low, R_0 is high (b) R_i is high, R_0 is low
(c) R_i and R_0 are both medium (d) None of these

14. The current gain of an emitter follower is [ ]
(a) zero (b) greater than unity (c) less than unity (d) all of them

15. Which of the following transistor amplifiers has the highest voltage gain? [ ]
(a) common-base (b) common-collector
(c) common-emitter (d) none of them

16. In an ac amplifier, larger the internal resistance of the ac signal source [ ]
(a) Greater the overall voltage gain (b) greater the input impedance
(c) Smaller the current gain (d) smaller the circuit voltage gain.

17. The main use of an emitter follower is as [ ]
(a) power amplifier (b) impedance matching device
(c) low-input impedance circuit (d) follower of base signal.

18. An ideal amplifier is one which [ ]
(a) has infinite voltage gain (b) responds only to signal at its input terminals
(c) has positive feedback (d) gives uniform frequency response.

19. The voltage gain of a single-stage amplifier is increased when [ ]
(a) its ac load is decreased (b)resistance of signal source is increased
(c) emitter resistance R_E is increased. (d) as load resistance is increased.

20. When emitter bypass capacitor in a common-emitter amplifier is removed, its _____ is considerably reduced. [ ]
(a) input resistance (b) output load resistance
(c) emitter current (d) voltage gain

21. Unique features of a CC amplifier circuit is that it [ ]
(a) steps up the impedance level (b) does not increases signal voltage
(c) acts as an impedance matching device (d) all of the above.

22. The h-parameters are called hybrid parameters because they [ ]
(a) are different from y- and z - parameters.
(b) are mixed with other parameters
(c) apply to circuits contained in a box
(d) are defined by using both open-circuit and short-circuit terminations

23. Which of the following statement is not correct regarding the h-parameters of a transistor [ ]
(a) The values of h-parameters can be obtained from transistor characteristics.
(b) their values depends upon the transistor configuration
(c) their values depend on operating point
(d) they are four in number

24. Which of the following four h-parameters of a transistor has a greatest value [ ]
(a) h_i (b) h_r (c) h_0 (d) h_f

26. Which of the following four h-parameters of a transistor has a smallest value? [ ]
(a) h_i (b) h_r (c) h_0 (d) h_f

27. The typical value h_{ic} is [ ]
(a) l KΩ (b) 40 KΩ (c) 100KΩ (d) 2MΩ

28. The h-parameters of a transistor depend on its [ ]
(a) Configuration (b) operating point
(c) Temperature (d) all of the above

29. The output admittance h_0 of an ideal transistor connected is common-base configuration is _____ Siemens [ ]
(a) 0 (b) **Error! Reference source not found.** (c) **Error! Reference source not found.** (d) -1

30. A transistor has h_{fe} = 100, h_{ie} = 5.2 KΩ, and r_{bb} = 0. At room temperature, V_T= 26 mV. The collector current, I_C will be [ ]
(a) 10 mA (b) 5 mA (c) l mA (d) 0.5 mA

UNIT-III

1. A field effect transistor (FET) operates on [ ]
(a) Majority carriers only (b) Minority carriers only
(c) Positively charged ions only

2. In JFET operating above pinch-off voltage, the [ ]
(a) Drain current remains practically constant
(b) Drain current starts decreasing
(c) Drain current increases rapidly
(d) Depletion region becomes smaller

3. The JFET is oftenly called square law device because its [ ]
(a) Trans-conductance curve is parabolic
(b) A.C. resistance from drain-to-source varies inversely as square of the drain current
(c) Drain current varies as square of drain voltage for a fixed gate- to-source voltage
(d) Reverse gate leakage current varies as a square of the reverse gate voltage

4. For the operation of depletion-type MOSFET, the gate voltage has to be [ ]
(a) Low positive (b) High positive
(c) High negative (d) Zero

5. The N-channel MOSFET devices are preferred more than P-channel's because [ ]
(a) N-channel devices are faster than P-channel devices
(b) N-channel devices consumes less power than P-channel devices
(c) N-channel devices have higher packing density than P-channe1 devices
(d) Both (a) and (c) above

6. As compared to N-channel MOS switch, the P-channel MOS switch has [ ]
(a) Same ON resistance (b) Less ON resistance
(a) More ON resistance (d) either (a) or (b)

7. Thermal runway is not possible in FET because as the temperature of the FET increases [ ]
(a) the mobility decreases (b) the trans-conductance increases
(c) the drain current increases (d) the mobility increases

8. (1217)8 is equivalent to [ ]

(A) (1217)16 (B) (028F)16 (C) (2297)10 (D) (0B17)16

9. The smallest integer than can be represented by an 8-bit number in 2's complement form is [ ]

(A) 256 (B) -128 (C) -127 (D) 0

10. P is a 16-bit signed integer. The 2's complement representation of P is (F87B)16. The 2's complement representation of 8*P is [ ]

(A) C3D8 (B) 187B (C) F878 (D) 987B.

11. Convert (101101.1101) binary number to decimal number [ ]

a). 45.8125 b) 44.8125 c) 45.8215 d) 44.8215

12. Express the number 107 into 1's compliment form. [ ]

a).10010100 b)10010101 c) 10000100 b)10000101

13. BCD addition for decimal number 113 & 101 is [ ]

a) 214 b) 241 c)142 d)124

14. convert 101011 to gray code number [ ]

a). 111110 b) 110110 c)101110 d)111011.

15. What is the minimum number of gates required to implement the Boolean function (AB+C) if we have to use only 2-input NOR gates? [ ]

(A) 2 (B) 3 (C) 4 (D) 5

16. convert 011001 to gray code number [ ]

a). 111110 b) 110110 c)101110 d)NONE

17. BCD addition for decimal number 143 & 167 is_____. [ ]

a) 214 b) 241 c)142 d)NONE

18. Any negative number is recognized by its_____. [ ]

a) MSB b) LSB c) Bits d) Nibble

19. The base or radix of binary number system is _____. [ ]

a) 2 b) 8 c) 10 d) 16

20. The quantity of double word is_____. [ ]

UNIT-IV

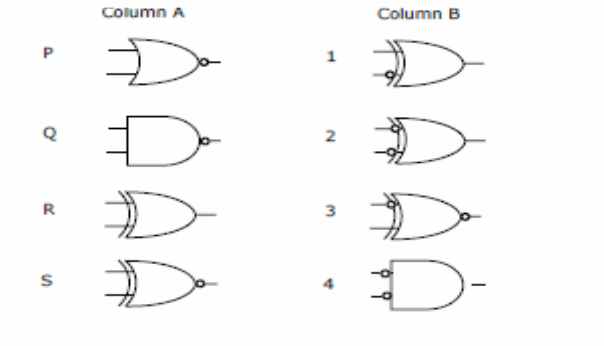
1. What is the minimum number of gates required to implement the Boolean function (AB+C) if we have to use only 2-input NOR gates?

(A) 2 (B) 3 (C) 4 (D) 5

2. A bulb in a staircase has two switches, one switch being at the ground floor and the other one at the first floor. The bulb can be turned ON and also can be turned OFF by any one of the switches irrespective of the state of the other switch. The logic of switching of the bulb resembles

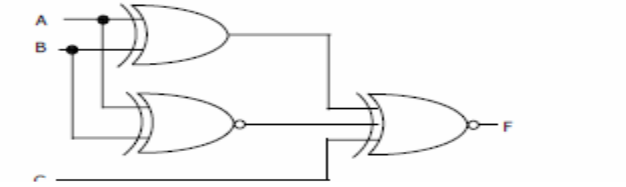
(A)an AND gate (B) an OR gate (C) an XOR gate (D) a NAND

3. Match the logic ga5tes in **Column A** with their equivalents in **Column B.**



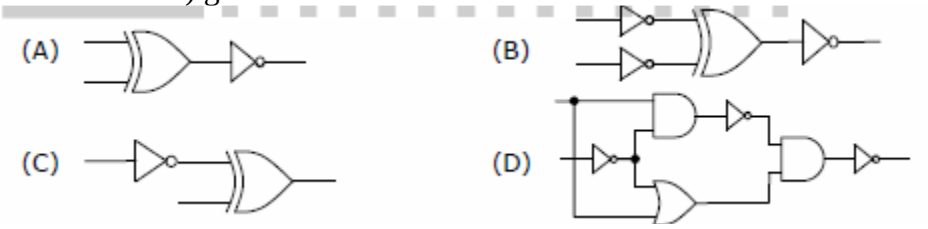
(A) P–2, Q-4, R-1, S-3 (B) P-4, Q-2, R-1, S-3
(C) P–2, Q-4, R-3, S-1 (D) P-4, Q-2, R-3, S-1

4. For the output F to be 1 in the logic circuit shown, the input combination should be

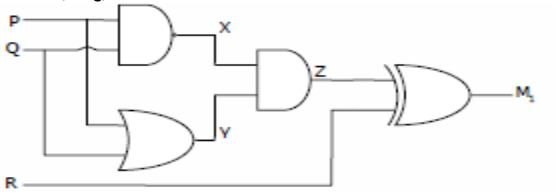


(A) (A) A = 1, B= 1. C = 0 (B) A = 1, B= 0,C = 0
(B) (C) A = 0, B= 1. C = 0 (D) A = 0, B= 0, C = 1

5) Which one of the following circuits is NOT equivalent to a 2-input XNOR (exclusive NOR) gate?



6) Which of the following Boolean Expression correctly represents the relation between P, Q, R and M1?



7)

The minterm expansion of $f(P, Q, R) = PQ + Q\overline{R} + P\overline{R}$ is

(A) $m_2 + m_4 + m_6 + m_7$ (B) $m_0 + m_1 + m_3 + m_5$
(C) $m_0 + m_1 + m_6 + m_7$ (D) $m_2 + m_3 + m_4 + m_5$

8).

The truth table

X	Y	f(X,Y)
0	0	0
0	1	0
1	0	1
1	1	1

represents the Boolean function

(A) X (B) X + Y (C) X ⊕ Y (D) Y

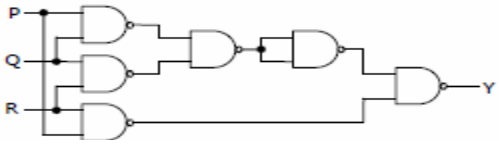
9) The output Y in the circuit below is always '1' when

(A) two or more of the inputs P,Q,R are '0'

(B) two or more of the inputs P,Q,R are '1'

(C) any odd number of the inputs P,Q,R is '0'

(D) any odd number of the inputs P,Q,R is '1'

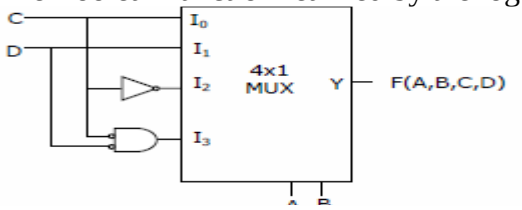


10. What is the minimum number of gates required to implement the Boolean function (AB+CD) if we have to use only 2-input NAND gates?

(A) 2 (B) 3 (C) 4 (D) NONE

UNIT-3

1. The Boolean function realized by the logic circuit shown is [ ]



(A) F=Σm(0,1,3,5,9,10,14) (B) F=Σm(2,3,5,7,8,12,13)

(C) F=Σm(1,2,4,5,11,14,15) (D) F=Σm(2,3,5,7,8,9,12)

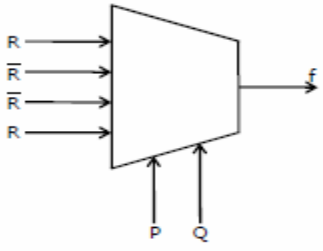
2. The Boolean expression for the output f of the multiplexer shown below is [ ]

(A) $\overline{P \oplus Q \oplus R}$

(B) $P \oplus Q \oplus R$

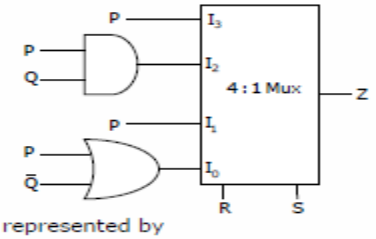
(C) $P + Q + R$

(D) $\overline{P + Q + R}$



3. For the circuit shown in the following figure I0-I3 are inputs to the 4:1 multiplexer R(MSB) and S are control bits

[ ]



The output Z can be represented by

(A) $PQ + P\bar{Q}S + \bar{Q}R\bar{S}$ (B) $P\bar{Q} + PQ\bar{R} + \bar{P}Q\bar{S}$

(C) $P\bar{Q}\bar{R} + \bar{P}QR + PQRS + \bar{Q}R\bar{S}$ (D) $PQ\bar{R} + PQR\bar{S} + P\bar{Q}\bar{R}S + \bar{Q}R\bar{S}$

4).How can Parallel data be taken out of shift register simultaneously [ ]

a) Use Q output of the first F.F b) Use Q output of the last F.F

c) Tie all Q outputs together d) Use Q output of each F.F

5) In a 16-bit Johnson Counter sequence there re totally how many bit patterns [ ]

a) 2 b) 6 c) 12 d) 24.

6).A 122-ring counter requires a minimum of [ ]

a) 10 F.F b) 12 F.F c) 6 F.F d) 2-F.F

7). A mod-16 counter, holding the count 1001. What will be count after 31 clock cycles? [ ]

a) 1000 b) 1010 c) 1011 d) 1101

8) A sequential circuit does not use clock pulse is [ ]

a) Asynchronous sequential circuit b) Asynchronous sequential circuit

c) Counter d) Shift register

9).In a 8- bit ring counter initial state 10111110, what is state after 4^{th} clock pluse [ ]

a) 11101011 b) 00010111 c)11110000 d)00000000

10).With 200Hz clock frequency 8 bits can be serially entered into shift register in [ ]

a) 4 µs b) 40 µs c) 400µs d) 40 ms

UNIT-V

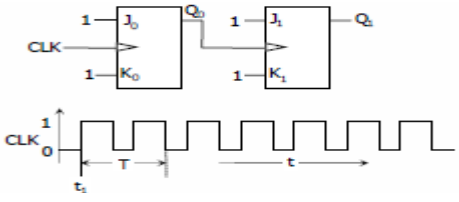
1).If all the flip-flops were reset to 0 at power on, what is the total number of distinct outputs (states) represented by PQR generated by the counter? [ ]

(A) 3 (B) 4 (C) 5 (D) 6

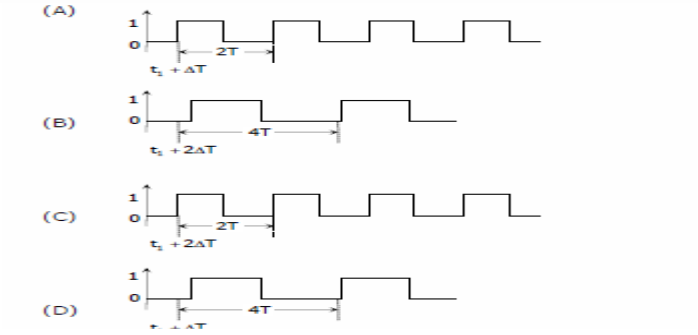
2. If at some instance prior to the occurrence of the clock edge, P. Q and R have a value 0, 1 and 0 respectively, what shall be the value of PQR after the clock edge? [ ]

(A) 000 (B) 001 (C) 010 (D) 011

2.For each of the positive edge-triggered J-K flip flop used in the following figure, the propagation delay is T [ ]



3.Which of the following waveforms correctly represents the output at Q1? [ ]

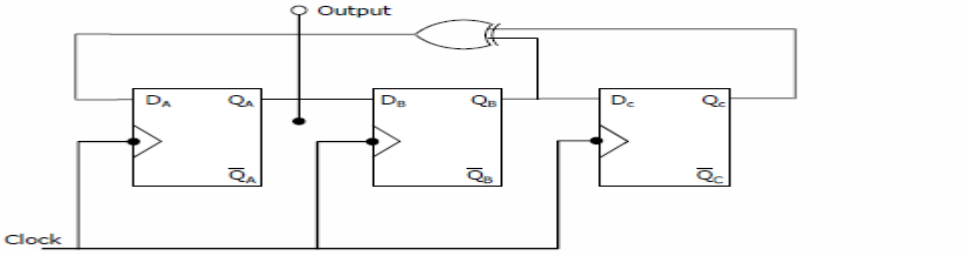


4.Two D flip-flops are connected as a synchronous counter that goes through the following QBQA sequence 00□11□01□10□00□…
The combination to the inputs DA and DB are [ ]

(A) $D_A = Q_B$; $D_B = Q_A$ (B) $D_A = \overline{Q_A}$; $D_B = \overline{Q_B}$

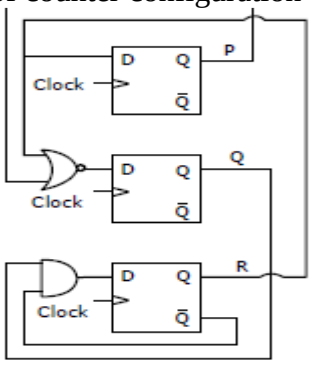
(C) $D_A = \left(Q_A\overline{Q_B} + \overline{Q_A}Q_B\right)$; $D_B = \overline{Q_A}$ (D) $D_A = \left(Q_AQ_B + \overline{Q_A}\,\overline{Q_B}\right)$; $D_B = \overline{Q_B}$

5.Assuming that flip-flops are in reset condition initially, the count sequence observed at QA in the circuit shown is [ ]



(A) 0010111… (B) 0001011… (C) 0101111… (D) 0110100…

6. Consider the following circuit involving three D-type flip-flops used in a certain type of counter configuration [ ]



7. The minimum number of D flip-flops needed to design a mod-258 counter is [ ]
(A) 9 (B) 8 (C) 512 (D) 258

8. A bulb in a staircase has two switches, one switch being at the ground floor and the other one at the first floor. The bulb can be turned ON and also can be turned OFF by any one of

the switches irrespective of the state of the other switch. The logic of switching of the bulb resembles [ ]

A) AND gate (B) OR gate (C) XOR gate (D) NAND

9. The minimum number of D flip-flops needed to design a mod-128 counter is [ ]
(A) 9 (B) 8 (C) 16 (D) 258 (E) NONE

10. The minimum number of T flip-flops needed to design a mod-32 counter is [ ]
(A) 4 (B) 8 (C) 16 (D) 32 (E) NONE

XII. WEBSITES:

1. http://www.onsemi.com
2. http://www.kpsec.freeuk.com/symbol.htm
3. http://buildinggadgets.com/index_circuitlinks.htm
4. http://www.guidecircuit.com
5. www.mathsisfun.com/binary-number-system.html
6. www.allaboutcircuits.com
7. www.electronics-tutorials.ws

XIII. EXPERT DETAILS:

1. Mr. S. Srinivasan, Professor, Indian Institute of Technology, Madras
2. Dr. P. V. D. Somasekhar Rao (JNTUH)
3. Dr. T.Satya Savithri (JNTUH)
4. Mrs N Mangala Gouri (JNTUH)
5. Dr.D.Rama Krishna (O.U)
6. Dr.K.Chandra Bhushana Rao (JNTUK)
7. Dr. V. Sumalatha (JNTUA)
8. Dr. M.N Giriprasad (JNTUA)

XIV. JOURNALS:

INTERNATIONAL

1. IEEE Transaction on Electronic Devices
2. International Journal of Micro and Nano Electronics, Circuits and Systems
3. Active and Passive Electronic Components (ISSN: 0882-7516)
4. International Journal Of Circuits And Architecture Design (IJCAD)

NATIONAL

1. Journal of Active and Passive Electronic Devices
2. Journal of Electronic Testing
3. IETE Journal of Research
4. Journal of Electrical Engineering and Electronic Technology
5. IET Computers & Digital Techniques

XV. LIST OF TOPICS FOR STUDENT SEMINARS:

1. Formation of depletion layer in PN junction diode
2. Zener diode as voltage regulator
3. Common Collector Configuration

4. Need for biasing
5.Thermal runaway, thermal stability
6. Design of CE amplifier
7. MOSFET Characteristics in Enhancement and Depletion Mode
8. Binary adders
9. Encoder& Decoder
10. Multiplexer
11. Flip-flops and latches
12. ROM,RAM,PLA,PAL

XVII. CASE STUDIES / SMALL PROJECTS:

1. Voltage regulator
2. Regulated power supply
3. Single stage amplifier
4. SCR acts as fastest switch
5. FET act as a variable resistor
6. Half adder using universal Gates.
7. Simple 2- bit ripple counter.
8. Basic 8- bit static Memory(RAM) device.