Curriculum Structure of B.Tech, ECE, UG Programme

(Department of Electronics & Communication Engineering)

MALAVIYA NATIONAL INSTITUTE OF TECHNOLOGY JAIPUR

Jawahar Lal Nehru Marg, Jhalana Gram, Malviya Nagar, Jaipur,

Rajasthan 302017

Vision of the Institution:

To create a centre for imparting technical education of international standards and conduct research at the cutting edge of technology to meet the current and future challenges of technological development.

Mission of the Institution:

To create technical manpower for meeting the current and future demands of industry: To recognize education and research in close interaction with industry with emphasis on the development of leadership qualities in the young men and women entering the portals of the Institute with sensitivity to social development and eye for opportunities for growth in the international perspective.

Vision (Department of ECE)

To create a centre for imparting technical education of international standards and conduct research at the cutting edge of Electronics & Communication technology to meet the current and future challenges of technological development.

Mission (Department of ECE)

To create technical manpower for meeting the current and future demands of industry and academia: to recognize education and research in close interaction with electronics & communication & related industry with emphasis on the development of leadership qualities in the young men and women entering the portals of the institute with sensitivity to social development and eye for opportunities for growth in the international perspective.

Program Outcomes

1. **Engineering knowledge**: Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.
2. **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.
3. **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.
4. **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.
5. **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 understanding of the limitations.
6. **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.
7. **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.
8. **Ethics**: Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.
9. **Individual and team work**: Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.
10. **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.
11. **Project management and finance**: Demonstrate knowledge and understanding 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.
12. **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.

Program Specific Outcomes

1. Capability to analyse and design emerging electronic devices, circuits, and subsystems.
2. Ability to apply knowledge of modern and advanced tools to design hardware/software solutions.
3. Capability to analyse and design advanced wired and wireless communication systems

Components of the Curriculum

Course Component	Curriculum Content (% of total number of credits of the programme)	Total number of contact hours	Total Number of credits
Basic Science	9	36	18
Engineering Science	11	44	22
Humanities and social science	3	8	6
Program Core	53	117	103
Program Elective	11	21	21
Open Electives	3	6	6
Projects	6	24	12
Internship/Seminar	2	6	4
Any other (Please Specify)	2	3	3
		Total number of Credits	195

CURRICULAR STRUCTURE FOR THE B.TECH. I YEAR COMMON TO ALL BRANCHES

Teaching Scheme					Contact Hrs/ Week
S.No.	**Course Code**	**Course Name**	**Category**	**Credit**	**L-T-P**
Theory Papers					
1	CPT101	Computer Science and Programming*	PC	2	2-0-0
2	EET101	Basic Electrical Engineering*	PC	4	3-1-0
3	ECT101	Basic Electronics Engineering*	PC	4	3-1-0
4	CET102	Environmental Science and Ecology*	PC	2	2-0-0
5	MET101	Basic Mechanical Engineering*	PC	4	3-1-0
6	MAT101	Mathematics I*	PC	4	3-1-0
7	MAT102	Mathematics II*	PC	4	3-1-0
8	PHT101	Physics*	PC	4	3-1-0
9	CYT101	Chemistry*	PC	4	3-1-0
10	HST102	Basic Economics*	PC	3	2-1-0
11	HST101	Technical Communication*	PC	2	1-2-0
12	CET101	Computer Aided Engineering Drawing*	PC	2	1-0-2
Lab Courses					
1	HSP103	Language Laboratory*	PC	1	0-0-2
2	PHP102	Physics Lab*	PC	1	0-0-2
3	MEP102	Workshop Practice*	PC	1	0-0-2
4	EEP102	Electrical Engineering Lab*	PC	1	0-0-2
5	CYP102	Chemistry Lab*	PC	1	0-0-2
6	CPP102	Programming Lab*	PC	1	0-0-2
7	ECP102	Electronics Engineering Lab*	PC	1	0-0-2
Creative Arts/ Sports/ NSS*					
Discipline					
Total Credits				**46**	

Total Credits = 46

*Some batches will be offered these subjects in first odd semester and the other in second even semester

Sports NSS

Creative Arts: 1. Music, 2. Drama, 3. Photography, 4.Literary, 5. Fine Arts, 6. Adventures

** Extra Curricular Activities (Creative Arts/ Sports) once opted cannot be changed

Extra Curricular Activities may run in both semester but evaluated and tabulated in second semester only.

Note: In case a particular activity is opted by larger number of students and some students cannot be accommodated, the Chief Advisor Sports in consultation with Student Welfare will reallocate Creative Arts/ Sports for such students.

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1. Range for total credits in III, IV, V and VI semester is 22-28

2. A course on Management (PC), will be run in VII semester for four branches and the rest will have it in VIII semester

3. Course credits have been assigned as per **R & R 8.7** of UG Manual.

4. Advance elective courses which can also be M.Tech courses or advance courses designed and offered to the UG students by the department have been identified.

Categories: PC: Programme Core PE: Programme Elective AEC: Advanced Elective Course OE: Open Elective

First Year (Common to all Branches)

S.No.	Semester	Course Code	Course Name	Category	Type	Credit	L-T-P
1	I/II	ECT 101	Basic Electronics Engineering	PC	Theory	4	3-1-0
2	I/II	ECP 102	Electronics Engineering Lab	PC	Lab	2	0-0-3

Semester III

SUM should be in the range 22-28

S.No.	Semester	Course Code	Course Name	Category	Type	Credit	L-T-P
1	III	ECT 201	Electronic Devices & Circuits	PC	Theory	3	3-0-0
2	III	ECT 202	Switching Theory & Finite Automata	PC	Theory	3	3-0-0
3	III	ECT 203	Network Theory	PC	Theory	3	3-0-0
4	III	ECT 204	Probabilistic Methods in Signals & System	PC	Theory	3	3-0-0
5	III	ECT 205	Graph Theory	PC	Theory	2	2-0-0
6	III	ECT 206	Data Structures & Algorithms	PC	Theory	3	3-0-0
1	III	ECP 201	Electronic Devices & Circuits Lab	PC	Lab	2	0-0-3
2	III	ECP 202	Switching Theory & Finite Automata Lab	PC	Lab	2	0-0-3
3	III	ECP 204	Data Structures & Algorithms Lab	PC	Lab	2	0-0-3
4	III	ECP 206	Probabilistic Methods in Signals & System	PC	Lab	2	0-0-3

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Semester IV

SUM should be in the range 22-28

S.No.	Semester	Course Code	Course Name	Category	Type	Credit	L-T-P
1	IV	ECT 211	Applied Electronics	PC	Theory	3	3-0-0
2	IV	ECT 212	Analog Communication	PC	Theory	3	3-0-0
3	IV	ECT 213	Microprocessors	PC	Theory	3	3-0-0
4	IV	ECT 214	Electromagnetic Field Theory	PC	Theory	3	3-0-0
5	IV	ECT 215	OPERATING SYSTEMS	PC	Theory	3	3-0-0
6	IV	ECT 216	Measurements & Instrumentation	PC	Theory	3	3-0-0
1	IV	ECP 211	Applied Electronics Lab	PC	Lab	2	0-0-3
2	IV	ECP 212	Analog Communication lab	PC	Lab	2	0-0-3
3	IV	ECP 213	Microprocessors lab	PC	Lab	2	0-0-3
4	IV	ECP 215	Operating Systems Lab	PC	Lab	2	0-0-3

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Semester V

SUM should be in the range 22-28

S.No.	Semester	Course Code	Course Name	Category	Type	Credit	L-T-P
1	V	ECT 301	Microwave Engineering	PC	Theory	3	3-0-0
2	V	ECT 302	Digital Signal Processing	PC	Theory	4	3-0-2
3	V	ECT 303	Digital Communication Systems	PC	Theory	3	3-0-0
4	V	ECT 304	Digital CMOS IC	PC	Theory	4	3-0-2
5	V	ECT 305	Optical Communication Systems	PC	Theory	4	3-0-2
6	V	ECT 306	VLSI Testing & Testability	PC	Theory	3	3-0-0
1	V	ECP 301	Microwave Engineering Lab	PC	Lab	2	0-0-3
2	V	ECP 303	Digital Communication Systems Lab	PC	Lab	2	0-0-3

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Semester VI SUM should be in the range 22-28

S.No.	Semester	Course Code	Course Name	Category	Type	Credit	L-T-P
1	VI	ECT 311	Antenna & Wave Propagation	PC	Theory	4	3-0-2
2	VI	ECT 312	Computer Architecture	PC	Theory	3	3-0-0
3	VI	ECT 313	Wireless & Mobile Communication	PC	Theory	3	3-0-0
4	VI	ECT 314	Control System Engineering	PC	Theory	3	3-0-0
5	VI	ECT 315	Embedded Systems	PC	Theory	3	3-0-0
6	VI	ECT 316	Analog CMOS IC	PC	Theory	3	3-0-0

1	VI	ECP 316	Analog CMOS IC lab	PC	Lab	2	0-0-3
2	VI	ECP 317	Embedded Systems Design Lab	PC	Lab	2	0-0-3
3	VI	ECS 318	SEMINAR	PC	Lab	2	0-0-3

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Semester VII

SUM should be in the range 22-28

S.No.	Semester	Course Code	Course Name	Category	Type	Credit	L-T-P
1	VII		Management*	PC	Theory	3	3-0-0
2	VII		FROM LIST*	OE	Theory	3	3-0-0
3	VII		FROM LIST*	OE	Theory	3	3-0-0
4	VII		FROM AEC LIST*	PE	Theory	3	3-0-0
5	VII		FROM PE LIST	PE	Theory	3	3-0-0
6	VII		FROM PE LIST	PE	Theory	3	3-0-0
7	VII		FROM PE LIST	PE	Theory	3	3-0-0
1	VII	ECD 481	Training Seminar	PC	Lab	2	0-0-3
2	VII	ECD 483	System Design Lab-I	PC	Lab	2	0-0-3
3	VII	ECD 498	Major Project A	PC	Project	4	0-0-8

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Semester VIII

SUM should be in the range 22-28

S.No.	Semester	Course Code	Course Name	Category	Type	Credit	L-T-P
1	VIII		Management*	PC	Theory	3	3-0-0
2	VIII		FROM LIST*	OE	Theory	3	3-0-0
3	VIII		FROM LIST*	OE	Theory	3	3-0-0
4	VIII		FROM AEC LIST*	AEC	Theory	3	3-0-0
5	VIII		FROM AEC LIST	AEC	Theory	3	3-0-0
6	VIII		FROM AEC LIST	AEC	Theory	3	3-0-0
7	VIII		FROM AEC LIST			3	3-0-0
1	VIII	ECD 482	System Design Lab-II	PC	Lab	2	0-0-3
2	VIII	ECD 499	Major Project B	PC	Project	8	0-0-16

25 Total=***149***

****Indicates that the courses individually, may be opted either in 7th Semester OR 8th Semester***

Note: * Programme elective and advanced elective course are taken as it is from PG (M.Tech.) courses running in the ECE department. Therefore, please refer the same for the syllabus and other details for PG courses.

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LIST OF PE/AEC: (3 credits each)

ECT 401	SPREAD SPECTRUM TECHNOLOGY
ECT 403/ECT663	Advanced ERROR CONTROL CODES
ECT404/ECT 670	SATELLITE COMMUNICATION & RADAR ENGINEERING
ECT 405	IMAGE PROCESSING
ECT 406/ECT607	CAD ALGORITHMS FOR VLSI PHYSICAL DESIGN
ECT 407/ECT 603	CAD ALGORITHMS FOR SYNTHESIS OF DIGITAL SYSTEMS
ECT 408/ECT 616	COMUPTER ARITHMETIC &MICROARCHITECTURE DESIGN
ECT 409/ECT622	SYSTEM LEVEL DESIGN & MODELLING
ECT 411	NEURAL NETWORKS
ECT 412	ADVANCED MICROPROCESSORS & MICRO-CONTROLLERS
ECT 413	COMPUTER NETWORKS
ECT 451/ECT665	ADV. MICROWAVE ENGG
ECT 452/ECT676	Design of MICROSTRIP ANTENNA
ECT 453	ADVANCED ANTENNA SYSTEMS
ECT 454	MICROWAVE INTEGRATED CIRCUITS
ECT 455	POWER ELECTRONICS
ECT 456	SEMICONDUCTOR OPTO-ELECTRONICS
ECT 457/ECT 628	MEMORY DESIGN & TESTING
ECT 459/ECT640	ELECTRONIC MANUFACTURING TECHNOLOGY
ECT 460/ECT 626	FORMAL VERIFICATION OF Digital HARDWARE & EMBEDDED Software
ECT 462	ARTIFICIAL INTELLIGENCE & EXPERT SYSTEM
ECT 463	PARALLEL COMPUTING ARCH
ECT 464	BIO-MEDICAL ENGINEERING
ECT 465/ECT658	CURRENT-MODE ANALOG SIGNAL PROCESSING
ECT 466/ECT 655	OPTICAL CODES AND APPLICATIONS
ECT 467/ECT 656	ADAPTIVE SIGNAL PROCESSING
ECT 468/ECT 657	VLSI SIGNAL PROCESSING Architectures
ECT470	Human Values -I
ECT478/ECT 642	FPGA PHYSICAL DESIGN
ECT479/ECT 614	VLSI TECHNOLOGY
ECT480	Information Theory & Coding
ECT481	System Design using FPGAs
ECT482	Instrumentation & Control

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LIST OF PE/AEC: (3 credits each)

ECT 672	WIRELESS AND MOBILE ADHOC NETWORKING
ECT 674	CRYPTOGRAPHY
ECT 678	DESIGN OF MIC AND MMIC'S
ECT 680	ADVANCED MOBILE SYSTEMS
ECT 682	SMART AND PHASED ARRAY ANTENNA DESIGN
ECT 684	ADVANCED TOPICS IN COMMUNICATION
ECT 686	PHOTONIC INTEGRATED DEVICES AND SYSTEMS
ECT 688	EMI/EMC
ECT 690	WIRELESS SENSOR NETWORK
ECT 692	COMPUTATIONAL ELECTROMAGNETIC
ECT 694	ADVANCED PHOTONIC DEVICES AND COMPONENTS
ECT 696	TELECOMMUNICATION TECHNOLOGY AND MANAGEMENT
ECT 698	ADVANCED NETWORKING ANALYSIS
ECT 662	ADVANCED DIGITAL SIGNAL & IMAGE PROCESSING
ECT 620	MICROELECTRONIC DEVICES AND CIRCUIT
ECT 630	ADVANCED COMPUTER ARCHITECTURE
ECT 634	MICRO AND NANO ELECTRO MECHANICAL SYSTEMS
ECT 638	DESIGN OF ASYNCHRONOUS SEQUENTIAL CIRCUITS
ECT 664	ESTIMATION AND DETECTION
ECT 650	SPECIAL TOPICS IN VLSI-1
ECT 652	SPECIAL TOPICS IN VLSI-2
ECT 654	RF INTEGRATED CIRCUITS
ECT 991	MATHEMATICAL METHODS & TECHNIQUES FOR ECE TECHNOLOGIES I
ECT 992	MATHEMATICAL METHODS & TECHNIQUES FOR ECE TECHNOLOGIES II

ECT 993 Pattern Recognition and Machine Learning

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Example-1 **Semester VII** Student goes on INTERNSHIP in 7th Sem SUM should be in the range 18-20

S.No.	Semester	Course Code	Course Name	Category	Type	Credit	L-T-P
1	*VII*		*Management**	*PC*	*Theory*	*3*	*3-0-0*
5	*VII*		*FROM PE LIST*	*PE*	*Theory*	*3*	*3-0-0*
6	*VII*		*FROM PE LIST*	*PE*	*Theory*	*3*	*3-0-0*
7	*VII*		*FROM PE LIST*	*PE*	*Theory*	*3*	*3-0-0*
2	*VII*	*ECD 483*	*System Design Lab-I*	*PC*	*Lab*	*2*	*0-0-3*
1	VII	ECD 481	Training Seminar	PC	Lab	2	0-0-3
3	VII	ECD 498	Major Project A	PC	Project	4	0-0-8
						0	

Exempted as per UG manual (16 credits max) End of 8th Sem

Semester VIII SUM should be in the range 18-20

S.No.	Semester	Course Code	Course Name	Category	Type	Credit	L-T-P
1							
2	VIII		FROM LIST	OE	Theory	3	3-0-0
3	VIII		FROM LIST	OE	Theory	3	3-0-0
4	VIII		FROM AEC LIST	AEC	Theory	3	3-0-0
5	VIII		FROM AEC LIST	AEC	Theory	3	3-0-0
6	VIII		FROM AEC LIST	AEC	Theory	3	3-0-0
7	VIII		FROM AEC LIST			3	3-0-0
1	VIII	ECD 482	System Design Lab-II	PC	Lab	2	0-0-3
2	VIII	ECD 499	Major Project B+ evaluation ONLY for A	PC	Project	8	0-0-16
						20	

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Example-2

Semester VII SUM should be in the range 18-20

S.No.	Semester	Course Code	Course Name	Category	Type	Credit	L-T-P
1	VII		Management	PC	Theory	3	3-0-0
4	VIII		FROM LIST	OE	Theory	3	3-0-0
	VIII		FROM LIST	OE	Theory	3	3-0-0
5	VII		FROM PE LIST	PE	Theory	3	3-0-0
6	VII		FROM PE LIST	PE	Theory	3	3-0-0
7	VII		FROM PE LIST	PE	Theory	3	3-0-0
2	VII	ECD 483	System Design Lab-I	PC	Lab	2	0-0-3
1	VII	ECD 481	Training Seminar	PC	-	2	0-0-3
3	VII	ECD 498	Major Project A	PC	Project	4	0-0-8
						20	

Semester VIII Student goes on INTERNSHIP in 8th Sem SUM should be in the range 18-20

S.No.	Semester	Course Code	Course Name	Category	Type	Credit	L-T-P
3	*VIII*		*FROM AEC LIST*	*OE*	*Theory*	*3*	*3-0-0*
5	*VIII*		*FROM AEC LIST*	*AEC*	*Theory*	*3*	*3-0-0*
6	*VIII*		*FROM AEC LIST*	*AEC*	*Theory*	*3*	*3-0-0*
7	*VIII*		*FROM AEC LIST*	*AEC*	*Theory*	*3*	*3-0-0*
8	*VIII*	*ECD 482*	*System Design Lab-II*	*PC*	*Lab*	*2*	*0-0-3*
9	VIII	ECD 499	Major Project B (evaluation ONLY)	PC	Project	8	0-0-16
						22	

Exempted as per UG manual (16 credits max)

Indicates that the courses individually, may be opted either in 7th Semester OR 8th Semester

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SYLLABUS OF B. Tech. (First Year)

Course Code : ECT-101 **LTP: 3-1-0 per week**	**Course : Basic Electronics Engineering** **Credits: 03**

Syllabus: Module I: Analog Electronics

Diode Circuits: Introduction to diodes, Current components in diode, Zener diode and applications. Half -wave and full -wave rectifiers & their analysis, comparison of bridge and center -tap rectifier, various types of RLC filters, clipping & clamping circuits. Introduction and working principles of LED and Solar cell. **(9)**

Transistors: Bipolar Junction Transistor, Current components in transistor, transistor construction, various configurations (CE, CB. CC) and characteristics (Input and Output) of BJT's configurations. The transistor as an amplifier and switch, Introduction to MOSFETs, Construction, characteristics and working principles of MOSFETs (depletion type MOSFET and Enhancement type MOSFET). **(7)**

Operational Amplifiers: Introduction, ideal and practical operational amplifiers, open and closed loop configurations, Applications of operational amplifiers**.** **(4)**

Module II: Digital Electronics

Digital Gates and Functions: Introduction to number systems and binary arithmetic, Logic Gates and universal gates, Boolean algebra, SOP & POS forms of a Boolean function, simplification of logical functions using Karnaugh map. **(6)**

Digital Circuits: Half and full adder, subtractor, multiplier, encoders, decoders, multiplexers, demultiplexers. **(4)**

Module III: Communication Systems

Principles of communication systems, Concepts of modulation and demodulation, AM, FM, PM.

Course Outcomes: At the end of the course the student will be able to:

ECT102:CO1	An understanding of basic electronics engineering principles, which are essential for analysis and design of electronic devices and circuits.
ECT102:CO2	The capability to apply the principles learned to analyse simple electronics circuit
ECT102:CO3	The ability to formulate and solve mathematical equations for given electronic circuits
ECT102:CO4	Ability to design the simple circuits using transistors, diodes and FETs.
ECT102:CO5	An understanding of modelling of complex devices such as semiconductor diodes, BJT and FET and how the models are used in design and analysis of useful circuits

References:

1. Basic Electronics and linear Circuits, N N Bhagava, TMH
2. Integrated Electronics, Millman Halkias, TMH.
3. Electronic Devices and Circuit, David A. Bell, Oxford
4. Electronic Devices and Circuit Theory, R. L. Boylestad, Pearson Education
5. Digital Circuits and Design, S Salivahanan, Vikas Publishers, Digital Electronics, Moris-Mano, PHI
6. An Introduction to Analog & Digital Communications, Simon Haykin, Michael Moher, Wiley
7. Fundamentals of Communication Systems, John G Proakis, Pearson Education

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SYLLABUS OF B. Tech. (ECE)

Course Code : ECT-201 **LTP: 3-0-0 per week**	**Course : Electronic Devices & Circuits** **Credits: 03**

Syllabus:

Transistor at low frequencies: Graphical Analysis of the CE configuration, Two-Port devices and the hybrid Model, Transistor hybrid model, The h-parameter, Conversion formulas for the parameters of the three transistor Configuration, Analysis of a transistor Amplifier Circuit using h parameters, The Emitter follower, Comparison of transistor amplifier configurations, Linear Analysis of a Transistor Circuit, Cascading Transistor Amplifiers, Simplified Common-Emitter Hybrid Model, Simplified calculations for the Common Collector Configuration, The Common-Emitter Amplifier with an emitter resistance, High input resistance transistor circuits, Multistage amplifier analysis.

Field Effect Transistors: The FET and MOSFET Small-Signal model, The Low-Frequency Common-Source and Common-Drain Amplifiers, The FET as a Voltage-variable Resistor (VVR). High frequency model of BJT: High frequency hybrid-π model of BJT, Common emitter and common collector configurations, Cascade configuration.

Feedback Amplifiers: General Feedback structure, Properties of negative Feedback, Four basic Feedback Topologies, Voltage series, Voltage shunt, Current series, Current Shunt, Effect of Feedback connection on various parameters. Analysis of above topology for BJT and FET.

Oscillators: Basic principle of sinusoidal oscillator (phase shift, wein bridge), Hartley & Colpitts, Crystal Oscillator, nonlinear/pulse oscillator.

Course Outcomes:

ECT201:CO1	Understand the modelling of bipolar junction transistors (BJTs), analyse the different amplifier configurations using these transistors models, learn to simplify these models and analyse the different transistor configurations.
ECT201:CO2	Acquire the basic understanding of the Field effect transistor (FET) and its small signal model, analyse the low frequency configurations of the amplifier using FET. (I/3)
ECT201:CO3	Understand the high frequency model of the bipolar junction transistors (BJTs) for the different configurations.
ECT201:CO4	Learn the concept of feedback to stabilize the amplifiers, analyse the different topologies and synthesise the same using BJTs and FETs (II/3)
ECT201:CO5	Learn the principles of sinusoidal oscillators. (III/3)

References:

1. Electronic principles, Bolysted
2. Millman, Halkias, Integrated Electronics- Analog & digital circuits, TMH.
3. Millman, Halkias & S. Jit. Electronics Devices & Circuits, TMH, 2009.
4. Microelectronic Circuits, Sedra Smith, Oxford press, India.
5. Electronic Devices and Circuits, David-A-Bell, Oxford Univ. Press 2008.

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SYLLABUS OF B. Tech. (ECE)

Course Code : ECT-202 **LTP: 3-0-0 per week**	**Course : Switching Theory and Finite Automata** **Credits: 03**

Syllabus:

Number System and Codes: Arithmetic of Nonconventional Number System, Weighted Codes, Error Correction/Detection Codes, BCD codes, Fixed point & floating point Number System

Boolean Algebra and Logic Gates: SOP and POS for Truth Table, K'Maps, Tabular method, NAND/NOR Universal Gates, Hazardous in the circuits

Combination Circuits: Adders, Magnitude comparators, Encoder/Decoders, Muxes/DeMuxes, BCD Adder, Logic Implementation using combination blocks

Sequential Circuits: FlipFlops, Master-Slave FlipFlop, Type of Counters (Synchronous/Asynchronous), Types Registers, FSM concept, Examples of FSM, Simplification of incompletely specified Machines.

PLD Concept and Implementation: Basics of HDL (VHDL/Verilog) , Syntax and Semantics of HDL, Design Style using HDL, Basics of PAL,PLA, PROM, CPLD, FPGA

Course Outcomes:

CO1	Is able to understand the arithmetic of nonconventional number systems (knowledge)
CO2	To understand the concept of Boolean algebra (knowledge)
CO3	To design basic digital circuit using HDL concept (skills)
CO4	Understand the concept of combination and sequential circuit (skills)
CO5	To implement FSM design for various real-world applications (skills)

References:

1. Digital Design by Morris Mano
2. Switching Theory and Finite Automata by Zvi Kohvi
3. VHDL : Programming By Example Author : Douglas L. Perry

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Curriculum structure of B.Tech ECE Programme

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SYLLABUS OF B. Tech. (ECE)

Course Code : ECT-203 **LTP: 3-0-0 per week**	**Course : Network Theory** **Credits: 03**

Syllabus:

Methods of Network Analysis: Mesh and node variable analysis; Star Delta transformation; Steady state analysis of AC circuits, Characteristics of the sinusoid: Average, peak and effective values, Impedance concept, Active, reactive and complex power, Power factor, Q of coils and capacitors, Series and parallel resonances, Series Parallel reduction of AC/DC circuits, Network Theorems.

Two Port Networks: Parameters: open circuit impedance Z parameters, short circuit admittance Y parameters, Hybrid h parameters, Chain parameters ABCD and g parameters, Image Impedances, T and pie network, Relationship between different two port network, Interconnection of two-port network: cascade, series, parallel, series-parallel and parallel-series connections, Indefinite admittance matrix and applications.

Network Graphs: Network Matrices, Incidence and Reduced Incidence matrix, Loop Matrix, Fundamental loop matrix, Cut set and cut set matrix, Fundamental cut set matrix, Relationship between network Matrices, Formulation of network equations, Fundamental loop equations and nodal admittance matrix.

Steady State & Transient Analysis: DC and sinusoidal response of R-L-C circuits, Laplace transforms and its properties, inverse transforms, initial and final value theorems, use of transfer function in network analysis. State Equations for Networks: Basic consideration in writing state equations, order of complexity, Formulation of state equations, Solutions of state equations, State transition matrix. Frequency domain analysis of RLC circuits, Poles & Zeros, Driving Point Function, Amplitude & Phase Response.

Passive Filters: Classification, Constant-K filters, m-Derived T-Section, Band pass filter, Band elimination filter, Tunable filter realization.

Course Outcomes:

CO1 Is able to apply different networking theorems to solve network problems.

CO2 Is able to compute methods of network matrixes, Incidence and reduced incidence matrix, loop matrix etc.

CO3 Is able to perform two port networks as Z parameter, ABCD parameter, T parameter, Y parameter etc.

CO4 Is able to analyses transient & steady states, formulate state equations and find solutions of state equations.

CO5 Is able to analyses networks in frequency domain, pole-zero plots, amplitude and phase response

CO6 Is able to design basic passive filters

References:

1) M. E. Valkenburg, Network Analysis, PHI, 1995
2) S. Ghosh, Network Theory: Analysis and Synthesis, PHI, 2005
3) T. S. K. Iyear, Circuit Theory, TMG Hill, 1985
4) Del Toro, Principles of Electrical Engg, PHI, 1994
5) A. Sudhakar & Shyammohan S. Palli, Circuits & Networks: Analysis & Synthesis, McGraw Hill, 2015

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SYLLABUS OF B. Tech. (ECE)

Course Code : ECT-204 **LTP: 3-0-0 per week**	**Course : Probabilistic Methods in Signals & System** **Credits: 03**

Syllabus:

Probability Theory & Random Variables : Introduction to theory of probability, Self, joint & conditional probabilities, Statistically dependent & independent events, Discrete and continuous Random Variables (RV's) , their CDF's and pdf's

Functions of random variable: Case of one/two random variables, Joint RVs, Mean values and moments of some pdf's (Binomial, Poisson, Gaussian, Rayleigh, Maxwell, Gaussian), Correlation function and their properties, Basic concept of Random processes

Representation of Signals and Systems: Continuous & discrete time signals, LTI systems and their classification, System modeling using differential and difference equations.

Analysis of signals: Fourier series, Fourier transforms and their properties, Convolution, Transmission of signals through linear systems

Fourier Analysis for DTS: Discrete time Fourier series, Discrete time Fourier transform and their properties, DFT and its properties, Fast Fourier Transform Z-transforms & its properties, ROC, Inversion of Z-transform, Application to System Analysis.

Course Outcomes:

ECT204:CO1	Understand the handling of signals in different domains- time and frequency -through Fourier transforms. Analysis and synthesis of different basic signals to be used in the communication systems.(I/3)
ECT204:CO2	Acquire the basic mathematical understanding of the probability theory; methods of converting these results of the probability theory into different form of expressions-distribution and density functions, so as to be useful in the analysis of signals. (II/3)
ECT204:CO3	Extend the concepts of probability theory to random processes. Learn to evaluate the different type of estimates generated through the probabilistic methods for use in the analysis of noise. (III/3)
ECT204:CO4	After undergoing this course, the student will be able to analyze the different type of signals and noises in communication systems.

References:

1. Cooper, McGillem: Probabilistic Methods of Signal and System Analysis, 3/e, OUP, 1999.
2. Peebles, P.: Probability, random variables and random signal principles, Mc Graw Hill, 2001.
3. Haykin S.: Communication Systems, 2/e, Student Edition, Wiley India, 2007.
4. Oppenheim A.V., Willsky A.S. and Nawab S.H..: Signals and Systems, 2/e, Prentice Hall of India, 1997
5. B.P. Lathi, Modern Digital and Analog. Communication Systems, 3rd ed., Oxford. University Press, 1998.

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SYLLABUS OF B. Tech. (ECE)

Course Code : ECT-205 **LTP: 3-0-0 per week**	**Course : Graph Theory** **Credits: 02**

Syllabus:

Graph- basics, Planarization, triangulation, graph algorithms for shortest/longest paths, spanning tree, search etc.

Algorithms & complexity- shortest path, max-flow, Dijkshtra's algorithm, min-cost flow, algorithm for graph search and matching; spanning trees and matroids;

Integer Linear programming, Greedy algorithm, approximation algorithms; branch-and-bound; dynamic programming

Course Outcomes:

ECT205:CO1	Is able to grasp core concepts, basic tenets of combinatorial graphs (knowledge)
ECT205:CO2	Is able to grasp features, properties of special graphs (knowledge)
ECT205:CO3	Is able to learn & apply graph algorithms and its applications into Circuits, computer problem solving etc. (Thinking, skills)
ECT205:CO4	Is able in long perspective, to appreciate the significance of GRAPH as a versatile modeling entitiy; and the significance that it can be used for analysis, problem solving as well as synthesis- especially for chip design, wireless communication protocols & system design, computer problem solving, data structures etc. (skills)
ECT205:CO5	Is able to write small C/C++ programmes related to implementation of graph algorithms (skills).

References:

1. Narsingh Deo, Graph theory, Prentice Hall India, 2008.
2. T. H. Cormen, C. E. Leiserson and R. L. Rivest, "Introduction to Algorithms," McGraw-Hill, 2007
3. S. Baase, Computer algorithms, Pearson India 2008.

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SYLLABUS OF B. Tech. (ECE)

Course Code : ECT-206 **LTP: 3-0-0 per week**	**Course : Data Structures and Algorithms** **Credits: 03**

Syllabus:

Introduction to data structures: Static and dynamic aspects of memory allocation. Recursion and its applications. Introduction to complexity analysis, measure and representation.
Algorithms for searching and Sorting: Non-recursive and recursive implementation of searching. Non-recursive and recursive sorting algorithms.

Creation and manipulation of data structures: arrays, stacks, queues and linked lists with static and dynamic memory allocation. Applications. Creation, manipulation and analysis of trees. Binary search tree algorithms.

Graph problems: Shortest path implementation. Introduction to Max Flow-Min Cut and travelling salesman problem.
Introduction to height balanced trees: AVL and B Trees.

Course Outcomes:

ECT206:CO1	Is able to grasp core concepts of space & time complexity analysis (knowledge)
ECT206:CO2	Is able to analyze & design basic algorithms for sorting, searching etc. (knowledge)
ECT206:CO3	Is able to analyze & solve for computing the order of time complexity of algorithms (Knowledge, skill)
ECT206:CO4	Is able to learn and code for various search algorithms like divide & conquer, branch & bound, greedy (skills)

References:

1. Kruse R.L., Data Structure and Program Design, PHI.
2. Rivest, Cormen, Introduction to Algorithms, MIT Press
3. Horowitz and Sahni: Data Structure in C++ , Glagotia
4. Ellis Horowitz, Sartaj Sahni, Fundamentals of Data Structures
5. Aaron M. Tenenbaum, Y. Langsam, Moshe J. Augenstein, Data Structures Using C

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SYLLABUS OF B. Tech. (ECE)

Course Code : ECT-211 **LTP: 3-0-0 per week**	**Course : Applied Electronics** **Credits: 03**

Syllabus:

Waveform Generators: Astable Multivibrator, Monostable Multivibrator, Bistable Multivibrator. Schmitt trigger.

Operational Amplifiers: The Ideal Op Amp, Inverting Configuration, Non inverting Configuration, Applications of Op Amps, Circuits. Effect of Finite Open loop gain and Bandwidth on circuit Performance, Large signal Operation of Op Amps, Practical operational Amplifier parameters. Feedback.

Power Amplifiers: Power Amplifier Circuits. Class A, Class B and Class AB output stages Class A, Class B Push pull amplifiers with and without Transformers.

Voltage Regulators: Basic series and shunt regulator, IC voltage regulator, short circuit or overload protection, Application of IC voltage regulator. Phase locked loop(PLL): Block diagram, working and its various applications

Recent advances in operational amplifiers.

Course Outcomes:

At the end of the course the student will be able to:

CO1: Understanding different modes of Schmitt trigger
CO2: Implementing circuits with Operational amplifier
CO3: Understanding different types of power amplifiers
CO4: Applying the voltage regulator in different configuration
CO5: Understanding PLL and its usage

References:

1. Sedra/Smith, Microelectronic Circuits, Oxford University Press.
2. L. Schilling and C. Belove, Electronic Circuits, McGraw-Hill.
3. S. Soclof, Applications & Design with analog IC's PH1
4. Jacob-Applications & Design with analog IC's, PH1
5. Coughlin Driscol-Operational Amplifiers & Linear IC's Pearson Education.
6. Millman, Halkias & Parikh. Integrated Electronics- Analog & digital circuits, TMH, 2009.
7. Current literature from reputed journals

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SYLLABUS OF B. Tech. (ECE)

Course Code : ECT-212 **LTP: 3-0-0 per week**	**Course : Analog Communication** **Credits: 03**

Syllabus:

Spectral density: Transmission of signals through linear systems, ideal filters, Hilbert transform, pre-envelope, complex envelope,

Amplitude Modulation: AM, Double Side Band Suppressed Carrier modulation, Single Side Band modulation, Vestigial Side Band modulation, AM receivers, Noise in AM receivers using envelope detection, SNR for coherent reception with SSB and DSBSC modulations, Frequency Division Multiplexing.

Angle modulation: Frequency modulated & Phase modulated signals, Frequency Modulation, Narrow Band and Wide Band Frequency Modulation, Multitone FM, De-emphasis in FM, Noise in FM reception,

Pulse Analog Modulation: Pulse Amplitude Modulation, Pulse time Modulation, Time Division multiplexing, Elements of Pulse Code modulation , Differential PCM, Delta Modulation, Adaptive Delta Modulation.

Time- and Frequency Characterization of Signals and Systems: The Magnitude-Phase Representation of the Fourier Transform Frequency Response of LTI Systems, Time-Domain Properties of Ideal Frequency-Selective Filters. Time- Domain and Frequency-Domain Aspects of Nonideal Filters. First-Order and Second-Order Continuous and Discrete-Time Systems, Discrete-Time Processing of Continuous-Time Signals, Sampling of Discrete-Time Signals.

Course Outcomes:

ECT212:CO1	To familiarize the students about different Analog Modulation and De-Modulation schemes
ECT212:CO2	Students shall be able to understand A/D conversion techniques
ECT212:CO3	Analyze the performance of different modulation techniques under noise
ECT212:CO4	Introduce students about channel capacity

References:

1. Haykin S.: Communication Systems, 2/e, Student Edition, Wiley India, 2007.
2. Oppenheim A.V., Willsky A.S. and Nawab S.H..: Signals and Systems, 2/e, Prentice Hall of India, 1997
3. Tan: Digital Signal Processing; Fundamentals and application, Elsevier
4. B.P. Lathi, Modern Digital and Analog. Communication Systems, 3rd ed., Oxford. University Press, 1998.
5. J.G. Proakis and M. Salehi, Communication Systems Engineering, 2nd Edition.

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SYLLABUS OF B. Tech. (ECE)

Course Code : ECT-213 **LTP: 3-0-0 per week**	**Course : Microprocessors** **Credits: 03**

Syllabus:

Introduction to 8085 Microprocessor: Block diagram, pins & their description, demultiplexing of buses, control signals & flags. Introduction to 8085 based microcomputer system.
Instruction & Timings: Instruction classification, instruction formats, addressing modes, Instruction timings and status.
Programming & Programming Techniques of the 8085: 8085 instruction set, data transfer instructions, arithmetic, logic & branch operations. Rotate & compare. Instructions related to stack operations. Looping, counting and indexing, counters & time delays.
Stack and Subroutines: Concept of stack in 8085 and its uses. Subroutines implementation in 8085 assembly language.
Interfacing Concepts: Basic interfacing concepts. Memory Interfacing. Memory mapped and peripheral mapped I/O. Interrupts in 8085 and their features. A/D and D/A converters. Interfacing A/D and D/A converters.
Programming & interfacing of Support ICs: Interfacing of 8155, 8255, 8279 with 8085.
Introduction to other support chips: Introduction of 8253 and 8259A with 8085 microprocessor. Direct memory Access: Basic concepts of DMA techniques and introduction DMA controller 8257.

Course Outcomes:

ECT213:CO1	Is able to grasp the functioning of 8085 microprocessor.
ECT213:CO2	Is able to appreciate the significance of demultiplexing for different application.
ECT213:CO3	Is able to understand the development of codes with different data transfer methods.
ECT213:CO4	Is able to understand the concept of memory mapping and I/O mapping.
ECT213:CO5	Is able to understand the different interfacing ICs as 8255/8257/8259.
ECT213:CO6	Design algorithm and writing the codes for different arithmetic, logical and control units.

References:

1. J.L. Antonakos, An Introduction to the Intel Family of Microprocessors, Pearson, 1999.
2. Barry B. Brey, The Intel Microprocessors, (7/e), Eastern Economy Edition , 2006.
3. M.A. Mazidi & J.C. Mazidi Microcontroller and Embedded systems using Assembly & C. (2/e), Pearson Education,

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SYLLABUS OF B. Tech. (ECE)

Course Code : ECT-214 **LTP: 3-0-0 per week**	**Course : ELECTRO-MAGNETIC FIELD THEORY (EMFT)** **Credits: 03**

Syllabus:

Unit I Introduction: Vector Relation in rectangular, cylindrical and spherical coordinate system. Concept and physical interpretation of gradient, Divergence and curl. Green's and Stokes theorems.

Unit II Steady Electric Field: Coulomb's Law, units, Electric field intensity, Relation between E and V, Electric flux and flux density, Gauss law, Boundary conditions: Dielectric-dielectric, Conductor – dielectric, Conductor-free space, scalar and vector potential, electric field in dielectric and conductor, Laplace and Poisson's equations, continuity equation, uniqueness theorem, energy stored in electric fields, equivalence theorem, method of image and numerical solution, energy storage and their applications

Unit III Magnetic field due to steady currents, force between current carrying wires, Ampere's circuit law, Bio-Savart's Law, Magnetic flux density, Stokes theorem, Magnetic static and Vector potential, magnetization vector and its relation to magnetic field, Magnetic boundary condition. Analogy between electric and magnetic fields

Unit IV Time Varying Fields, Faraday's law, Displacement currents and equation of continuity, their physical interpretation, Maxwell's equations, integral & differential form of Maxwell's equation, Time varying fields.

Unit V Uniform plane wave in free space, dielectrics and conductors, skin effect sinusoidal time variations, reflection of UPW, standing wave ratio. Potentials vector and power considerations.

Course Outcomes:

At the end of this course, students will be able to:

CO1 Apply vector calculus to static electro-magnetic fields in different engineering situation.
CO2 Describe static and dynamic electric and magnetic fields.
CO3 Use boundary conditions for electric and magnetic fields.
CO4 Understand Maxwell equations in different form and apply them to diverse engineering problems.
CO5 Analyze the behaviour of plane waves in different media.
CO6 Examine the phenomenon of wave propagation and reflection in different media.

References:

1. Elements of Electromagnetics- Matthew N.O. Sadiku, Oxford University Press.
2. Electromagnetics- J.D. Kraus,Tata McGraw Hill
3. Electromagnetic Waves & Radiating Systems- E.C. Jordan & K.G. Balmain, Prentice Hall.
4. Fields and Wave Electromagnetics- David K. Cheng, Pearson.
5. Engineering Electromagnetics-W. H. Haytt, Tata McGraw Hill

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SYLLABUS OF B. Tech. (ECE)

Course Code : ECT-215 **LTP: 3-0-0 per week**	**Course : Operating Systems** **Credits: 03**

Syllabus (contents will be elaborated in lecture schedule) -

Introduction: H/W, S/W and Firmware, Process concepts, operations on processes, suspend and resume, interrupt.

Deadlock and Indefinite Postponement:- Conditions of deadlock, deadlock prevention and avoidance, deadlock detection and deadlock recovery.

Storage management:- Storage management & hierarchy, various strategies, storage allocation, Fixed and variable partitioning, Virtual storage concepts, Block mapping, Paging, Segmentation, Virtual storage management, Page replacement strategies, locality, Demand Paging, Program behaviour.

Processor Management:- Job and Processor scheduling, Preemptive and Non-preemptive scheduling, FIFO, RR, SJF, SRT, HRN, etc scheduling techniques.

Auxiliary Storage Management:- Seek optimization, systems considerations, RAM disks, optical disks, File system, blocking & buffering, File organization, backup and recovery, CD-ROMs, Worm, database OS Security:- security requirements, external, password, security kernels, Fault-tolerant systems, cryptography, OS penetration, Worms & Viruses.

Case Studies:- UNIX systems, MS-DOS systems and Windows Architecture.

Course Outcomes:

CO1:To understand the objectives , structures and functions of modern operating systems To understand the working of processes and threads and their scheduling algorithms

CO2:To understand the problems of synchronization and deadlock in OS and its various solutions To understand the memory and storage handling/allocation methods

CO3:To understand files, its structures, implementation and protection issues

CO4:To analyze the problems related to OS and suggest viable solutions (analytically and design issues)

References:

1. Operating system concept--Silberschatz and Galvin- John wiley Operating system - Stalling by phi /pearsoned
2. Operating system -Tannenbaum by phi /pearsoned
3. An introduction to Operating Systems - H.M. Deitel ,Addison-Wesley Operating system - Godbole (TMH)
4. Operating system- Damdhare (TMH)

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SYLLABUS OF B. Tech. (ECE)

Course Code : ECT-216 **LTP: 3-0-0 per week**	**Course : Measurements and Instrumentation** **Credits: 03**

Syllabus:

Measurements: Errors & classification.

Analog Ammeters and Voltmeters: PMMC and MI Instruments, Construction, Torque Equation, Range Extension, Effect of temperature,

Analog Wattmeters and Power Factor Meters: Electrodynamometer type wattmeter, power factor meter, Construction, torque equation, active and reactive power measurement in single phase and in three phase.

Analog Energy Meter: Single phase induction type energy meters, construction, Operation, lag adjustments, Max Demand meters/indicators, Measurement of VAH and VARh.

DC and AC Bridges: Measurement of resistance (Wheatstone Bridge, Kelvin's Bridge, Kelvin's Double Bridge), Measurement of inductance, Capacitance (Maxwell's Bridge, Desauty Bridge, Anderson Bridge, Schering Bridge, Wien Bridge).

Instrument Transformers: Current Transformer and Potential Transformer - construction, operation, phasor diagram, errors, testing and applications.

Transducers: Measurement of Temperature, RTD, Thermistors, LVDT, Strain Gauge, Piezoelectric Transducers, Tachometer.

Electronic Instruments: Electronic Display Device, Digital Voltmeters, CRO, measurement of voltage and frequency, Wave Analyzers, Harmonic Distortion Analyzer.

Course Outcomes:

CO1: To understand the working principle of different measuring instruments.
CO2: Analyse the MC, MI and Dynamometer types of measuring instruments, Watt-meters and Energy-meters
CO3: Determine the values of components of circuits using AC and DC bridges
CO4: To know about transformers and transducers for the measurement of temperature, strain and speed

References:

1. J. B. Gupta: A course in Electrical and Electronic Measurements and Instrumentation, 13/E, Kataria and Sons, 2009.
2. U. A. Bakshi, A. V. Bakshi: Electrical Measurements and Instrumentation, Technical Publications, 2009.
3. A. K. Sawhney: A course in Electrical Measurements Electronic Measurements Instrumentation, Edition 11, Dhanpat Rai and Sons, 1996.
4. W.D. Coopers and Helfrick, Modern Electronic instrumentation and Measurements Techniques, Prentice Hall of India Pvt. Ltd, 2002.
5. E.W. Gowlding and F.C.Widdis, Electrical Measurements and Measuring Instruments 5/e, Wheeler Publications 1998.

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SYLLABUS OF B. Tech. (ECE)

Course Code : ECT-301 **LTP: 3-0-0 per week**	**Course : MICROWAVE ENGINEERING** **Credits: 03**

Syllabus:

Unit I Introduction of Microwave Electromagnetic spectrum. Microwave signal propagation, Applications of Microwave and Microwave hazards. Transmission line, smith chart

Unit II Review of Maxwell's equation, Rectangular waveguides, characteristics of TE and TM wave in rectangular wave guides, Dominant mode in rectangular waveguide, Introduction to Cylindrical waveguides, waveguide excitation.

Unit III Microwave resonator, Microwave Network representations. Scattering matrix. S-Matrix for two, three & four port networks such as E-plane tee, H-plane tee, Magic tee, directional coupler and other microwave components.

Unit IV Transit time effect, Tubes for very high frequency limitation of conventional tubes, Reflex klystron, two cavity klystron, Magnetron, Travelling Wave Tube.

Unit V Measurement of VSWR, impedance, frequency, dielectric constant power, attenuation and phase shift.

Course Outcomes:

After the completion of this course students will be able to:

CO1. Evaluate various parameters of transmission lines

CO2. Analyze modes and dominant mode in rectangular waveguide and cylindrical waveguide.

CO3. Explain and evaluate performance of multiport microwave networks

CO4. Design isolator, basic microwave amplifiers, particularly klystrons, magnetron, basic RF oscillator and mixer models.

CO5. Compute the measurement parameters such as VSWR, impedance, frequency, dielectric constant power, attenuation and phase shift etc related to microwave circuits

References:

1. Introduction to Microwaves -Wheeler G.J., Prentice-Hall
2. Microwave circuits & passive devices- Sisodia and Raghuvanshi, New Age International.
3. Microwave engineering-David M. Pozar, John Wiley & Sons, Inc.
4. Microwave Devices and Circuits- Samuel Y. Liao, Prentice Hall
5. Microwave and Radar Engineering- Kulkarni, McGraw Hill Education

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SYLLABUS OF B. Tech. (ECE)

Course Code : ECT-302 **LTP: 3-0-0 per week**	**Course : Digital Signal Processing** **Credits: 03**

Syllabus:

Z-Transform, Inverse Z-Transform, Properties of the Z-Transform, Inversion of the Z-Transforms (by Power Series Expansion, by Partial-Fraction Expansion), Analysis of Linear Time-Invariant Systems in the z-Domain, Response of Systems with rational System Functions, Transient and Steady-State Responses, Causality and Stability.

Frequency-Domain Sampling and Reconstruction of Discrete-Time Signals, The Discrete Fourier Transform, The DFT as a Linear Transformation, Relationship of the DFT to other Transforms, Properties of the DFT: Periodicity, Linearity, and Symmetry Properties, Multiplication of Two DFTs and Circular Convolution, Additional DFT Properties, Linear Filtering Based on DFT.

FFT Algorithms, Direct Computation of the DFT, Radix-2 FFT Algorithms: Decimation-In-Time (DIT), Decimation-In-Time (DIF); Applications of FFT Algorithms: Use of the FFT Algorithm in Linear Filtering and Correlation.

Structure for the Realization of Discrete-Time Systems, Structure for FIR Systems: Direct-Form Structure, Cascade-Form Structures, Structure for IIR Systems: Direct-Form Structures, Signal Flow Graphs and Transposed Structures, Cascade-Form Structures, Parallel-Form Structures.

Design of FIR Filters, Symmetric and Antisymmetric FIR Filters, Design of Linear-Phase FIR Filters by using Windows, Design of Linear-Phase FIR Filters by the Frequency-Sampling Method; Design of IIR Filters from Analog Filters: IIR Filter Design by Impulse Invariance, IIR Filter Design by the Bilinear Transformation

Course Outcomes:

CO1	The basic objective of the course is to introduce and familiarize some important & useful signal processing techniques such as convolution, Fourier & Z-transform, filter design, structures for FIR and IIR systems
CO2	Students will develop programming skills for implementing signal processing algorithms using MATLAB.
CO3	Students will be introduced some mathematical tools of transforms, matrix theory for analysis and design of signal processing algorithms.

References:

1.Digital Signal Processing – Principles, Algorithms and Applications by J. G. Proakis and D. G. Manolakis, 4th Edition, Pearson.
2. Digital Signal Processing by A. V. Oppenheim and R. W. Schafer, PHI.
3. Principles of Signal Processing and Linear Systems by B.P. Lathi, Oxford.
4. Digital Signal Processing: A MATLAB-Based Approach by Vinay K. Ingle and John G. Proakis, Cengage Learning.
5. Fundamentals of Digital Signal Processing using MATLAB by Robert J. Schilling and Sandra L. Harris, Cengage Learning.

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SYLLABUS OF B. Tech. (ECE)

Course Code : ECT-303 **LTP: 3-0-0 per week**	**Course : Digital Communication Systems** **Credits: 03**

Syllabus:

Line Codes: On-Off (RZ), Polar (RZ), Bipolar (RZ), on-off (NRZ),-Polar (NRZ) & their Power spectrum density (PSD), HDB coding, B8ZS signaling.

Baseband Pulse transmission: Inter-symbol Interference (ISI) & its Reduction. Techniques, Nyquist criterion for distortionless baseband binary transmission, correlative coding, eye pattern.

Digital Passband transmission: BPSK, BFSK, QPSK, QAM, MSK and M-ary, PSK, M-ary FSK transmitter and receiving systems and their detection , Probability of error, Power spectra, Matched filter. Introduction to Link Budget Analysis.

Spread spectrum Techniques: Spread Spectrum Overview, PN Sequences, DS-spread spectrum & Frequency- hop spread spectrum systems and their analysis, Introduction to W-CDMA and multiuser detection.

Course Outcomes:

Co1- Understanding of different types of modulation and demodulation techniques for digital communication

Co2- To learn the ISI and equalization techniques.

Co3-To analyse different types of channel coding schemes.

Co4-Understanding the performance of different digital communication systems

References:

1) Modern Digital & Analog Comm. systems 3/e B.P. Lathi; Oxford
2) Principles of Comm. Systems., Taub & Schilling, McGraw Hill publications.
3) Digital Comm.- By Proakis (TATA McGraw Hill) publications.
4) Digital Comm.-By Sklar (Pearson Education)
5) Comm. System 3/e Simon Haykin, Wiley Eastern Ltd.

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SYLLABUS OF B. Tech. (ECE)

Course Code : ECT-304 **LTP: 3-0-1 per week**	**Course : Digital CMOS ICs** **Credits: 04**

Syllabus:

Introduction to MOSFETs technology: Construction and working of MOSFET, Current-Voltage Characteristics, Performance metrics for digital design, Scaling of MOSFETs, Fabrication flow of CMOS n-well process. [05h].
CMOS Inverter: Design , analysis of NMOS inverter (resistive, enhancement and depletion load) , CMOS inverters; transfer characteristics, Noise margins, , rationing of transistor size, logic voltage levels, rise and fall of delays, Propagation Delay, Power Consumption. [8h].
Combinational Circuits: Design of basic gates in NMOS technology; CMOS logic design styles: static CMOS logic (NAND, NOR gates), complex gates, Pass Transistor logic, Transmission gate, Dynamic MOS design: pseudo NMOS logic, clocked CMOS (C2 MOS) logic, domino logic, NORA, Half and Full adder), Multiplexer, XOR, XNOR [10h].
Logical Effort: Logical effort of different digital circuit design: Input capacitance, Logical and Electrical effort, parasitic delay, Single stage and Multistage with and without branch network. Design of minimum delay and optimization of best stages. [6h]
Layout and stick diagram: Layout design rules: Lambda and micron based design rules- stick diagram, Layer properties of various conducting layers in MOS and CMOS technology (diffusion, poly-silicon and metal), Layout design of different CMOS circuit, area estimation. [6h]
Sequential and Memory Design: Sequential MOS Logic and Memory Design: Static latches; Flip flops & Register. [5h]
Project: Introduction of open source tools: EDA. The class project is to design reasonably complex CMOS circuit. The project will be performed as a team of three or four students.

Course Outcomes:

CO1- Understand the advancement of CMOS devices and circuits

CO2- Design CMOS circuits with specified noise margin and propagation delay.

CO3- Implement efficient techniques at circuit level for improving power and speed of combinational and sequential circuits.

CO4- Design and optimization of layout for Digital ICs.

CO5-Design and analysis of efficient memory architectures

References:

1. Sung-Mo Kang & Yusuf Leblebici, CMOS Digital Integrated Circuits Analysis and Design, Second Edition, McGraw-Hill, 1999.
2. Rabaey, Chandrakasan and Milokic. Digital system design- A design perspective. Pearson education, India. 3.Neil H.E.Weste and Kamran Eshraghian, Principles of CMOS VLSI Design, A System Perspective, Pearson Education, India. 4. Ken Martin, Digital Integrated Circuits, Oxford Press

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Curriculum structure of B.Tech ECE Programme

(Department of Electronics & Communication Engineering)

SYLLABUS OF B. Tech. (ECE)

Course Code : ECT-305 **LTP: 3-0-2 per week**	**Course : Optical Communication Systems** **Credits: 04**

Syllabus:

Fundamentals of fiber optics: Ray propagation, waveguiding in optical fibers, step index and graded index fibers, Modes in optical fiber, mono mode & multimode fibers, fiber fabrication, dispersion relations. Signal degradation: Dispersion, attenuation & scattering in fibers, link analysis.

Fiber Measurement: Measurement of fiber attenuation, bandwidth, power, & cut-off wavelength, OTDR.

Opto electronic devices:- Light source materials, LEDs, Lasers, Photo-diodes, PIN diodes etc. Modulation capability. Photodetectors, PIN photodiode and Avalanche photodiodes,

Power launching and coupling: Fiber joints, cables and connectors, fiber splices, optical coupler and optical measurements.

Analog and Digital optical transmission systems: Link Analysis, system design considerations for point-topoint links, noise sources in optical communication, system architecture. WDM, Coherent optical systems. Methods of modulation, Heterodyne and Homodyne systems, Noise in coherent systems, Multichannel coherent systems, Optical amplifiers, Introduction to lightwave networks

Course Outcomes:

At the end of the course the student will be able to:

CO1: Distinguish Step Index, Graded index fibers and compute mode volume.

CO2: Explain the Transmission Characteristics of fiber and Manufacturing techniques of fiber/cable.

CO3: Classify the construction and characteristics of optical sources and detectors.

CO4: Discuss splicing techniques, passive optical components and explain noise in optical system.

CO5: Design short haul and long haul Analog/ Digital optical communication system and explain advanced optical transmission systems.

References:

1. Fiber Optics and Optoelectronics – R.P. Khare
2. Optical Communication-VK Jain, Franz
3. Optical Communication - Keiser
4. Optical fiber communication - J.M. Senior

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Curriculum structure of B.Tech ECE Programme

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SYLLABUS OF B. Tech. (ECE)

Course Code : ECT-306 **LTP: 3-0-0 per week**	**Course : VLSI Testing &Testability** **Credits: 03**

Syllabus:

Introduction to Digital Testing: Introduction, Test process and Test economics,- Functional vs. Structural Testing Defects, Errors, Faults and Fault Modeling (Stuck at Faults, Bridging Faults, transitor fault, delay fault), Fault Equivalence, Fault Dominance, Fault Collapsing and Checkpoint Theorem

Fault Simulation and Testability Measures: Circuit Modelling and Algorithms for Fault Simulation, Serial Fault Simulation, Parallel Fault Simulation, Deductive Fault Simulation, Concurrent Fault Simulation, Combinational SCOAP Measures and Sequential SCOAP Measures, Critical Path Tracing

C**ombinational Circuit Test Pattern Generation:** Introduction to Automatic Test Pattern Generation (ATPG) and ATPG Algebras, Standard ATPG Algorithms, D-Calculus and D-Algorithm, Basics of PODEM Random, Deterministic and Weighted Random Test Pattern Generation; Aliasing and its effect on Fault Coverage.

PLA Testing, Cross Point Fault Model and Test Generation. Memory Testing- Permanent, Intermittent and Pattern Sensitive Faults

Sequential Circuit Testing and Scan Chains: ATPG for Single-Clock Synchronous Circuits, Use of Nine-Valued Logic and Time-Frame Expansion Methods, Complexity of Sequential ATPG, Scan Chain based Sequential Circuit Testing, Scan Cell Design, Design variations of Scan Chains, Sequential Testing based on Scan Chains, Overheads of Scan Design, Partial-Scan Design Controllability and Observability Scan Design, BILBO , Boundary Scan for Board Level Testing ; BIST and Totally self checking circuits

Self Repairing circuits and BIST: Introduction to BIST architecture BIST Test Pattern Generation, Response Compaction and Response Analysis, Memory BIST, March Test, BIST with MISR, Neighbourhood Pattern Sensitive Fault Test, Transparent Memory BIST, Totally self checking circuits, Concept of Redundancy, Spatial Redundancy, Time Redundancy, Error Correction Codes. Recent trends in VLSI Testing and Testability

Course Outcomes: At the end of the course the student will be able to:

CO1 To able to grasp core concept of digital system testing and testability. (Knowledge)
CO2 To understand how a faulty circuit may cause disasters and affect the nature as well as society. (Attitude & Value)
CO3 To understand fault detection using different fault simulation techniques. (Skill)
CO4 To develop ability to design algorithms for automatic test generation for combinational circuits, sequential circuits, PLAs and memory. (Skill)
CO5 To apply probabilistic approaches for random test generation. (Skill)
CO6 To apply different redundancy based fault tolerance techniques to increase circuit reliability. (Skill)
CO7 To design BIST for a CUT in Verilog and implement ATPG algorithms in C/C++/MATLAB. (Skill)

References:

1. Abramovici, M., Breuer, M. A. and Friedman, A. D. Digital systems testing and testable design. IEEE press (Indian edition available through Jayco Publishing house), 2001.
2. Bushnell and Agarwal, V. D. VLSI Testing. Kluwer.
3. Agarwal, V. D. and Seth, S. C. Test generation for VLSI chips. IEEE computer society press.
4. Hurst, S. L. VLSI testing: Digital and mixed analog/digital techniques. INSPEC/IEE, 1999
5. https://nptel.ac.in/courses/106103116/handout/mod7.pdf
6. http://ece-research.unm.edu/jimp/vlsi_test/slides/html/overview1.htm, http://www.cs.uoi.gr/~tsiatouh/Courses/CCD/Section_8_1-2p.pdf, Latest

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Curriculum structure of B.Tech ECE Programme

(Department of Electronics & Communication Engineering)

SYLLABUS OF B. Tech. (ECE)

Course Code : ECT-311 **LTP: 3-0-2 per week**	**Course : Antenna & Wave Propagation** **Credits: 04**

Syllabus:

Antennas: Antenna fundamentals and definitions, Effective length, Effective aperture, gains, bandwidth, beamwidth, radiation resistance, input impedance, Polarization, Pattern, reciprocity Theorem.

Antenna Arrays: Collinear, broadside, endfire and Binomial, Dolph-Tschebyscheff arrays. Multiplication of Patterns.

UHF & Microwave Antennas: Parabolic reflector, Horn, Lens antennas, Yagi, Log-periodic, Helical Antennas, Square & Circular loop antennas.

Microstrip antennas: Rectangular Patch, Circular Patch antennas & their analysis (End results only) Arrays & feed networks.

Radio Wave Propagation: Theory of Ground wave, Space wave & Sky wave Propagation, Various ionospheric Layers. Effect of ground constants on wave propagation, Duct Propagation, Tropospheric scattering, Critical frequency, Skip zone, MUF in sky wave propagation, Effect of Earth's, Magnetic field Atmospheric Conditions, Solar activity.

Radio wave Propagation in Mobile Environments: Free space, Ground Reflection models, Knife-edge diffraction model & Okumura models; Indoor propagation models.

Course Outcomes:

CO1	Identify the different characteristics of antennas.
CO2	Decide which type of antenna is required for particular application.
CO3	Analyze and synthesize single and array antennas.
CO4	Gain knowledge of some important practical antennas used frequently.
CO5	Apply the knowledge gained to practical applications.
CO6	Understand the atmospheric effect of radio wave propagation
CO7	Understand the propagation mechanism and effect of various terrestrial and cosmic factors.
CO8	Familiarizing students with the measurement of various parameters of antennas.
CO9	Practical understanding of various factors such as reflections, environment changes, effect of moving objects

References:

1. Antennas Theory & Practice- By Balani
2. Antennas & wave Propagation - By K.D. Prasad
3. Wireless Communications: Principles & Practice - By Theodore S. Rappaport

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Curriculum structure of B.Tech ECE Programme

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SYLLABUS OF B. Tech. (ECE)

Course Code : ECT-312 **LTP: 3-0-0 per week**	**Course : Computer Architecture** **Credits: 03**

Syllabus:

Syllabus (contents will be elaborated in lecture schedule) -

Single processor- basics of microprocessors,CPU control unit, Register Transfer and Micro-operations, assembler and Instruction set pipeline architecture. 16-bit, 32-bit /64-bit RISC and CISC processors ISA and assembly programming.

Memory organization- memory hierarchy, main memory, associative memory, cache memory, virtual memory, memory management .

Input-output organization- peripheral devices . Bus interface. Data transfer techniques. Direct memory access. I/O interrupts.

Multiprocessors- characteristics of microprocessors. Interconnection structures. Interprocessor arbitration. Digital computer arithmetic- fixed point addition,subtraction, multiplication and division. Decimal arithmetic. Floating point arithmetic.

Course Outcomes:

At the end of the course the student will be able to:
CO1:To understand the working of basic processor
CO2:To describe the 16,32,64-bit processors ISA (CISC and RISC)
CO3:To understand the memory and its management in computer system
CO4:To understand I/O interface and multiprocessor interconnect and other issues
CO5:To learn the arithmetic(fixed and floating point) algorithms and equivalent circuits
CO6:To write assembly programmes and design memory and arithmetic ckts. (analytically and design issues)

References:

1. Computer System Architecture-M. Morris Mano (PHI)
2. Computer Architecture- A quantitative approach (ARM ed) -Hennessy , Patterson (PHI) Computer Organization -V. Carl. Hamacher (TMH)
3. Computer Organization and Architecture -John P Hayes (McGraw -Hill) Computer Organization and Architecture – William Stallings (Pearson)
4. Computer System Organization-A. S. Tanenbaum (PHI).

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SYLLABUS OF B. Tech. (ECE)

Course Code : ECT-313 **LTP: 3-0-0 per week**	**Course : : Wireless and Mobile Communication** **Credits: 03**

Syllabus:

Cellular System Design Fundamentals: Components of Mobile Cellular Systems, Frequency Reuse Concepts, Cell design, Co channel Interference, Channel Assignment Strategies, Handoff strategies, Network Control, System operation, Call origination & Termination, Interference & System Capacity, Improving Capacity in cellular systems, **Small Scale Fading & Multipath Propagation:** Impulse response model of a multipath channel, Doppler shift, Multipath measurements, Parameters of mobile multipath channels, Types of small-scale fading,

Multiple Access Techniques for Wireless Communication- FDMA, TDMA, SDMA, CDMA, Diversity Techniques.

Course Outcomes:

At the end of the course the student will be able to:

CO1:Appreciate and familiarize the world of mobile communications.

CO2:Develop requisite mathematical background for mobile systems using teletraffic theory, probability theory and stochastic processes as well as linear algebra.

CO3:Design parts of mobile communication system using mathematical models.

CO4:Develop proficiency in the subject by working on individual term papers and presenting their study to the entire class (Presentation Sessions).

References:

1. Wireless Communications: Principles & Practices by Theodore S. Rapport.
2. Mobile Cellular Telecomm. B y William C. Y. Lee.
3. Mobile Communication by Schiller, (Pearson Education India.)

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SYLLABUS OF B. Tech. (ECE)

Course Code : ECT-314 **LTP: 3-0-0 per week**	**Course : Control Systems Engineering** **Credits: 03**

Syllabus:

Concept of open loop and closed loop control systems. Examples and applications of open loop and closed loop systems.

Representation of physical system (Electro-Mechanical) by differential equations. Determination of transfer function by block diagram reduction technique and signal flow graph method.

Time response analysis of first order and second order system: Transient response analysis, steady state error and error constants.

Absolute stability and relative stability. Routh's stability criterion, Root locus method of analysis.

Frequency domain method; Bode plot and Nyquist stability criterion.

Representation of state equations, Relationship between state equations and differential equations and transfer functions, solution of state equations, state transition matrix, state transition equation. Controllability and observability of control systems.

Course Outcomes:

At the end of the course the student will be able to:

CO1- Ability to analyze the operation and modeling of closed loop feedback systems

CO2- Ability to analyze and compensate the steady- state and transient response of the systems.

CO3- Ability to investigate the stability of control systems

CO4- Ability to analyze control system using state variable technique.

References:

1) I.J. Nagrath & M. Gopal : Control Systems Engineering, III Edition, NAI Pub.
2) Katshuhiko Ogata : Modern Control Engineering, III Edition, PHI.
3) Banjamin C. Kuo : Automatic Control Systems, VII Edition, PHI.

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SYLLABUS OF B. Tech. (ECE)

Course Code : ECT-315 **LTP: 3-0-0 per week**	**Course : Embedded Systems** **Credits: 03**

Syllabus:

Embedded computing- Microprocessors, embedded design process, system description formalisms. Instruction sets- CISC and RISC;

CPU fundamentals- programming I/Os, co-processors, supervisor mode, exceptions, memory management units and address translation, pipelining, super scalar execution, caching, CPU power consumption. Embedded computing platform- CPU bus, memory devices, I/O devices, interfacing, designing with microprocessors, debugging techniques.

Program design and analysis- models of program, assembly and linking, compilation techniques, analysis and optimization of execution time, energy, power and size.

Processes and operating systems- multiple tasks and multiple processes, context switching, scheduling policies, inter-process communication mechanisms.

Hardware accelerators- CPUs and accelerators, accelerator system design. Networks- distributed embedded architectures, networks for embedded systems, network-based design, Internet-enabled systems.

System design techniques- design methodologies, requirements analysis, system analysis and architecture design, quality assurance.

Course Outcomes: At the end of the course the student will be able to:

ECT315:CO1	Appreciate difference between embedded and other types of computing and their specific hardware requirements
ECT315:CO2	Identify and interface embedded platform components
ECT315:CO3	ARM family processor architectures and their specific uses.
ECT315:CO4	Program analysis and optimization
ECT315:CO5	Able to compile programs,, download and run them on hardware

References:

1. Wolf, W. Computers as components- Principles of embedded computing system design. Academic Press (Indian edition available from Harcourt India Pvt. Ltd., 27M Block market, Greater Kailash II, New Delhi-110 048.)

2. Vahid and T. Givargis. Embedded System Design: A Unified Hardware/Software Introduction , Wiley, 2002.

3. Furber, ARM System-on-Chip Architecture, Pearson

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SYLLABUS OF B. Tech. (ECE)

Course Code : ECT-316 **LTP: 3-0-0 per week**	**Course : Analog CMOS ICs** **Credits: 03**

Syllabus:

Physics of MOS Transistors: Review of current equation, regions of operation, small signal model.

Amplifiers: Common Source, Source follower, Common Gate and Cascode amplifiers, Biasing Techniques.

Current Mirror: Basic Current Mirrors, Cascode Current mirror.

Differential Amplifier: Basic differential Pair, common mode response, CMRR, Differential Pair with MOS load, Active load, Cascode differential amplifier.

Frequency Response of Amplifiers: Miller Effect, Association of Poles with nodes, Frequency Response of all single stage amplifiers.

Feedback: Topologies, Stability and Compensation.

Two Stage OpAmp

Course Outcomes:

At the end of the course the student will be able to:

CO1: Understand the operation of MOSFET and its small signal model. (Cognitive- Understanding)

CO2: Analyze and design amplifiers, current mirrors and differential amplifiers. (Skills- Analyze)

CO3: Understand the significance of different biasing techniques and apply them aptly to different circuits. (Cognitive- Understanding)

CO4: Comparatively evaluate the frequency response of different single stage amplifiers (Cognitive- Analyze)

CO5: Analyze & design the compensation method of amplifiers for stability.(Skills- Evaluate)

References:

1. Behzad Razavi, Fundamentals of Microelectronics, Second edition, Wiley, 2013,
2. Sedra and Smith, Microelectronics Circuits, Oxford Univ. Press, 2004, Johns and Martin, Analog Integrated Circuit Design, John Wiley & Sons, 2002 AND Allen Holberg, CMOS Analog Integrated Circuit Design: Oxford University Press, 2002.

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Curriculum structure of B.Tech ECE Programme

(Department of Electronics & Communication Engineering)

Electronics Engineering Lab-ECP102

(B.Tech. I and II semester)

List of Experiments

1. Study of various Electronic instruments such as Multimeter, DSO, Function Generator and Power Supply.
2. To observe sine, square and triangular waveforms on the DSO and to measure amplitude and frequency of the waveforms.
3. Familiarization of Electronics Components such as:- Resistor, Capacitor, Diode, Transistor, LED, Photodiode, Phototransistor, IC and also test them with the help of Multimeter.
4. To obtain V-I characteristics of PN junction diode.
5. To obtain V-I characteristics of Zener diode.
6. To observe waveform at the output of half wave rectifier with and without capacitor filter and also measure its DC voltage, DC current and ripple factor.
7. To observe waveform at the output of center tapped full wave rectifier with and without capacitor filter and also measure its DC voltage, DC current and ripple factor.
8. To observe waveform at the output of full wave bridge rectifier with and without capacitor filter and also measure its DC voltage, DC current and ripple factor.
9. To observe waveforms at the output of various clipper circuits.
10. To observe waveforms at the output of various positive and negative clamper circuits.

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Curriculum structure of B.Tech ECE Programme

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ECP201 - Electronics Devices and Circuits Lab

(B. Tech. III Semester)

List of Experiments

1. To study the Digital Storage Oscilloscope.

2. To observe and draw the Forward and Reverse bias V-I Characteristics of a P-N Junction diode.

3. Plot V-I characteristic of zener diode and study of zener diode as voltage regulator. Observe the effect of load changes and determine load limits of the voltage regulator.

4. Application of Diode as clipper & clamper.

5. Study half wave rectifier and effect of filters on wave. Also calculate theoretical & practical ripple factor, with Filter and without Filter

6. Study center tap rectifier and measure the effect of filter network on D.C. voltage output & ripple factor.

7. Study bridge rectifier and measure the effect of filter network on D.C. voltage output & ripple factor.

8. To study Wein Bridge Oscillator and observe the frequency effect of Variation in R and C.

9. Study of R.C. phase shift oscillator and observe the effect in R and C oscillator frequency and obtain theoretical and practical value.

10. Plot frequency response curve for single stage amplifier and to determine gain bandwidth product.

11. To draw the input and output characteristics of transistor connected in CE configuration and find h-parameters.

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ECP202- Switching Theory & Finite Automata (STFA) Lab

(B. Tech. III Semester)

List of Experiments

1. Study of the Digital trainer kit and multi-output power supply.
2. Verify the truth table of AND, OR, NOT, NAND, NOR gates.
3. To derive all basic logic gates using NAND/NOR gates only.
4. To verify the truth table of half-adder and full-adder circuits.
5. To design a 2-bit multiplier and implement it.
6. To design and implement a latch using two NOR gates and verify its truth table.
7. Verify the operation of S-R, D, J-K and T flip-flops.
8. To implement a synchronous up/down counter.
9. To realize the following shift registers using IC7474. (a) SISO (b) SIPO (c) PISO.
10. To realize (a) 4:1 Multiplexer using gates (b) 3-variable function using IC 74151(8:1 MUX).
11. Realize 1:8 Demultiplexer and 3:8 Decoder using IC74138.

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ECP204 - Data Structures Lab

(B. Tech. III Semester)

List of Experiments

Using C language, implement the following programs/ data structures:

1. To find the roots of a quadratic equation for all cases.
2. To find the largest of N integers.
3. To find the factorial of an integer using a) non-recursive b) recursive functions.
4. To calculate the value of nCr.
5. To find the sum and difference of two integers in a single function.
6. To generate first N terms of a Fibonacci series using
   (a) non-recursive (b) recursive functions.
7. To multiply two matrices using a function.
8. To find the transpose of a matrix.
9. To make a structure for students in a class and use it.
10. To implement the problem of Tower of Hanoi.
11. To implement Linear search using a) non-recursive b) recursive functions.
12. To implement Binary search using a) non-recursive b) recursive functions.
13. To implement following sorting algorithms using functions:
    a) Selection b) Insertion c) Bubble
14. To implement functions of a stack using array.
15. To implement Infix to Postfix conversion.
16. To implement functions of a queue using array. (Linear and circular)
17. To implement functions of Linear Linked list using arrays.
18. Implement linked list using Dynamic Memory Allocation
    (a) linear (b) circular (c) doubly (d) multiply-linked

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19. To implement quick sort.
20. To implement merge sort.
21. To implement the functions of a binary search tree.
22. To implement Heapsort.
23. To implement functions of string manipulation.
24. To implement the shortest path algorithm.

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ECP206 - Probabilistic Methods in Signals and Systems Lab

(B. Tech. III Semester)

List of Experiments

1. Introduction to MATLAB working environment and language fundamentals to create matrices and to do basic mathematical operations
2. Program to convert Celsius into Fahrenheit and vice versa
3. Program to calculate simple probability and express it in fraction
4. Plotting of sine, cos and exponential functions using their series expansions
5. Plotting of sine, cos using inbuilt functions on a single plot and using plot function properties to make changes to plot.
    a. To plot uniform pdf by: concatenation, using loop , using inbuilt function CRV X.
6. Generation of square waveform of different periods and duty cycles using inbuilt functions
7. To make a function for Fourier series of Square wave and using it to form and plot a square wave
8. To make a function for impulse signal and calling it to plot different shifted impulses.
9. To plot pdf of binomial distribution and calculate the probability of a binomially distributed random variable
10. To plot Gaussian pdf
    a. by mathematical formula
    b. by generating normally random numbers and plotting their histogram
11. Introduction to symbolic Math Toolbox: use of special functions for the purpose of performing mathematical operations such as, integration, differentiation, Fourier Transform and Laplace Transform

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ECP211 – Applied Electronics Lab

(B. Tech. IV Semester)

List of Experiments

1. Op-amp characteristics and get data for input bias current measure the output-offset voltage and reduce it to zero and calculate slew rate.

2. To design op-amp in (a) Inverting mode (b)Non-inverting mode

3. To design op-amp as (a) Scalar (b) Summer (c) Voltage follower.

4. To design op-amp as integrator.

5. To design op-amp as differentiator.

6. To Design low pass filter using op-amp 741 IC

7. To Design high pass filter using op-amp 741 IC

8. To Design oscillator using op-amp- Wein Bridge Oscillator

9. To Design oscillator using op-amp- RC phase shift oscillator

10. To Design astable multivibrators using 555 timer

11. To Design monostable multivibrators using 555 timer

12. To Design square wave generator using op-amp-741

13. To Design triangular wave generator using op-amp-741

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ECP213 – Microprocessors Lab

(B. Tech. IV Semester)

List of Experiments

1. A byte is stored in location 0x0100. Complement this byte and store the result in location 0x0101.
2. Two bytes are available in locations 0x0100 and 0x0101. Add them and store the result in 0x0102. Neglecting the carry generated.
3. Subtract using 2's complement 0x0100 (Subtrahend), 0x0101 (Minuend), Store result in location 0x0102, Neglect borrow.
4. Two 16 bit numbers are in locations 0x0100 and 0x0101 & 0x0102 and 0x0103. Add these 16 bit numbers and store the result in 0x0104-0x0105.
5. Evaluation of problem (4) using 16 bit instructions.
6. Two 8-bit packed BCD numbers are available in 0x0100 and 0x0101. Add them and store the result in 0x0102, Neglect carry.
7. Adding 3 consecutive bytes available in memory locations available in 0x0101, 0x0102, 0x0103. Neglect carry generated at each level and store the result in 0x0104.
8. A byte is available at location 0x0100. Separate out its nibbles and store them at locations 0x0101 and 0x0102.
9. Two nibbles are available at locations 0x0100 and 0x0101. Combine them to form a byte and store at location 0x0102.
10. Two bytes are available at location 0x0100 & 0x0101. Compare them for equality i.e. if they are equal than store the same value at 0x0102 else store 00 at 0x0102.
11. A byte is available at 0x0100. Check this byte for odd/even parity. If odd store 'OD' in 0x0101 else store 'EE' in 0x0101.
12. Multiplication by 2 using bit rotation. A byte is available at 0x0100. Multiply it by 2 and store the result generated in 0x0101. Neglect carry.
13. A group of N bytes are available from 0x0101 onwards. The no. of bytes in the group available in 0x0100. Add these bytes and store the result in 0x0200. Neglect carry generated.
14. Addition of N bytes starting from 0x0101 onwards. No. of bytes is available in 0x0100. Take carry into account. The result will be stored in 0x0200-0x0201.
15. Multiplication by repeated addition of two bytes is available in location 0x0100 and 0x0101. Multiply them and store the result in 0x0102-0x0103 (with minimum no. of addition).

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16. Multiplication of 16 bit number by a 8 bit number. Let 16 bit number located at 0x0100 and 0x0101. 8-bit no. is stored at 0x0102. Store result in 0x0103, 0x0104 and carry at 0x0105.
17. Divide two 8-bit numbers by repeated subtraction. Dividend at 0x0100 and divisor at 0x0101 and store the quotient at 0x0102 (rounding off).
18. A group of N bytes are available from 0x0101 onwards. The value of N is available in 0x0100. Move these bytes from 0x0201 onwards.
19. Numbers from 0x00 to 0x0F are present in 0x0100. Squares of numbers are available from 0x0200 onwards. Store the result in 0x0101.
20. Multiplication by partial products (0x0100–Multiplicand,0x0101- Multiplier, 0x0102-0x0103 – Product).
21. To print "Hello World" in screen.
22. Read a character from keyboard and display it on monitor.
23. Adding two one digit numbers. The result should also be of one digit.
24. Find the factorial of numbers (factorial max value can be 65535).
25. Conversion of a byte from Hexadecimal to BCD.

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ECP215 -Operating System Lab

(B. Tech. IV Semester)

List of Experiments

1. To learn the basic commands of Linux- part 1 - file creation, paths, sub-directory, move copy, delete, access rights etc.
2. Learn of editor nano.
3. Learning of editor vi.
4. To learn Windows/ MS-DOS basic commands- file creation, paths, sub-directory, move copy, delete, file attributes etc.
5. To learn Linux commands- part II
6. To learn process creation part-I using system cell fork()
7. To learn process creation part-II - execution of a (new) programme (process) using system cell exec()
8. To learn interprocess communication using pipe, shared memory and implementation of process synchronization algorithms
9. To learn process synchronization- using open MP/ IPC
10. To learn signal handling system calls in Linux
11. To learn concurrent programming in Linux using threads
12. To write solution of a classical synchronization problem using thread and semaphores

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Curriculum structure of B.Tech ECE Programme

(Department of Electronics & Communication Engineering)

ECT302 - Digital Signal Processing Lab

(B. Tech. V Semester)

List of Experiments

1. Write a program to find convolution of two vectors.
2. Write a program to find correlation of two vectors.
3. Write a program to find out circular convolution of two vectors.
4. Write a program to design FIR low pass filter.
5. Write a program to design FIR high pass filter.
6. Write a program to design FIR band pass filter.
7. Write a program to design FIR band stop filter.
8. Write a program to design IIR low pass filter.
9. Write a program to design IIR high pass filter.
10. Write a program to design IIR band pass filter.
11. Write a program to evaluate Discrete Fourier Transform (DFT) of a Signal.
12. Write a program to evaluate Inverse Discrete Fourier Transform (IDFT) of a Signal.
13. Writing a program to apply histogram equalization on an image to improve its brightness.
14. Write a program to compress an image using Discrete Wavelet transform and reconstruct the original image from the compressed image.

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Curriculum structure of B.Tech ECE Programme

(Department of Electronics & Communication Engineering)

ECP301 - Microwave Engineering Lab

(B. Tech. V Semester)

List of Experiments

1. To study about microwave bench components.
2. To measure frequency and wavelength of a rectangular waveguide's dominant mode by using frequency meter and slotted line
3. Familiarization with the Spectrum Analyzer.
   a. To learn the basic concept of frequency domain measurements.
   b. To learn and understand how to operate the Spectrum Analyzer.
   c. To understand the function of each block of the Spectrum Analyzer.
4. To measure an unknown impedance by using slotted line
5. To measure an unknown impedance by using a Smith Chart.
6. To measure isolation and coupling of E plane Tee, H plane tee and Hybrid Tee.
7. To measure isolation and insertion loss of Isolator, Circulator.
8. To plot the radiation pattern of the Horn antenna using a polar graph.
9. To measure VSWR using a Slotted Line Section.
10. To study the function of a Multi Hole Directional Coupler by measuring a) coupling factor, b) directivity & amplitude; c) isolation.
11. To study various characteristics of a Reflex Klystron.
12. To determine forward and backward attenuation offered by a ferrite wavelength Isolator.

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ECP303 - Digital Communication Systems Lab

(B. Tech. V Semester)

List of Experiments

1. Study of BPSK Modulation and Demodulation
2. Study of DPSK Modulation and Demodulation
3. Study of QPSK Modulation and Demodulation
4. Study of QAM Modulation and Demodulation
5. Study of ADPCM Modulation and Demodulation
6. Study of Square waveform synthesis
7. Study of Triangular waveform synthesis
8. Study of Saw-tooth waveform synthesis
9. Study of Amplitude-Modulated signal synthesis
10. Simulation of ASK Generation and Detection Scheme
11. Simulation of BPSK Generation and Detection Schemes
12. Simulation of FSK generation and detection scheme
13. Simulation of DPSK, QPSK Generation Schemes
14. Observation (simulation) of signal constellations of BPSK, QPSK and QAM
15. Simulation of linear block coding scheme
16. Simulation of error control using cyclic code
17. Simulation of Convolutional coding scheme
18. Communication link simulations

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ECT305 - Optical Communication Systems Lab

(B. Tech. V Semester)

List of Experiments

1. To Study of Optisystem and Optisystem component library.
2. To Design and study basic optical communication systems.
3. To study the length dependence of attenuation in the given optical fiber at different wavelengths.
4. To study indirect modulation technique with Mach-Zehnder modulator(MZM) using OptiSystem.
5. To observe variation in BER with respect to different sets of parameters in the OFC system.
6. To Optimize the length and power of an optical fiber for given system parameters.
7. To Calculation of minimum sensitivity of the optical receiver.
8. To study and Draw EDFA characteristic curves.
9. To Design optical NOT gate using MATLAB components.
10. To Design optical AND and NAND using MATLAB components.
11. To Design optical OR and NOR gate using MATLAB components.
12. To Design optical XOR and XNOR usingMATLAB components.

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Curriculum structure of B.Tech ECE Programme

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ECT304 - Digital CMOS IC Lab / CMOS IC Lab

(B. Tech. V Semester)

List of Experiments

1. I-V characterization of Long channel N-MOSFET & P-MOSFET for using SPICE simulation.
2. I-V characterization of Short Channel N-MOSFET & P-MOSFET using a SPICE simulation.
3. VTC analysis of CMOS Inverter for different W/L Ratio of NMOS and PMOS.
4. Transient analysis of CMOS Inverter for input signal of equal rise and fall time.
5. Noise Margin Analysis of different NMOS based Inverter circuits such as Diode Connected Load, Depletion Load, PMOS Load, etc.
6. Connect a 2 I/P NAND Gate to an identical NAND Gate such that the fan out is 1,2,5,10,50,100. Plot the propagation Delay.
7. Connect a set of 7 inverters in a closed loop in the form of a clock. Estimate the clock frequency. Determined experimentally change in clock frequency without load (i.e Cout/Cin), varying from 1, 20, 100.
8. Connect 3 I/P NAND gate a, b, c and connect to a capacitor such that fan out is 1. Find the rise time of NAND gate for the I/P=000;001;011.
9. To design layout of CMOS inverter and followed by simulation.
10. To design a layout of 2 input NOR gate and followed by simulation.
11. To design a layout of 3 input NAND gate and followed by simulation.

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ECT311 - Antenna and Wave Propagation Lab

(B. Tech. VI Semester)

List of Experiments

1. To study and plot the radiation pattern of λ/2 Dipole antenna in azimuth plan on log/linear scale on polar plot.
2. To study and plot the radiation pattern of folded Dipole antennas in azimuth plan on log/linear scale on polar plot.
3. To study and plot the radiation pattern of Yagi (4el) antenna in azimuth plan on log/linear scale on polar plot.
4. To study and plot the radiation pattern of the Square Loop antenna in azimuth plan on log/linear scale on polar plot.
5. To study and plot the radiation pattern of Helix antenna in azimuth plan on log/linear scale on polar plot.
6. To study and plot the radiation pattern of Micro Strip antenna in azimuth plan on log/linear scale on polar plot.
7. To study and plot the radiation pattern of Log Periodic antenna in azimuth plan on log/linear scale on polar plot.
8. To study and plot the radiation pattern of the End Fire antenna in azimuth plans on Log/linear scale on polar plot.
9. To study and plot the radiation pattern of Broadside antenna in azimuth plans on Log/linear scale on polar plot.
10. To study resonant and non-resonant antenna and calculate the resonant frequency and estimate the VSWR of the antenna.
11. Familiarization with basic operation of Vector Network Analyzer (VNA) and Use the VNA to measure the complete S parameters of the components under test

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ECP316 - Analog CMOS IC Lab

(B. Tech. VI Semester)

List of Experiments

1. To find 3dB frequency & gain for different values of load & W/L ratio in case of common source stage with resistive load using N-MOSFET.
2. To find 3 dB frequency & gain for different values of load & W/L ratio for common source stage with resistive load using P-MOSFET.
3. Simulation & analysis of diode connected load common source amplifier. Find edge of triode region & gm1, gm2, gain & 3 dB frequencies.
4. DC analysis of source follower using resistive & current source load.
5. AC analysis of common gate amplifiers and calculate input and output impedance.
6. AC analysis of cascade stage amplifier.
7. AC analysis differential amplifier & calculate CMRR.
8. Simulation of basic current mirrors using resistive load using N-MOSFET and P MOSFET.
9. Simulation of cascade current mirrors using resistive load using N-MOSFET and N-MOSFET and P-MOSFET.
10. Simulation of Wilson Current mirror circuit.
11. Mini project

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ECP317 - Embedded Systems Design Lab

(B. Tech. VI Semester)

List of Experiments

1. Write a C or Assembly program to interface 7 segments with 8051/ARM to display 0-9 and 0-99 on Universal embedded system Board.
2. Write a C or Assembly program to interface 16*2 Char LCD module with 8051/ARM on Universal embedded system Board.
3. Write a C or Assembly program to interface ADC 0809 IC with 8051/ARM and Read Value on LCD on Universal embedded system Board.
4. Write a C or Assembly program to interface DAC 0808 IC with 8051/ARM and Sine and triangular Wave on Universal embedded system Board.
5. Write a C or Assembly program to interface a DC motor with 8051/ARM and Control the RPM using PWM on Universal embedded system Board.
6. Write a C or Assembly program to interface Stepper Motor with 8051/ARM and study the angle of rotation on Universal embedded system Board.
7. Write a C or Assembly program to interface Serial Communication with 8051/ARM and Read the Value of ADC on PC.
8. Write a C or Assembly program to interface RTC with 8051/ARM and Read the Time on LCD and serial monitor on PC.
9. Write a C or Assembly program to interface Relay Buzzer with 8051/ARM and control and per instruction.
10. Write a C or Assembly program to interface HEX KEYPAD with 8051/ARM and Read the Values on LCD and serial monitor on PC.
11. Write a C or Assembly program to interface external EEPROM with 8051/ARM and store the values of ADC.

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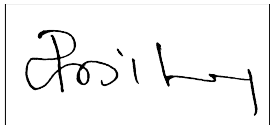
ECD483 - System Design Laboratory 1

(B. Tech. VII Semester)

List of Experiments

1. To learn Hardware Descriptive Language (Verilog/VHDL) and Xilinx Vivado Introduction.
2. To design different Logic gates using VHDL Programming Language and upload bit file to FPGA and verify.
3. To Design Decoder Using three different types of VHDL programming.
4. To Design different flip-flops using VHDL Programming Language and upload bit file to FPGA and verify.
5. To Design shift register (PIPO) parallel in parallel Out using VHDL Programming Language and upload bit file to FPGA and verify.
6. To Design an ALU using VHDL Programming Language and upload bit file to FPGA and verify.
7. To design N bit adder using VHDL Programming Language and upload bit file to FPGA and verify.
8. To Implement BCD to 7 segments Decoder using VHDL Programming Language and upload bit file to FPGA and verify.
9. To design an up counter using VHDL Programming Language and upload bit file to FPGA and verify.
10. To design a Multiplexer and Demultiplexer using VHDL Programming Language and upload bit file to FPGA and verify.



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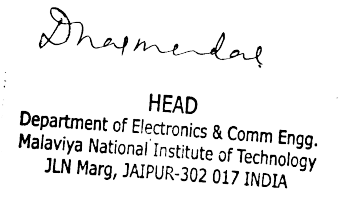

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Curriculum structure of B.Tech ECE Programme

(Department of Electronics & Communication Engineering)

ECD482 - System Design Laboratory 2

(B. Tech. VIII Semester)

List of Experiments

1. To study Basics of RTOS and Introduction to the Wind River VxWorks 6.9 software system.
2. To demonstrate how to time a single subroutine using the VxWorks timex () routine.
3. To teach the student how to initiate multiple processes using VxWorks tasking routines.
4. To demonstrate the use of VxWorks semaphores and perform the objective given.
5. To demonstrate the use of VxWorks message queues and perform the objective given.
6. To demonstrate the use of VxWorks Round-robin Based Scheduling and perform the objective given.
7. To demonstrate the use of VxWorks preemptive priorities-based task scheduling facilities and perform the objective given.
8. To demonstrate VxWorks' priority inversion avoidance mechanisms and perform the objective given.
9. To demonstrate VxWorks' implementation of POSIX signal routines and perform the objective given.
10. To demonstrate VxWorks' implementation of interrupt service routines and perform the objective given.

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Programme Elective and Advanced Elective course (Syllabus)

Program: B.Tech/M. Tech.	Department: Electronics & Communication Engineering
Course Code: ECT634	Course Name: Micro& Nano Electro Mechanical System (MEMS & NEMS)
Credit: 3	L-T-P: 3-0-0
Pre-requisite Course:	
Objective:	
COURSE DURATION: 12/13/14 weeks excluding examinations	

COURSE ASSESSMENT

The Course Assessment (culminating to the final grade), will be made up of the following three components;

(i) Weekly Submissions (Internal assessment)	20%
(ii) Mid-term examinations	30%
(iii) End Semester Examination	50%

Syllabus:

Introduction to MEMS: Introduction: micro- and nano-scale size domains; scaling of physical laws; MEMS materials and processes; Miniaturization Issues. MEMS devices and applications, MEMS Market **[4h].**

MEMS Fabrication Technology: Introduction to Submicron Technology: semiconductor materials; photolithography; doping; thin film growth and deposition; CVD, lithography and Ion Implantation, metallization; wet and dry etching; silicon micromachining; Bulk micromachining; Surface micromachining and LIGA **[4h].**

MEMS Sensors and Actuators (Electrostatic, Thermal, piezoresistive): mechanics including elasticity, beam bending theory, membranes/plates; microactuators based on various principles, electrostatic, thermal, piezoresistive and applications e.g. acceleration, strain, tactile, temperature, IR detector flow; inkjet **[10h].**

MEMS Sensors and Actuators (RF and Bio): MEMS Sensors and Actuators: mechanics including piezoelectric, magnetic, optical and its application. e.g. Microphone, micro speaker, nanogenerator, micro-motor, RF resonator, SAW filter. Materials and processes for BioMEMS, Applications **[10h].**

MEMS Devices Packaging and Calibration: MEMS device Calibration and packaging techniques, Reliability. MEMS software training: COMSOL & Intellisuite [**12h].**

Project

The class project is to design reasonably complex MEMS devices. The project will be performed as a team of two or three students

References:

1. Course notes – will be posted weekly on the course website
2. Foundations of MEMS, Chang Liu, Prentice Hall (2006)
3. Fundamentals of Micro fabrication, Marc Madou, CRC (2002)
4. Introduction to BioMEMS – Albert Folch, CRC (2012)

Course Outcomes:

At the end of the course the student will be able to:
CO1- Gain a knowledge of basic approaches for various MEMS sensors and actuators design. (Cognitive- understaning)
CO2-Capability to critically analyze microsystems technology for technical feasibility as well as practicality. (Affective- Evaluate)
CO3 -Develop efficient design for improving device performance in terms of speed, sensitivity Selectivity and accuracy. (Skills- Create)
CO4- Design and optimization of RF MEMS sensors and actuators (Skills- Create)
CO5- Design and analysis of efficient MEMS presser sensor. (Skills- Analyze)

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Program: B.Tech/M. Tech.	Department: Electronics & Communication Engineering
Course Code: ECT614	**Course Name: VLSI Technology**
Credit: 3	**L-T-P: 3-0-0**
Pre-requisite Course:	
Objective:	
COURSE DURATION: 12/13**/**14 weeks excluding examinations	

COURSE ASSESSMENT

The Course Assessment (culminating to the final grade), will be made up of the following three components;

(i) Weekly Submissions (Internal assessment)	20%
(ii) Mid-term examinations	30%
(iii) End Semester Examination	50%

Syllabus:

Crystal growth & wafer preparation: Processing considerations: Chemical cleaning, getting the thermal Stress factors etc**.**

Epitaxy: Vapors phase Epitaxy Basic Transport processes & reaction kinetics, doping & auto doping, equipments, & safety considerations, buried layers, epitaxial defects, molecular beam epitaxy, equipment used, film characteristics, SOI structure**.[10h]**

Oxidation

Growth mechanism & kinetics, Silicon oxidation model, interface considerations, orientation dependence of oxidation rates thin oxides. Oxides. Oxidation technique & systems dry & wet oxidation. Masking properties of SiO_2**.[56h]**

Diffusion

Diffusion –kinetics, Fick's law, sheet resistivity, methods of diffusion. Diffusion from a chemical source in vapor form at high temperature, diffusion from doped oxide source, diffusion from an ion implanted layer**.[6h]**

Lithography

Optical Lithography: optical resists, contact & proximity printing, projection printing, electron lithography: resists, mask generation. Electron optics: roster scans & vector scans, variable beam shape. X-Ray, e-beam lithography. **[6h]**

Etching

Reactive plasma etching, AC & DC plasma excitation, plasma properties, chemistry & surface interactions, feature size control & apostrophic etching, ion enhanced & induced etching, properties of etch processing. Reactive Ion Beam etching, Specific etches processes: poly/polycide. Trench etching**,[6h]**

Thin Film Materials & their Deposition: Interlayer dielectrics in microelectronic devices, interconnections within and between different electronic devices. **Packaging of Microelectronic Devices:** Packaging materials, different types of packaging, Microelectronic devices reliability. [6h]

References:

1. S. M. Sze, "VLSI Technology", McGraw Hill.
2. May, Sze, "Fundamentals of Semiconductor Fabrication", Wiley
3. Stephen A. Campbell, "The Science and Engineering of Microelectronic Fabrication", Oxford University Press, 1996.
4. Hong Xiao, "Introduction to Semiconductor Manufacturing", Prentice Hall, 2001.
5. SK Gandhi, "VLSI Fabrication Principles", John Wiley 1983.
6. AB Glaser, GE Subak-Sharpe, "Integrated Circuit Engineering", Reading MA, Addison Wesley 1977.
7. D. Nagchoudhuri, "Principles of Microelectronic Technology", Wheeler Publishing, 1998.
8. Plummer, Deal , Griffin, "Slilcon VLSI Technology: Fundamentals, Practice and Modeling" , Pearson
9. Research papers published in Applied Physics Letters and IEEE Journals.

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Course Outcomes:

CO1 An understanding of silicon and GaAs electronic device fabrication processes
CO2 Learn different types of operations involved in converting silicon wafer into a complex integrated circuit. Learn in detail basics of all operations used to manufacture a silicon-based monolithic integrate circuit.
CO3 Gain experience in the modelling and simulation of semiconductor manufacturing processes.
CO4 Develop an understanding of the working principle and operational details of semiconductor measurement device.
CO5 Develop an understanding of industrially relevant and research intensive methods of electronic device fabrications. Students should develop understanding of silicon growth methods, thin film growth technologies, lithography and etching processes.
CO6 Become proficient in the measurements of key electrical parameters and characteristics of integrated circuits

Program: M. Tech.	**Department: Electronics & Communication Engineering**
Course Code: ECT622	**Course Name: System Level Design & Modeling**
Credit: 3	**L-T-P: 3-0-0**
Pre-requisite Course:	
Objective:	
COURSE DURATION: 12/13**/**14 weeks excluding examinations	

COURSE ASSESSMENT
COURSE ASSESSMENT
The Course Assessment (culminating to the final grade), will be made up of the following three components;

(i) Weekly Submissions (Internal assessment)	20%
(ii) Mid-term examinations	30%
(iii) End Semester Examination	50%

Syllabus:

UNIT 1. Introduction: Embedded systems, electronic system-level (ESL) design, Models of Computation (MoCs): finite state machines (FSMs), dataflow, process networks, discrete event [6 hrs]
UNIT 2. System-level design languages (SLDLs): SpecC, SystemC. System specification, profiling, analysis and estimation. System-level design: partitioning, scheduling, communication synthesis [10 hrs]
UNIT 3. System-level modeling: processor and RTOS modeling, transaction-level modeling (TLM) for communication. System-level synthesis: design space exploration (DSE) [8 hrs]
UNIT 4. Embedded hardware and software implementation: synthesis and co-simulation, case study. Application specific processors, Retargetable compilers, instruction set-simulation and co-simulation. [8 hrs]
UNIT 5. System design examples and case studies. . Recent trends in system level design and modeling [6 hrs]

References:

1. Gajski, S. Abdi, A. Gerstlauer, G. Schirner, Embedded System Design: Modeling, Synthesis, Verification,
2. Springer, September 2009. ISBN 978-1-4419-0503-1, ("Orange book", authors' site).
3. Gerstlauer, R. Doemer, J. Peng, D. Gajski, "System Design: A Practical Guide with SpecC",
4. Kluwer Academic Publishers, Boston, June 2001. ISBN 0-7923-7387-1 ("Yellow book")
5. T. Groetker, S. Liao, G. Martin, S. Swan, "System Design with SystemC", Kluwer Academic Publishers, Boston, May 2002. ISBN 1-4020-7072-1 ("Black book")
6. F. Vahid, T. Givargis, "Embedded System Design: A Unified Hardware/Software Introduction" (authors' site),
7. John Wiley & Sons, 2001. ISBN 978-0-471-38678-0

Course Outcomes:

At the end of the course the student will be able to:

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CO1- To model a problem at system level (Cognitive- Analyze)
CO2- Realize architecture for a design problem (Skills- Create)
CO3 -To model a system in System C language (Cognitive- Analyze)
CO4 -To generate system interface specifications and perform refinement (Skills- Create)
CO5- To appreciate HW-SW Co-design with latest trends (Cognitive- understanding)

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Program: B.Tech/M. Tech.	**Department: Electronics & Communication Engineering**
Course Code: ECT640	**Course Name: Electronic manufacturing Technology**
Credit: 3	**L-T-P: 3-0-0**
Pre-requisite Course:	
Objective:	
COURSE DURATION: 12/13**/**14 weeks excluding examinations	

COURSE ASSESSMENT

The Course Assessment (culminating to the final grade), will be made up of the following three components;

(i) Weekly Submissions (Internal assessment)	20%
(ii) Mid-term examinations	30%
(iii) End Semester Examination	50%

Syllabus: Overview of different technologies & future trends- (i) PCB, multilayer PCB, (ii) thin film, (iii) Thick film, (iv) Surface mount devices (v) monolithic- VLSI & MMIC (vi) packaging of semiconductor devices (vii) multichip modules & optoelectronic sub-system packaging (viii) system-on-package(ix) Micro-electro-mechanical systems & NEMS (x) Nanotechnology (xi) standards & procedures- MIL-M- 38 510F, MIL-STD-883B, ISO-9000 etc. [36 hours]

References:

1. Manufacturing Technology in the Electronics Industry: An introduction, Edwards P., Springer Netherlands, 1991
2. Handbook of Electronics Manufacturing Engineering, Bernard S. Matisoff, Springer Netherlands, 1991

Course Outcomes:

At the end of the course the student will be able to:

CO1- Gain a knowledge of different PCB layers. (Cognitive- understanding)

CO2- Understand challenges in PCB design technologies. (Cognitive - understanding)

CO3 –Analyze different method for improving packaging of chips. (Skills- analyze)

CO4- Design and optimization of system on package as per industry standards. (Skills- Create)

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Program: b.Tech/M. Tech.	Department: Electronics & Communication Engineering
Course Code: ECT642	**Course Name: FPGAs Physical Design**
Credit: 3	**L-T-P: 3-0-0**
Pre-requisite Course:	
Objective:	
COURSE DURATION: 12/13**/**14 weeks excluding examinations	

COURSE ASSESSMENT

The Course Assessment (culminating to the final grade), will be made up of the following three components;

(i) Weekly Submissions (Internal assessment)	20%
(ii) Mid-term examinations	30%
(iii) End Semester Examination	50%

Syllabus:

Module 1: Introduction to FPGA Architectures, CLB, LUT, programming technology, routing, State of art architectures[5 hours]

Module 2: FPGA design flow, Physical design automation, Fabrication of devices, Design rules, Fabrication process and its impact on physical design, Basic data structure methods [8 Hours]

Module 3 Partitioning : Classification, Group Migration Algorithms, Simulated Annealing and Evolution, Other Partitioning algorithms, Performance driven partitioning [9 Hours]

Module 4: Floor Planning, Placement and routing algorithms: Types of Floor planning, Chip planning, pin assignment, Classification of Placement algorithms, Simulation based placement, Partitioning based placement, other placement, Global routing, Detailed routing, Clock and power routing etc. [10 Hours]

Module 5: Technology mapping for FPGAs, case studies. [5 hours]

References:

1. Naveed A. Sherwani, Algorithms for VLSI Physical Design Automation, Kluwer, 1999
2. Brown, S. D., Francis, R. J., Rose, J. and Vranesic, Z G. Field programmable Gate arrays. Kluwer, 1992.
3. Betz, V., Rose, J. and Marquardt, A. Architecture and CAD for Deep-submicron FPGAs. Kluwer, 1999.
4. Trimberger, S. M. FPGA Technology. Kluwer, 1992.
5. Oldfield, J. V. and Dorf, R. C. FPGAs: Reconfigurable logic for rapid prototyping and implementation of digital systems. John Wiley, 1995

Course Outcomes:

At the end of the course the student will be able to:

CO1- Gain a knowledge of different FPGA Architectures (Cognitive- understanding)

CO2- Understand challenges in placement and routing algorithms. (Cognitive - understanding)

CO3 –Analyze different method for improving physical design. (Skills- analyze)

CO4- Evaluate Technology mapping for FPGAs (Skills- Evaluate)

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Head, ECE

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Program: B.Tech/M. Tech.	Department: Electronics & Communication Engineering
Course Code: ECT649	Course Name: Nanotechnology & Emerging Applications
Credit: 3	L-T-P: 3-0-0
Pre-requisite Course:	
Objective:	
COURSE DURATION: 12/13/14 weeks excluding examinations	

COURSE ASSESSMENT

The Course Assessment (culminating to the final grade), will be made up of the following three components;

(i) Weekly Submissions (Internal assessment)	20%
(ii) Mid-term examinations	30%
(iii) End Semester Examination	50%

Syllabus:

Introduction: concept of nanotechnology, Origin of nanotechnology: change in optical, mechanical, electronic and magnetic behavior at nanoscale, Advantages of nanostructures in comparison to macrostructures, Scope of nanotechnology. **(4h)**

Categories of nanostructures and nanomaterials and their properties: Classification based on dimensionality: zero, one, two and three dimensional nanostructures:-Quantum Dots and Wells, nanowires, nanorods, nanoparticles, thin films, Carbon-based nano materials (buckyballs, nanotubes, graphene), Metallic nano materials (nanogold, nanosilver and metal oxides), Nanocomposites, Nanopolymers, Biological nanomaterials. **(8h)**

Synthesis of nanostructures and nanomaterials: Synthesis of nanoparticles, nanorods and nanowires, thin films: Ball Milling, Electrodeposition, Spray Pyrolysis, Flame Pyrolysis, Sol-Gel Processing, Solution Precipitation, Molecular Beam Epitaxy (MBE), Metal Nanocrystals by Reduction, Solvothermal Synthesis, Fundamental aspects of VLS and SLS growth, VLS growth of Nanowires, Control of the size of the nanowires, Template based synthesis, Chemical Vapor Deposition (CVD), Metal Oxide - Chemical Vapor Deposition (MOCVD), Physical vapor Deposition (PVD), Chemical vapour Deposition (CVD), DC/RF Magnetron Sputtering, Atomic layer Deposition (ALD).
(9h)

Characterization of nanostructures and nanomaterials: Scanning Electron Microscopy (SEM), Field Emission Scanning Electron Microscopy (FESEM), High Resolution Transmission Electron Microscope (HRTEM), Scanning Tunneling Microscope (STM), Atomic Force Microscopy (AFM), X-ray Photoelectron Spectroscopy (XPS), Raman Spectroscopy, Infrared Spectroscopy, X-Ray Diffraction, Photoluminescence Spectroscopy, X-ray Fluorescence Method, Energy Dispersive Analysis of X-rays (EDAX), Thermogravimetry, Differential Thermal Analysis and Differential scanning calorimetry. **(9h)**

Applications: Application of nanotechnology in various domains: nano and molecular electronics, nano-devices like FinFETs, Tunnel-FETs, nanochemistry, nanobiotechnology, nanomedicine, nanomagnetism, nanorobotics, nanophotonics, smart nanosensors, MEMS/NEMS, nanotechnololgy for energy systems. **(6h)**

References:

1. Nabok A., “Organic and Inorganic Nanostructures”, Artech House, 2005.
2. Dupas C., Houdy P., Lahmani M., “Nanoscience: Nanotechnologies and Nanophysics”, Springer-Verlag Berlin Heidelberg, 2007.
3. Edelstein A S and Cammarata R C, “Nanomaterials: synthesis, Properties and Applictions”,Taylor and Francis, 2012.
4. Michael Wilson, Kamali Kannangara and Geoff Smith, “NANOTECHNOLOGY - Basic Science and Emerging Technologies”, A CRC Press Company, D.C, 2002.;

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Course Outcomes:

At the end of the course the student will be able to:

CO1: Knowledge of vast scope and capabilities of nanotechnology (Cognitive- understanding)
CO2: Acquaintance with various kinds of nanostructures and nanomaterials (Cognitive- Analyze)
CO3: Awareness of several kinds of synthesis and characterization techniques for nanostructures and nanomaterials (Cognitive- understanding)
CO4: Knowledge of applications of nanotechnology in various diverse domains.(Skills- Applying)

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Program: B.Tech/M. Tech.	Department: Electronics & Communication Engineering
Course Code: ECT652	**Course Name: RF MEMS**
Credit: 3	**L-T-P: 3-0-0**
Pre-requisite Course:	
Objective:	
COURSE DURATION: 12/13**/**14 weeks excluding examinations	

COURSE ASSESSMENT

The Course Assessment (culminating to the final grade), will be made up of the following three components;

(i) Weekly Submissions (Internal assessment)	20%
(ii) Mid-term examinations	30%
(iii) End Semester Examination	50%

Syllabus:

RF MEMS relays and switches: Switch parameters, Actuation mechanisms, Bistable relays and micro actuators, Dynamics of switching operation. [6h]
MEMS inductors and capacitors: Micromachined inductor, Effect of inductor layout, Modeling and design issues of planar inductor, Gap tuning and area tuning capacitors, Dielectric tunable capacitors.[8h]
Micromachined RF filters: Modeling of mechanical filters, Electrostatic comb drive, Micromechanical filters using comb drives, Electrostatic coupled beam structures. [8h]
MEMS phase shifters: Types, Limitations, Switched delay lines, Micromachined transmission lines, Coplanar lines, Micromachined directional coupler and mixer.[8h]
Micromachined antennas: Microstrip antennas – design parameters, Micromachining to improve performance, Reconfigurable antennas. [6]

References:

1. H.J.D.Santos, “RF MEMS Circuit Design for Wireless Communications”, Artech House ,2002.
2. G.M.Rebeiz , “RF MEMS Theory , Design and Technology”, wiley , 2003.
3. Stephen D Senturia, “Microsystem Design”, Kluwer Academic Publishers, 2001.
4. Marc Madou, “Fundamentals of Microfabrication”, CRC Press, 1997.
5. V.K.Varadan, K.J Vinoy & K.A. Jose, “RF MEMS and their Applications”, Wiley,2003.
6. Gregory Kovacs, “Micromechanised Transducers Source Book”, WCB McGraw Hill, Boston, 1998.
7. M H Bao, “Micromechanical Transducers, Pressure Sensors, Accelerometers and Gyroscopes” Elsevier, Newyork, 2000.

Course Outcomes:

At the end of the course the student will be able to:

CO1: Understand various parameters of RF MEMS Switch and its actuation

CO2: Model and design inductor and capacitors

CO3: Design Micromechanical filters

CO4: Understand the various aspects of design of MEMS phase shifters and its application

CO5: Analyze the performance of microstrip antennas

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Head, ECE

Program: B.Tech/M. Tech.	Department: Electronics & Communication Engineering
Course Code: ECT656	**Course Name: Adaptive Signal Processing**
Credit: 3	**L-T-P: 3-0-0**
Pre-requisite Course:	
Objective:	
COURSE DURATION: 12/13**/**14 weeks excluding examinations	

COURSE ASSESSMENT

The Course Assessment (culminating to the final grade), will be made up of the following three components;

(i) Weekly Submissions (Internal assessment)	20%
(ii) Mid-term examinations	30%
(iii) End Semester Examination	50%

Syllabus:

Adaptive Filter Structures and Algorithms:

Introduction to Adaptive systems, Adaptive Linear combiner, Minimum Mean-Square Error, Wiener-Hopf Equation, Error Performance Surface, LMS algorithm, Convergence of weight vector, Learning Curve, FX-LMS algorithm (Filtered X-LMS) and its application to ANC, Types of LMS, RLS algorithm, Matrix Inverse Lemma for RLS, Computational complexity of LMS and RLS, Convergence Analysis.

IIR-LMS, Lattice Filter, FIR to Lattice conversion and vice-versa, Adaptive Lattice Filter

Kalman Filter, Adaptive Kalman Filter

Transformed domain adaptive filtering : Block Linear, Block Circular

Filter Banks and multi-rate signal processing

Distributed signal Processing : Incremental LMS, Diffusion LMS

Applications:

Direct Modelling or System Identification, Inverse Adaptive Modelling (Equalization), Adaptive Noise Cancellation, Adaptive filters for time series and stock market prediction, Biomedical Applications (Cancellation of 50-Hz interference in Electro-Cardiography, Cancelling donor heart interference in heart-transplant electrocardiography, Cancelling Maternal ECG in Fetal Electrocardiography), Echo Cancellation in Long distance Telephone Circuits, Adaptive self tuning filter, Adaptive line enhancer, Adaptive filters for classification and data mining. [36h]

References:

1. B. Widrow and S. D. Stearns : Adaptive Signal Processing, Prentice Hall.
2. D. G. Manolakis, V. K. Ingle, S. M. Kogon : Statistical and Adaptive Signal Processing, McGraw Hill.
3. S. S. Haykin : Adaptive Filter Theory, 4th Edition, Prentice Hall.
4. A. H. Sayed : Fundamentals of Adaptive Filtering, John Wiley & Sons.

Course Outcomes:

At the end of the course the student will be able to:

CO1 : To learn the characteristics of adaptive system architecture and analyze Wiener-Hopf Equation.
CO2 : To understand the machine learning algorithms including LMS, RLS, Fx-LMS etc.
CO3 : To learn the adaptive structures like : Adaptive Lattice Filter, Kalman Filter, Transformed domain adaptive filtering, Filter Banks.
CO4 : To explore the applications of adaptive signal techniques to System Identification, Channel Equalization, time series prediction etc.

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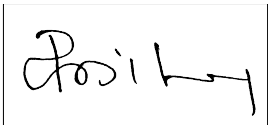
CO5 : To develop MATLAB programming skills for adaptive systems.

Program: B.Tec/M. Tech. (VLSI Design)	**Department: Electronics & Communication Engineering**
Course Code: ECT703	**Course Name: CAD Algorithms for Synthesis of VLSI Systems**
Credit: 3	**L-T-P: 3-0-0**
Objective:	
Pre-requisite Course:	



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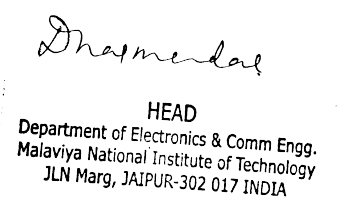

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Syllabus:

Unit 1: **Introduction to CAD Algorithms**

Role of CAD in digital system design, levels of design, modeling & description and support of languages, RTL, gate and system level synthesis; Technological alternatives and technology mapping [6 hrs]

Unit 2**: CAD Tools for synthesis**

CAD tools for synthesis, optimization, simulation and verification of design at various levels as well as for special realizations and structures such as microprogrammes, PLAs, gate arrays etc. Technology mapping for FPGAs. Low power issues in high level synthesis and logic synthesis. [8 hrs]

Unit 3: **Architectural-Level Synthesis and Optimization**

Architectural Synthesis, Scheduling, Data path synthesis and control unit synthesis, scheduling algorithm, Resource Sharing and Binding [8 hrs]

Unit 4: **Logic-Level Svnthesis and Optimization**

Two-Level Combinational Logic Optimization, Multiple-Level Combinational Logic Optimization, Sequential Logic Optimization [8 hrs]

Unit 5: **CAD Algorithms for VLSI Physical Design**

Introduction to VLSI Physical Design flow. Circuit partitioning, placement and routing algorithms. Design Rule-verification, Circuit Compaction; Circuit Extraction and post layout simulation. FPGA design flow- partitioning, placement and routing algorithms. Deep sub-micron issues; interconnects modeling and synthesis

[6 hrs]

References:

1. G. D. Micheli. Synthesis and optimization of digital systems.
2. Dutt, N. D. and Gajski, D. D. High level synthesis, Kluwer, 2000.
3. T. H. Cormen, C. E. Leiserson and R. L. Rivest, “Introduction to Algorithms,” McGraw-Hill, 1990.
4. N. Deo, Graph Theory, PH India.
5. Sait, S. M. and Youssef, H. VLSI Physical design automation. IEEE press, 1995.
6. Sherwani, N. VLSI physical design automation. Kluwer, 1999.

Course Outcomes:

CO1: Is able to grasp various operations on graphs, clique, coloring, partitioning etc & apply graph algorithms and its applications into Boolean function representation (Skills- Apply)

CO2: Is able to grasp graph models for architecture representation (Cognitive- understanding)

CO3: Is able to analyze & implement two level/Multilevel/ sequential logic synthesis algorithms

(approximate & exact algorithms) (skills- Analyze)

CO4: Is able to analyze & implement library binding algorithms- FSM equivalence & optimization (skills- Evaluate)

CO5: To able to grasp core concept of VLSI Physical Design algorithms. (Cognitive- Apply)

Program: M.Tech	**Department: *Electronics & Comm. Engg.***
Course Code ECT657	**Course Name: VLSI Signal Processing Architectures**
Credit: 3	L-T-P: 3-0-0
Pre-requisite Course:	
Objective	
COURSE DURATION: 12/13/14 weeks excluding examinations	
COURSE ASSESSMENT	

The Course Assessment (culminating to the final grade), will be made up of the following three components;

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(i) Weekly Submissions (Internal assessment)	20%
(ii) Mid-term examinations	30%
(iii) End Semester Examination	50%

Unit 1: **Introduction to VLSI DSP Sytems**
Need of VLSI DSP algorithms. main DSP Blocks and typical DSP Algorithms. Fixed point /Floating point Representation; Floating point Arithmetic Implementation, Architectures of Adders/Multipliers; CORDIC, representation of DSP algorithms: Block Diagram, signal flow graph, data flow graph, dependence graph. [8 hrs]

Unit 2**: Iteration Bound**
Data flow graph representations, loop bound and iteration bound, longest path matrix algorithm, iteration bound of Multirate data flow graphs [6 hrs]

Unit 3: **Pipelining and Parallel Processing:**
Pipelining and parallel processing of FIR digital filters, pipeline interleaving in digital filters: signal and multichannel interleaving [4 hrs]

Unit 4: **Retiming, Unfolding and Folding:**
retiming techniques; algorithm for unfolding, Folding transformation, Techniques of retiming, Unfolding & Folding [10 hrs]

Unit 5: **Systolic Array Architecture**
Systolic Array Architecture: Methodology of systolic array architecture, FIR based Systolic Array, Selection of Scheduling Vector, Matrix multiplication of systolic array [6 hrs]

Unit 6: **Low power Design**
Theoretical background , Scaling v/s power consumption, power analysis, Power reduction techniques, Power estimation approach [4 hrs]

Reading References

- VLSI Digital Signal Processing System : : Design and implementation by K.K. Parhi
- Digital Signal Processing with Field Programmable Gate Arrays Uwe Meyer-Baese , Springer.
- FPGA-based Implementation of Signal Processing Systems. by Roger Woods, John Mcallister, WILEY

ECT657:CO1	To understand Graphical representation of DSP algorithms and Mapping algorithms into Architectures (Cognitive/Skills- Apply)
ECT657:CO2	To study architecture for real time systems and parallel and pipelining for Low power design (Cognitive- Remembering)
ECT657:CO3	To be aware of systolic Array architecture and methodology for developing Architectures (Cognitive- Understanding)
ECT657:CO4	To know different signal processing modules as convolution technique, retiming concept, folding /unfolding Transformation and CORDIC architecture. (Cognitive- Analyse)
ECT657:CO5	To implement different low power Design techniques. (Skills- evaluate)

MALAVIYA NATIONAL INSTITUTE OF TECHNOLOGY JAIPUR

Department/Centre : Department of Electronics and Communication Engineering

Course Code : 21ECT815

Course Name : Optical Codes and Applications

DUGC Convener Head, ECE

Credits : 3 **L -** 3 **T -** 0 **P -** 0

Course Type : Elective

Prerequisites : none

Course Contents

Introduction: Historical Perspective of Optical Communications, Optical Transmission and Optical Networking, Optical Communications Trends, Migration to 100 Gb/s Ethernet and Beyond. **(no. of lectures- 9)**

Optical Coding Schemes: Unipolar and Bipolar codes, 1D time spread codes, phase encoding, spectral amplitude coding, 2D phase-wavelength, wavelength-time and space-time codes, spectral amplitude coding and 3D space-wavelength-time, polarization-wavelength-time and space-wavelength-phase codes.

(no. of lectures- 9)

Performance Metrics for comparison of codes: Cardinality, Code dimension, Correlation functions, BER due to multiple access interference, received power & noise.

(no. of lectures- 9)

Enabling Hardware Technologies: Optical encoders/decoders using fiber optic components & integrated optics, Optical AND gate as a decoder, Realization of Optical logic gates, Potential Applications. Latest topics in optical codes and applications

(no. of lectures- 9)

COURSE OUTCOMES

CO1. Is able to grasp historical perspective and recent trends of Optical Communications including Networking.
CO2. Is able to construct and analyze 1D, 2D and 3D codes.
CO3. Is able to design Optical encoders/decoders using fiber optic components & integrated optic technologies.
CO4. Is able to search and review latest topics.

Recommended Readings

Text Books:-

1. Optical code division multiple access: Fundamentals and Applications - Paul R. Prucnal (CRC Press)
2. Optical coding theory with prime - Wing C. Kwong; Guu-Chang Yang (CRC Press)
3. Spreading codes for all-optical code division multiple access communication systems – M. Ravi Kumar (Ph.D. Thesis, IIT Kharagpur)

Reference books:-

1. Design and Performance Analysis of a New Family of Wavelength/Time Codes for Fiber-Optic CDMA Networks - E. S. Shivaleela (Ph.D. Thesis, IISc Bangalore)

MALAVIYA NATIONAL INSTITUTE OF TECHNOLOGY JAIPUR

Department/Centre : Department of Electronics and Communication Engineering

DUGC Convener Head, ECE

Course Code	**:**	**21ECT803**							
Course Name	**:**	**Advanced Error Control Codes**							
Credits	**:**	3	**L -**	3	**T -**	0	**P -**	0	
Course Type	**:**	Elective							
Prerequisites	**:**	none							

Course Contents

Error Control coding for wireless fading channels, Channel Estimation and Adaptive channel coding, Joint Source and Channel coding . Non binary Linear Block Codes, Hard and soft decision decoding, Coding and Decoding of BCH, Reed Solomon Codes, Convolution codes: Coding and Decoding , Distance bounds, Performance bounds Turbo
codes: Coding, Decoding Algorithms, Performance comparison , Interleaver design Trellis coded Modulation, TCM Decoders, TCM for AWGN and Fading Wireless Channels, Performance comparison.
LDPC Codes, Polar Codes, Error control codes for : Audio/video transmission, mobile communications, space and satellite communication, data transmission, data storage and file transfer.

(no. of lectures- 36)

COURSE OUTCOMES

CO1. Appreciate the need of Error Correction in communication systems after going through the course
CO2. Develop requisite mathematical background for Error Correction using linear algebra
CO3. Design error correcting codes using mathematical models
CO4. Design encoders and decoders for a given error correcting capability
CO5. Validate theoretical results with simulation results
CO6. Use MATLAB software for simulation (TT)

Recommended Readings

Text Books: -

1. Stephen G. Wilson; Digital Modulation & Coding;. Prentice Hall Inc.
2. Ranjan Bose; Information Theory Coding and Cryptography, TMH
3 .Blahut R.E. , Theory and practice of error control codes, AWL1983.
4. J.G.Proakis; Digital Communication.

Online/E resources: -

1. https://nptel.ac.in/courses/117/108/117108044/

MALAVIYA NATIONAL INSTITUTE OF TECHNOLOGY JAIPUR

Department/Centre : Department of Electronics and Communication Engineering

Course Code : ECT815

Course Name : Optical Codes and Applications

DUGC Convener Head, ECE

Credits : 3 **L -** 3 **T -** 0 **P -** 0

Course Type : Elective

Prerequisites : none

Course Contents

Introduction: Historical Perspective of Optical Communications, Optical Transmission and Optical Networking, Optical Communications Trends, Migration to 100 Gb/s Ethernet and Beyond.
Optical Coding Schemes: Unipolar and Bipolar codes, 1D time spread codes, phase encoding, spectral amplitude coding, 2D phase-wavelength, wavelength-time and space-time codes, spectral amplitude coding and 3D space-wavelength-time, polarization-wavelength-time and space-wavelength-phase codes**.**
Performance Metrics for comparison of codes: Cardinality, Code dimension, Correlation functions, BER due to multiple access interference, received power & noise.
Enabling Hardware Technologies: Optical encoders/decoders using fiber optic components & integrated optics, Optical AND gate as a decoder, Realization of Optical logic gates, Potential Applications. Latest topics in optical codes and applications

Recommended Readings

1. Text books-
    a. Optical code division multiple access: Fundamentals and Applications - Paul R. Prucnal, CRC Press.
    b. Optical coding theory with prime - Wing C. Kwong and Guu-Chang Yang, CRC Press
    c. Spreading codes for all optical code division multiple access communication systems – M. Ravi Kumar (Ph.D. Thesis, IIT Kharagpur)
2. Reference books-
    a. Design and Performance Analysis of a New Family of Wavelength/Time Codes for Fiber-Optic CDMA Networks - E. S. Shivaleela (Ph.D. Thesis, IISc Bangalore)

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First Year Syllabus

Theory Papers

Code: CPT101	Computer Science and Programming	Credit: 02 L-T-P: (2-0-0)
Course Content	**Overview of Computer organization**: Historical perspective computer applications in various fields of science and management. **Data Representation**: Number Systems, Character Representation Codes, Binary, Hex, Octal Codes and Their Inter Conversions. Binary Arithmetic, Floating-point Arithmetic, Signed and Unsigned Numbers. **Problem Solving Theory**: Flow Charts, Introduction to Algorithm, Termination and Correctness. **Basic Programming in 'C'**: Data Types, Control Structures, Arrays, Structures and Unions, File Handling.	
Important Text Books/References	• Fundamental of Computers and Programming with C, by A. K. Sharma, Dhanpat Rai Publications, New Delhi. • Fundamental of Computers, by E Balagurusamy, Tata McGraw-Hill Education. • Programming In Ansi C, by E Balagurusamy, Tata McGraw-Hill Education. • Let us C, by Y. Kanetkar, BPB.	

Code: EET101	Basic Electrical Engineering	Credit: 04 L-T-P: (3-1-0)
Course Content	**D. C. Circuits:** Source conversion, Delta-Star and Star-Delta transformations, Node voltage and mesh current methods. Superposition principle, Thevenin's, Norton's, Maximum Power Transfer theorems. **A. C. Circuits:** Single Phase A. C. Circuits: Phasor Algebra, Solution of R, L, C series, parallel and series-parallel circuits, Resonance in Series and parallel R-L-C circuits. Three- Phase A. C. Circuits: Three-phase e.m.f. generation. Delta and Star Connections. Line and phase quantities, Solution of three-phase balanced circuits, phasor diagram, Measurement of power in 3-phase circuits. **Electrical Measuring Instruments:** Introduction, types of measuring instruments. Deflection, controlling and damping torques. PMMC instruments, shunts and multipliers. Moving iron ammeter and voltmeter, Dynamometer wattmeter. **Transformers:** Construction, theory and operation of single-phase transformer, e.m.f. equation. Development of equivalent circuit and phasor diagram. Open-circuit and short-circuit tests, efficiency and voltage regulation. **Rotating Machines:** Basic construction, principle of operation and applications of DC motors, 3-phase, 1- phase induction motors and synchronous motors. (Qualitative treatment only).	

Important Text Books/References	• Electrical Engineering Fundamentals, By V. Del Toro, PHI • Basic Electrical Engineering, By D. P. Kothari and I. J. Nagrath, Tata McGraw Hill

Code: ECT101	**Basic Electronics Engineering**	**Credit: 04** **L-T-P: (3-1-0)**
Course Content	**Analog Electronics** **Diode Circuits:** Band structure of insulators, Metals & Semiconductors, mobility, conductivity, doping, Electrons and holes in an intrinsic semiconductor, Donor and acceptor impurities, charge densities in a semiconductor, Hall Effect. Current components in diode, transition & diffusion Capacitances, Single phase rectifier (half- wave and full-wave rectifier) & their analysis, compare half-wave and full-wave rectifiers, compare bridge and center-tap rectifier, various types of filter (Capacitor filter, Inductor Filter, Choke-Input LC filter, π filter), clipping circuits (series and shunt) & clamping circuits . **Bipolar Junction Transistor (BJT):** Junction Transistor, Current components in transistor, transistor construction, The transistor as an Amplifier, various configurations (CE, CB, CC) and characteristics (Input and Output) of BJT's configurations, cut off, saturation and active region, Early effect, analytical expression for transistor characteristics (Ebers-Moll Model). **Transistor Biasing & Stabilization:** Operating point. DC &AC load line, biased stability, various types of transistor biased circuits (Fixed-bias circuit, Fixed-bias with emitter resistor, self-bias or Emitter Bias), stabilization against variation in Ico, V_{be} and β bias compensation, thermister & sensitor compensation, thermal runaway &thermal stability. **Field Effect Transistor (FET)** : Introduction to junction field effect transistor (n- channel and p-channel), comparison between BJT and JFET, Construction of JFET, the JFET Volt-Ampere characteristics, the pinch off voltage, Construction & characteristics of MOSFET (depletion type MOSFET and Enhancement type MOSFET), biasing of FET's **Digital Electronics** **Number Systems**: Binary arithmetic: addition, subtraction, multiplication and division, Base conversion, conversion formulas with examples, one's and two's compliment arithmetic. Logic Gates, Boolean algebra, Boolean postulates, Evaluation of truth functions, Truth- function calculus as Boolean algebra. **Minimization Techniques**: Using Boolean identities, standard representations for logical functions (SOP & POS forms), Karnaugh map representation, simplification of logical functions using K-map, Minimization of logical functions specified in miniterms/maxterms or Truth Table.	

Important Text Books/References	• Basic Electronics and linear Circuits, N N Bhagava (TTTI Chandigarh), TMH • Integrated Electronics, Millman Halkias, TMH. • Electronic Devices and Circuit, David A. Bell, Oxford • Electronic Devices and Circuit Theory, R. L. Boylestad, Pearson Education • Digital Circuits and Design, S Salivahanan, Vikas Publishers • Digital Electronics, Moris-Mano, PHI

Code: CET102	**Environmental Science and Ecology**	**Credit: 02**
		L-T-P: (2-0-0)
Course Content	**Ecosystems:** Concept of an ecosystem. Structure and function of an ecosystem. Producers, consumers and decomposers. Energy flow in the ecosystem, Ecological succession, Food chains, food webs and ecological pyramids. **Environmental Pollution:** Definition, Causes, effects and control measures of: 1. Air Pollution (Ambient and Indoor) 2. Water Pollution 3. Soil Pollution 4. Marine Pollution **Noise Pollution, Solid Waste Management**: cases, effects and control measures of urban and industrial wastes. Role of an individual in preventing pollution, Pollution case studies. **Social issues and environment:** From unsustainable to sustainable development. Urban problems related to energy, Water conservation, rainwater harvesting, and watershed management. Resettlement and rehabilitation of people: its problem and concerns case studies. Climate change, global warming, acid rain, ozone layer depletion. Wasteland reclamation. Consumerism and waste products. Environment Protection Act. Introduction to ISO 14000, Green Building Concept, Introduction to biodiversity.	
Important Text Books/References	• P. Meenakshi, "Elements of Environmental Science and Engineering", Prentice-Hall of India Pvt. Ltd. New Delhi, 2008. • P. D. Sharma, "Ecology and Environment" Rastogi Publication, 2009. • J.Glynn Henry, Gary W. Heinke, "Environmental Science and Engineering" Prentice-Hall of India Pvt. Ltd. New Delhi, 2004 • Bala Krishnamoorthy," Environmental Management"Prentice-Hall of India Pvt. Ltd. New Delhi, 2005.	

Code: MET101	**Basic Mechanical Engineering**	**Credit: 04**
		L-T-P: (3-1-0)
Course Content	**Working Fluid:** Properties of steam, Steam tables and Mollier Diagram. Steam Generators, Classification, Construction and working of Simple Vertical Boiler, Cochran boiler, Babcock and Wilcox boiler.	

	Internal Combustion Engines: Classification of I.C. Engines. Two stroke and Four stroke engines, Otto and Diesel cycles, Calculation of thermal efficiency of cycles, Construction and working of Petrol and Diesel engines, Introduction of Ignition system, Fuel system and Cooling system. **Refrigeration and Air Conditioning:** Reverse Carnot cycle, Bell Coleman cycle, Vapour Compression cycle, Calculation of C.O.P. of cycles, Working principles and schematic diagrams of Refrigerator, Desert air cooler, Air Conditioner and Ice plant. Comfort Air Conditioning, Summer Air Conditioning system. **Power Transmission:** Classification and applications of mechanical drives like belts, ropes, chains and gear drives and their velocity ratios, length of belts, power transmitted, ratio of tensions in belts and ropes, gear trains, Calculation of different parameters. **Machine Tools:** Construction and Working of Lathe, Drilling machine, Shaper and Milling machine. **Foundry:** Foundry tools and equipments, Procedure for moulding. **Welding:** Gas and Arc welding, Soldering and Brazing.
Important Text Books/References	• Mechanical Engineering by Dr. A.K.Rajvanshi • Elements of Mechanical Engineering by P.N.Gupta and M.P.Poonia

Code: MAT101	**Mathematics-I**	**Credit: 04**
		L-T-P: (3-1-0)
Course Content	**Matrices:** Rank and inverse of matrix by elementary transformation, consistency of linear system of equations and their solution. Eigen values and Eigen vectors. Cayley- Hamilton theorem (statement only) & its applications. Diagonalization of matrices. **Differential Calculus :** Curvature , Concavity, convexity and points of Inflexion, Asymptotes, Partial differentiation, Euler's theorem on homogeneous functions, Total differentiation, Approximate calculation, Curve tracing (Cartesian and five polar curves- Folium of Descartes, Limacon, Cardioids, Lemniscates of Bernoulli and Equiangular spiral). **Integral Calculus:** Improper integrals, Area and length of curves, Surface area and volume of solid of revolution. Multiple integrals, Change of order of integration (Cartesian form). **Vector Calculus:** Differentiation and integration of vector functions of scalar variables, scalar and vector fields, gradient, Directional derivative, Divergence, curl. Line integral, Surface integral and Volume integral. Green's, Gauss's and Stokes's theorems (statement only) and their simple applications	
Important Text Books/References	• R.K.Jain & S R K Iyengar, Advanced Engineering Mathematics, Narosa Pub.House • Thomas & Finney, Advanced calculus and geometry Addison-Wesley Pub. Co. • D. W. Jordan & P Smith, Mathematical Techniques, OXFORD • Peter V. O'Neil, Advanced Engineering Mathematics, Cengage Learning,NewDehli	

	• B.V.Ramana, Higher Engineering Mathematics, McGraw – Hill.

Code: MAT102	Mathematics-II	Credit: 04
		L-T-P:(3-1-0)
Course Content	**Differential Equations:** differential equations of first order & of first degree: Linear form, reducible to linear form, exact form, Reducible to exact form, Picard's Theorem (statement only). **Linear differential equations with constant coefficients:** Differential equations of second & higher order with constant coefficients. **Second order Ordinary linear differential equations with variable Coefficients:** Homogeneous, Exact form, Reducible to exact form, Change of dependent variable (normal form), Change of Independent variable, method of variation of parameters. **Series Solution:** Sequence, Power series, radius of conversions, solution in series of second order LDE with variable co-efficient (C.F. only). Regular Single points and extended power series (Frobenius Method). **Fourier Series:** Fourier series, half range series, change of intervals, harmonic analysis. **Partial Differential Equation:** Formulation and classification of linear and quasi linear partial differential equation of the first order, Lagrange's method for linear Partial Differential Equation of the first order, solution by separation of variables methods, Wave and Diffusion equation in one dimension.	
Important Text Books/References	• Erwin Kreyszig, Advanced Engineering Mathmatics, John Wiley. • B.V.Ramana, Higher Engineering Mathematics, McGraw – Hill. • Peter V. O'Neil, Advanced Engineering Mathematics, Cengage Learning, NewDehli • M Ray, A Text Book On Differential equations Students Friends & Co., Agra-2 • Robert C. Mcowen, Partial Differential Equation Pearson Education. • George F. Simmons & S.G. krantz, Differential Equation Tata McGraw – Hill. • R.K.Jain & S R K Iyengar, Advanced Engineering Mathematics, Narosa • T Amarnath , An Elementary course in partial differential equations, Narosa, New Delhi. • S. G. Deo and V. Raghavendra: Ordinar Differential Equations, Tata McGraw Hill Pub. Co. ,New Delhi	

Code: PHT101	Physics	Credit: 04
		L-T-P: (3-1-0)
Course Content	**Fields**: gradient, divergence and curl, Gauss divergence theorem and Stokes theorem; laws of electromagnetism (in vector form); equation of continuity; Maxwell's equations and their interpretation; wave equation for electric and magnetic fields and its solution in	

	free space; Poynting vector and power flow. **Temporal and spatial coherence**: stimulated emission, Einstein coefficients; requirements for laser action; Types of Lasers- Ruby and He-Ne Laser; Applications of Lasers, Introduction to optical fibers in communication and numerical aperture. **Postulates of Special Theory of Relativity:** Lorrentz transformation, Addition of Velocities, relativistic variation of length, time and mass, Einstein's Mass-Energy Relation. **Compton effect:** Heisenberg's uncertainty principle and its applications; concept of phase and group velocity; wave function and Schrodinger equation-both time dependent and time independent; solution of Schrodinger equation in potential well, 3D- box and tunneling problems. **Free electrons in solids**: concept of density of states and Fermi energy, intrinsic and extrinsic semiconductors - carrier concentration and Fermi levels; Hall effect in metals and semiconductors, superconductivity: Meissner effect; concept of Cooper pairs, introduction to nano-structured materials; synthesis and properties.
Important Text Books/References	• Concepts of Modern Physics by Beiser (McGraw Hill) • Elements of Electromagnetics by Sadiku (Oxford University Press) • Introduction to Electrodynamics by Griffiths (Pearson) • Elements of Electromagnetics by Seth (Dhanpat Rai & Co.) • Engineering Physics by Joshi (Mc Graw Hill) • Solid State Physics by Wahab (Narosa) • Solid State Physics by Pillai (Wiley Eastern Ltd.) • Essentials of Engineering Physics by A. S. Vasudeva (S. Chand)

Code: CYT101	**Chemistry**	**Credit: 04** **L-T-P: (3-1-0)**
Course Content	**Chemistry of water and its treatment** : Introduction, Hardness, Degree of hardness, Determination of hardness by complexometric method (EDTA method) Municipal Water Supply: Requisites of drinking water, purification of water by Sedimentation, Filtration and disinfection methods. Water for steam Making: Sludge and scale formation and caustic embrittlement. Methods of Boiler Water Treatment: Lime Soda process (hot and cold lime soda process), Permutit or Zeolite process and Deionization or Demineralization. **Corrosion**: Introduction, theories of corrosion, Galvanic cell and concentration cell corrosion. Methods of protection against corrosion. **Lubricants**: Methods of lubrication, Uses and properties of lubricants viz. Viscosity & Viscosity index, Flash &fire point, Cloud and pour point. **Fuels and Non conventional energy sources**: Introduction and characteristics of Fuels. Solid Fuels: Gross and Net calorific values, Determination of calorific value by Bomb calorimeter and Junker's calorimeter . Liquid Fuels: Petroleum: Occurrence and composition, mining, refining and fractional distillation of crude petroleum, Cracking, Thermal and Catalytic cracking, synthetic	

	petrol and reforming. Knocking, Anti-knocking Agents, Octane number and Cetane number. Fuel Cell: Introduction to Fuel Cell, H2-O2 Fuel cell. **Explosives**: Introduction, Classification, Requisites of Explosives, Applications of Explosives. **New Engineering Materials**: Brief idea of Organic electronic materials and fullerenes. **Building materials**: Introduction, manufacture of cement and its chemistry. Refractory: Introduction, classification and requirements. Glass: Introduction, classification and types of glass. Numerical problems based on Water Treatment, Fuels and Non conventional energy sources.
Important Text Books/References	• Engineering chemistry: A Text book by S.K. Jain & K.D. Gupta, Jaipur Publishing House. • Engineering chemistry: A Text book by P.C. Jain, Dhanpat Rai & Sons. • Engineering chemistry: A Text book by S.S. Dara, S. Chand & Co.

Code: HST102	**Basic Economics**	**Credit: 03**
		L-T-P: (2-1-0)
Course Content	Basic Economic Concepts and foundations of economics for decision – making; circular flows Demand analysis and consumer behaviour; elasticity of demand and its measurement; supply analysis and price – mechanism. Production Analysis – short run and long run production functions; law of variable proportions and returns to scale. Cost Concepts and Analysis (short run and long run), Revenue curves under perfect and imperfect competition Break Even Analysis (revenue – cost –output relationship). Market Structures; pricing in perfect competition, monopoly, monopolistic competition and oligopoly. Economic Appraisal Techniques (pay - back period, NPV, IRR, cost - benefit ratio). Macro Economic Concepts such as national income, inflation, deflation, stagflation, monetary and fiscal policies, business cycles, foreign exchange rates and balance of payments	
Important Text Books/References	• Managerial Economics, H.C. Peterson, W. Cris Lewis & S.K.Jain; Prentice Hall. • Managerial Economics, Suma Damodran; Oxford University Press. • Managerial Economics, G.S. Gupta; Tata Mc Graw Hill. • Industrial Economics, An Introductory Text Book, R.R. Barthwal; New Age International (P) Limited. • Economics; Samuelson, Nordhaus; Tata Mc Graw Hill. • Managerial Economics, C.S. Barla,; National Publishing House, N. Delhi • Managerial Economics, N.D. Mathur; Shivam Book House (Pvt. Ltd.),Jaipur	

Code: HST101	Technical Communication	Credit: 02
		L-T-P: (1-2-0)
Course Content	**Objectives:** • To improve the students' key skills for effective communication including reading, listening, comprehending, speaking and composing through the lectures and tutorials. • With the increased number of smaller groups of students in the tutorials, the teaching methodology in the classroom is proposed to be more interactive so that at the end of the semester, the students are able to express themselves comfortably in English. • To assist the students in using language and literature to enhance and express their knowledge of technical, social and cultural issues. **Syllabus:** 1. **Reading and Comprehension**: Selected chapters from the prescribed textbook: Insights: A Course in English Literature and Language by K. Elango. Orient Blackswan Publishers, 2009. 2. **Writing and Composition**: Letters – Formal and Informal, Creative Writing, Précis Writing, Résumé, Projects on Social Issues 3. **Language Skills:** Common Errors, Prepositions, Tenses, Passive Voice, Conditional Sentences, Reported speech, Subject-Verb Agreement, Idioms and Proverbs, Vocabulary-building.	
Important Text Books/References	• Eastwood, John. Oxford Practice Grammar: Oxford University Press. • Murphy, Raymond. English Grammar in Use, Third Edition. Cambridge University Press. • Greenbaum, Sydney. Oxford English Grammar. Oxford University Press. • Carter, Ronald, Rebecca Hughes, Michael McCarthy. Exploring Grammar in Context - Upper Intermediate and Advanced. Cambridge University Press. • Hewings, Martin. Advanced Grammar in Use: A Self-study Reference and Practice Book. Cambridge University Press, 2005.	

Code: CET101	Computer Aided Engineering Drawing	Credit: 02
		L-T-P: (1-0-2)
Course Content	**Basic Concepts:-** Importance of drawing, Drawing standards, Types of Lines, Layout and printing of drawing, Principles and methods of dimensioning, Scaling **Introduction to AutoCAD** **Orthographic Projections:-** Introduction to different types of projections and their uses, Orthographic projection, I angle and III angle projections Projection of points lying in different quadrants, Projections of lines inclined to one or more planes, Traces, True length of line and its inclination with principal planes, Projection on auxillary plane.	

	Projection of planes other than reference planes, Planes perpendicular and inclined to principal planes, Traces, Cases of planes of different shapes and making different angles with one or both reference planes, True shape of the plane figure. Projection of regular solids and simple objects like tetrahedron, cube, polygonal prism and pyramid etc. Cases of solids placed in different positions with axis, faces and/or side of solids making given angles with reference planes. **Sections :-** Importance of sectioning, Principles and types of sectioning, Cutting plane representation, Sections of solids, Sectional views and true shape of sections, Hatching. **Development of Surfaces :-** Development of surface of simple and sectioned solids. **Method of drawing projections:-** Isometric and oblique projections Drawing of elements like screws, nuts and bolts, locking, welding and riveting joints and symbols
Important Text Books/References	• Engineering Drawing – P.S. Gil • Engineering Drawing – N.D. Bhatt • Engineering Drawing – P. Bali

Practical and Sessional Subjects

Code: HSP103	**Language Laboratory**	**Credit: 01** **L-T-P:(0-0-2)**
Course Content	**Objectives:** • To provide an opportunity to the students to improve their pronunciation and language skills through the Language Laboratory software. • To engage them in interactive exercises focusing on improving their communication skills and fluency in English. **Syllabus:** 1. Pronunciation Practice: Practice Phonetic Symbols (IPA) and Transcription on Language Laboratory Software 2. Language Skills: Practice in Common Errors, Prepositions, Tenses, Passive Voice, Conditional Sentences, Reported Speech, Subject-Verb Agreement, Idioms and Proverbs on Language Laboratory Software 3. Speaking Skills Practice: Self-presentation, Extempore, Just-a-Minute, Weave-a-Story, Elocution, Expansion of Themes, and Presentation of Projects	
Important Text Books/References	• Jones, Daniel. English Pronouncing Dictionary. ELBS. • Sethi, J., P.V. Dhamija. A Course in Phonetics and Spoken English. PHI Learning. • McKay, Matthew, Martha Davis, Patrick Fanning. Messages: The Communication Skills Book. New Harbinger Publications; Third Edition, 2009. • Mitra, Barun K. Personality Development and Soft Skills. Oxford University Press.	

Code: PHP102	Physics Lab	Credit: 01
		L-T-P:(0-0-2)
Course Content	The students shall complete at least **nine** experiments out of the following during the semester: 1. To study the Hall effect in a semiconductor and determine the Hall coefficient. 2. To determine the value of Planck's constant using a photo-cell. 3. To determine the band gap of a given semiconducting p-n junction diode (n or p type). 4. To determine the input, output and transfer characteristics of a given transistor (npn or pnp). 5. To study the I-H curve and hysteresis losses in a given magnetic material. 6. To study the variation of magnetic field along the axis of a uniform circular coil and also determine its diameter. 7. To study the temperature variation of resistivity using four probe method and determine the band gap of a given semiconductor. 8. To study the interference fringes in Fresnel's biprism and determine the wavelength of sodium light. 9. To study the diffraction spectra using a plane transmission grating and find the wavelength of light constituents. 10. To study the polarization of light using a biquartz polarimeter and determine the specific rotation of glucose solution. 11. To study the formation of Newton's rings and determine the wavelength of sodium light. 12. To determine the numerical aperture of a given optical fibre cable using a laser source. 13. To determine the dielectric constant of a given solid.	

Code: MEP102	Workshop Practice	Credit: 01
		L-T-P (0-0-2)
Course Content	1. **Machine Shop** -- 3 Turns a) Introduction to Lathe, Shaper, Drilling, Grinder, Milling machines -- 1 Turn b) Job on lathe machine--Simple Turning, Step turning, facing, Knurling,--2 Turns 2. **Welding Shop** -- 3 Turns a) Introduction to Gas, Arc and Spot Welding-- 1 Turn b) Job on Spark and Gas welding --2 Turns 3. **Foundry**-- 3 Turns a) Introduction to Oil , Electric Furnace, Foundry tools, Sand, etc-- 1 Turn b) Moulding Job --2 Turns 4. **Fitting Shop** -- 3 Turns a) Introduction to various Fitting tools, -- 1 Turn b) Job- Filing, Drilling, Tapping etc, --2 Turns	

Code: EEP102	Electrical Engineering Lab	Credit: 01
		L-T-P: (0-0-2)
Course Content	**LIST OF EXPERIMENTS:** PREREQUISITE: 1. The knowledge of electrical science lab. 2. The knowledge of the electric supply distribution system. 3. The knowledge of basic measuring instruments. 4. The knowledge of the behavior of the basic circuit elements R, L and C. **PART-A (PRACTICAL)** 1. To determine the inductance and effective resistance of the given choke coil. 2. To observe the operation of a given fluorescent lamp and determine its power factor. 3. To verify KCL and KVL for a given network on d.c supply. 4. To verify Thevenin's theorem for a given network. 5. To verify Norton's theorem for a given network. 6. To observe sinusoidal a.c. waveform on C.R.O. and to determine its frequency, time period, peak value, peak factor and form factor. **PART-B (STUDY)** 1. To study various electrical accessories. 2. To study various electrical wirings. 3. To study various electrical appliances. (Electric iron, immersion rod, table fan, ceiling fan etc.) 4. To study various electrical lamps (sodium vapour, mercury vapour, incandescent etc.)	

Code: CYP102	Chemistry Lab	Credit: 01
		L-T-P :(0-0-2)
Course Content	**List of Experiments** 1. To determine the percentage of available chlorine in given sample of bleaching Powder. 2. To determine hardness of Water by EDTA method. 3. To determine the total alkalinity of water. 4. To determine the amount of various oxidizing agents iodometrically. 5. Analysis of ores and alloys. (i) Estimation of copper in brass. (ii) Estimation of iron in plain carbon steel. (iii) Estimation of iron in Hematite ore. 6. Preparation of Bakelite polymer. 7. Synthesis of Nylon 66 8. Synthesis of Melamine. 9. Determination of Viscosity of an oil by Redwood Viscometer.	

	10. To carry out Conductometric titration.
Important Text Books/References	1. Laboratory Manual on engineering chemistry by S.K. Bhasin & Sudha Rani, Dhanpat Rai Publishing Company, New Delhi. 2. A text book of Practical chemistry by K.D. Gupta & K.K. Saxena University Press, Jaipur.

Code: CPP102	**Programming Lab**	**Credit: 01**
		L-T-P: (0-0-2)
Course Content		

Formula based

1. Wap to perform addition of two numbers.
2. Wap to perform operations of a calculator (all primitive operations '+', '-', '*', '/').
3. Wap to determine area and circumference of a circle.
4. Wap to calculate simple and compound interest when rate, principal and time is given.
5. Wap to interchange values of two variables using a third variable.
6. Wap to find out distance between two points e.g. (x1, y1) and (x2, y2).
   Distance=$\sqrt{(x2-x1)^2+(y2-y1)^2}$

IF-else

1. Wap to accept a year and find whether it is a leap year or not.
2. Wap to determine type of triangle (i.e. isosceles, equilateral or scalene) when three sides of it are given.
3. Wap to find largest of three numbers.
4. Wap to accept marks of a student in any three subjects and display his/her result (I /II /III / FAIL).
5. Wap to calculate amount of a telephone bill for the following criteria.

	Calls	charge per call (Rs.)
a)	1-150	0
b)	151-250	.9
c)	251-400	1.2
d)	401 on wards	1.5

6. Wap to calculate amount of a electricity bill for the following criteria.

	Units	charge per unit (Rs.)
a)	1-100	0
b)	101-200	1.5
c)	201-400	2.5
d)	401 on wards	3.5

Switch case

1. Wap to perform 5 basic arithmetic operations depending on what the user wants. Display a menu.
   a. '+' For addition
   b. '-' For subtraction
   c. '*' For multiplication
   d. '/' For division
   e. '%' For modulus.
2. Wap to take month no. input and display no. of days into that month.
3. Wap to take month no. input and display total no. of days into those months

LOOPING CONSTRUCTS (For, While, DO-while)

1. Print following series
   a. 1,2, ……..,n terms
   b. 1,3,5,7,…..n terms
   c. 2,4,6,8,…..n terms
   d. 1,2,4,7,11,…..n terms
   e. 0, 1, 1, 2, 3, 5, 8,….n terms(Fibonacci series)
2. Wap of find factorial of an integer no.
3. Wap to find whether a given no. is prime or not.
4. Wap to determine the area of 10 different circles.
5. Wap to read unsigned integer no. and print it in words
   Ex- 235(two three five).
6. Wap to find the sum of the digits of a given number.
7. Wap to check whether a given integer no. is palindrome or not.
8. Wap of find LCM and HCF of two numbers.

Array

1. Wap which reads a list of 'n' numbers and finds the largest of them.
2. Wap which reads a list of 'n' numbers and searches for a value.
3. Wap to perform bubble sorting (ascending /descending).
4. Wap which add/multiply two matrices A and B.
5. Wap which reads a character array and finds the length.
6. Wap which reads a string and find its length.
7. Wap to copy one string into another.
8. Wap which reads a string and reverses it.
9. Wap to concatenate two strings
10. Wap which read a string and test for palindrome.

Structures

1. Write a program to define a structure with tag book with fields author, book name and edition. Read and display the data. Also search for a given book by author name.
2. Write a program to define a structure with tag student with fields name, roll no and percentage. Define an array of 10 students and sort array on percentage.
3. Write a program to define a structure with tag complex no with fields real and imaginary. Perform addition, subtraction, and multiplication and division operation on them.

File Handling

1. Write a program to count the number of words from a file (read).
2. Write a program to store multiplication table of specific number into a file(write).
3. Write a program to copy a file from another file (read/write).

**The assignment list is not exhausted. More assignments may be added related to particular topic.

Code: ECP102	Electronics Engineering Lab	Credit: 01
		L-T-P :(0-0-2)
Course Content	**Introduction of Equipments:** 1. CRO 2. Function Generator 3. DMM/ Analog Multi-meter 4. Frequency meter 5. Power Supply **Introduction of Components:** 1. LED 2. Photo Diode 3. Capacitors 4. Resistors 5. IC Wave form display with CRO, Applications of CRO such as voltage and frequency measurement V-I characteristics of PN junction Diode V-I characteristics of Zener Diode Half Wave/ Full Wave Rectifiers Filters With Rectifiers Diode Clipper and Clamper Soldering Circuit Testing	