List of New Course(s) Introduced

Department : *Electronics and Communication Engineering*

Programme Name : *B.Tech.*

Academic Year : 2020-21

List of New Course(s) Introduced

Sr. No.	Course Code	Name of the Course
01.	EC05TPE02	CMOS Design
02.	EC05TPE03	Introduction to MEMS
03.	EC06TPE07	High Speed Devices & Cicuits
04.	EC06TPE08	Nanoelectronics
05.	EC06TOE04	Artificial Intelligence
06.		

विभागाध्यक्ष (इले. एवं संचार अभियांत्रिकी)
H.O.D. (Elect. & Comm. Engineering)
प्रौद्योगिकी संस्थान
Institute of Technology
गु. घा. वि., बिलासपुर (छ.ग.)
G. G. V. Bilaspur (C.G.)

Minutes of Meetings (MoM) of Board of Studies (BoS)

Academic Year: 2020-21

School : *School of Studies of Engineering and Technology*

Department : *Electronics and Communication Engineering*

Date and Time : *July 14, 2020 – 11:00 AM*

Venue : *Online Platform*

The scheduled meeting of member of Board of Studies (BoS) of Department of Electronics and Communication Engineering, School of Studies of Engineering and Technology, Guru Ghasidas Vishwavidyalaya, Bilaspur was held to design and discuss the B. Tech. Third year (V and VI semesters) scheme and syllabi.

The following members were present in the meeting:

1. Prof. Shrish Verma (External Expert Member BoS, Dept. of ECE, NIT Raipur)
2. Mr. Vikas Patel, (External Expert Member BoS, Senior SDE, BSNL Bilaspur)
3. Mrs. Anita Khanna (HOD, Assistant Prof., Dept. of ECE-cum Chairman, BOS)
4. Mr. Shrawan K. Patel (Member BoS, Assistant Professor, Dept. of ECE)
5. Mrs. Bhawna Shukla (Invited Member, Assistant Professor, Dept. of ECE)
6. Mrs. Beaulah Nath (Invited Member, Assistant Professor, Dept. of ECE)
7. Mr. Nipun Kumar Mishra(Invited Member, Assistant Professor, Dept. of ECE)
8. Dr. Soma Das (Invited Member, Assistant Professor, Dept. of ECE)
9. Mr. Sumit Kumar Gupta (Invited Member, Assistant Professor, Dept. of ECE)
10. Mrs. Praveena Rajput (Invited Member, Assistant Professor, Dept. of ECE)
11. Mrs. Nikita Kashyap (Invited Member, Assistant Professor, Dept. of ECE)
12. Dr. Anil Kumar Soni (Invited Member, Assistant Professor, Dept. of ECE)
13. Mr. Chandan Tamrakar (Invited Member, Assistant Professor, Dept. of ECE)

Following points were discussed during the meeting

1. New CBCS based evaluation scheme of B. Tech. Third year (V and VI semesters) was discussed and finalized.
2. Courses of B. Tech. Third year (V and VI semesters) are discussed one by one and the changes have been incorporated as per the valuable suggestions of Expert member.

The committee discussed and approved the scheme and syllabi. The following courses were revised in the of B. Tech. Third year (V and VI semesters):

- Electromagnetic Waves (EC05TPC08)
- Computer Network (EC05TPC09)
- Control Systems (EC05TPC11)
- Computer Architecture (EC05TPE04)
- Information Theory & Coding (EC05TPE01)
- Data Structure & Algorithms (EC05TOE01)
- Digital Signal Processing (EC06TPC12)
- Probability Theory and Stochastic Processes (EC06TPC13)
- Antenna & Wave Propagation (EC06TPE05)
- Power Electronics (EC06TPE06)

The following new courses were introduced in the of B. Tech. Third year (V and VI semesters):

- EC05TPE02 CMOS Design
- EC05TPE03 Introduction to MEMS
- EC06TPE07 High Speed Devices & Circuits
- EC06TPE08 Nanoelectronics
- EC06TOE04 Artificial Intelligence

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Signature & Seal of HoD

Scheme and Syllabus

SCHEME OF EXAMINATION
B.TECH (FOUR YEAR) DEGREE COURSE
THIRD YEAR, ELECTRONICS & COMMUNICATION ENGINEERING
SCHOOL OF ENGINEERING & TECHNOLOGY, GGVV BILASPUR (CG) 495009
EFFECTIVE FROM SESSION 2020-21
SEMESTER V (THIRD YEAR)

Sr. No.	Course Code	Course Title	L	T	P	Periods/ week	Evaluation Scheme			Credit
							IA	ESE	Total	
Theory										
1	EC05TPC08	Electromagnetic Waves	3	1	0	4	30	70	100	4
2	EC05TPC09	Computer Network	3	0	0	3	30	70	100	3
3	EC05TPC10	LIC and its Application	3	0	0	3	30	70	100	3
4	EC05TPC11	Control Systems	3	1	0	4	30	70	100	4
5	EC05TPE01 EC05TPE02 EC05TPE03 EC05TPE04	Program Elective – 1 • Information Theory & Coding • CMOS Design • Introduction to MEMS • Computer Architecture	3	0	0	3	30	70	100	3
6	EC05TOE01 EC05TOE02	Open Elective-1 • Data Structure & Algorithms • Operating Systems	3	0	0	3	30	70	100	3
Practical										
1	EC05PPC06	Electromagnetic Waves Lab	0	0	2	2	30	20	50	1
2	EC05PPC07	Computer Networks Lab	0	0	2	2	30	20	50	1
3	EC05PPC08	LIC and its Application Lab	0	0	2	2	30	20	50	1
									Total Credits	23

SEMESTER VI (THIRD YEAR)

Sr. No.	Course Code	Course Title	L	T	P	Periods/ week	Evaluation Scheme			Credit
							IA	ESE	Total	
Theory										
1	EC06TPC12	Digital Signal Processing	3	1	0	4	30	70	100	4
2	EC06TPC13	Probability Theory and Stochastic Processes	3	0	0	3	30	70	100	3
3	EC06TPE05 EC06TPE06 EC06TPE07 EC06TPE08	Program Elective – 2 • Antenna & Wave Propagation • Power Electronics • High Speed Devices & Circuits • Nanoelectronics	3	1	0	4	30	70	100	4
4	EC06TOE03 EC06TOE04	Open Elective-2 • Cryptography & Network Security • Artificial Intelligence	3	0	0	3	30	70	100	3
5	EC06TBS07	Life Science	3	0	0	3	30	70	100	3
Practical										
1	EC06PPC09	Digital Signal Processing Lab	0	0	2	2	30	20	50	1
2	EC06PPC10	Electronic Measurement Lab	0	0	2	2	30	20	50	1
3	EC06PPC11	Mini Project/Electronic Design workshop	0	0	4	4	30	20	50	2
									Total Credits	21

L : LECTURE T: TUTORIAL P: PRACTICALIA: INTERNAL ASSESSMENT ESE: END SEMESTER EXAM

Sub Code	L	T	P	Duration	IA	ESE	Credits
EC05TPE02	3	0	0	3 hours	30	70	3

CMOS DESIGN

Course Objectives:

- Impart knowledge of MOS transistor theory and CMOS technologies.
- Impart knowledge on architectural choices and performance tradeoffs involved in designing and realizing the circuits in CMOS technology. study of VHDL language

Unit I: FUNDAMENTALS OF MOSFETS: Introduction to MOS transistor, basic operation, threshold voltage ,V-I characteristic ,Depletion MOSFET ,trans conductance, PMOS and its V-I characteristic, aspect ratio and its implication, channel length modulation, substrate bias effect, electrical parameters of MOSFETS.

Unit II: CMOS INVERTER: Introduction, ideal inverter, Logic level standards, VTC of inverter, Noise margin, Basic NMOS inverter, CMOS inverter, design technique, inverter switching characteristic, delay times, transient effects, power dissipation, introduction to bi-CMOS inverter

Unit III: STATIC AND DYNAMIC LOGIC CIRCUITS: Introduction, Various Static CMOS logic gate design ,Pseudo-nMOS gates ,pass transistor logic, transmission gates, tristate buffer, dynamic logic, Evaluate logic, Domino CMOS logic, Non ideal effects of dynamic logic circuits

Unit IV: SEQUENTIAL AND COMBINATIONAL CIRCUITS: Types of regenerative circuits, bi-stability principle, basics S-R flip flop, JK flip-flop, Master slave Flip Flop, D latch, Static Vs Dynamic latch ,memory system, types of semiconductor memory, Dynamic RAM, Static RAM.

Unit V: INTRODUCTION TO VHDL: Introduction and use of VHDL, Entity and Architecture Declaration, Types of Models of Architecture, Data objects, Data types, Operators ,concurrent and sequential statements, process statements, case ,if, when statements ,Design of sequential and combinational circuits.

Text/References books:

1. Douglas A. Pucknell & Kamran Eshraghian "Basic VLSI Design", PHI 3rd Edition.
2. Neil H.E. Weste, David Harris, Ayan Banerjee, "CMOS VLSI Design-A Circuits and Systems Perspective", Pearson Education 3rd Edition.
3. J Bhaskar, "A VHDL Primer", Pearson Publication.
4. Brow and Varsenic "Fundamentals of VLSI Design Techniques with VHDL" MGH Publication.
5. Angsuman Sarkar and Swapandip De, "VLSI design and EDA tools", SCITECH Publication.

Course outcomes:

At the end of this course, students will demonstrate the ability:

- To introduce the concept of VLSI.
- To introduce the concept of MOS fabrication, MOS design and different MOS circuits.
- To introduce the concept of VHDL.

Sub Code	L	T	P	Duration	IA	ESE	Credits
EC05TPE03	3	0	0	3 hours	30	70	3

INTRODUCTION TO MEMS

Course Objectives:

- To provide knowledge of semiconductors and solid mechanics to fabricate MEMS devices.
- To educate on the rudiments of Micro fabrication techniques.
- To introduce various sensors and actuators
- To introduce different materials used for MEMS
- To educate on the applications of MEMS to disciplines beyond Electrical and Mechanical engineering.

Unit I: Introduction : Intrinsic Characteristics of MEMS – Energy Domains and Transducers- Sensors and Actuators – Introduction to Micro fabrication – Silicon based MEMS processes – New Materials – Review of Electrical and Mechanical concepts in MEMS – Semiconductor devices – Stress and strain analysis – Flexural beam bending- Torsional deflection.

Unit II: Sensors and Actuators-I : Electrostatic sensors – Parallel plate capacitors – Applications – Interdigitated Finger capacitor – Comb drive devices – Micro Grippers – Micro Motors – Thermal Sensing and Actuation – Thermal expansion – Thermal couples – Thermal resistors – Thermal Bimorph – Applications – Magnetic Actuators – Micromagnetic components – Case studies of MEMS in magnetic actuators- Actuation using Shape Memory Alloys.

Unit III : Sensors And Actuators-II: Piezoresistive sensors – Piezoresistive sensor materials – Stress analysis of mechanical elements – Applications to Inertia, Pressure, Tactile and Flow sensors – Piezoelectric sensors and actuators – piezoelectric effects – piezoelectric materials – Applications to Inertia , Acoustic, Tactile and Flow sensors.

Unit IV: Micromachining: Silicon Anisotropic Etching-Anisotrophic Wet Etching-Dry Etching of Silicon – Plasma Etching – Deep Reaction Ion Etching (DRIE)-Isotropic Wet Etching-Gas Phase Etchants – Case studies –Basic surface micro machining processes-Structural and Sacrificial Materials – Acceleration of sacrificial Etch – Striction and Antistriction methods – LIGA Process - Assembly of 3D MEMS – Foundry process.

Unit V: Polymer and Optical MEMS: Polymers in MEMS– Polimide - SU-8 - Liquid Crystal Polymer (LCP) – PDMS – PMMA – Parylene – Fluorocarbon - Application to Acceleration, Pressure, Flow and Tactile sensors- Optical MEMS – Lenses and Mirrors – Actuators for Active Optical MEMS.

Text books:

1. Chang Liu, 'Foundations of MEMS', Pearson Education Inc., 2012.
2. Stephen D Senturia, 'Microsystem Design', Springer Publication, 2000.
3. Tai Ran Hsu, "MEMS & Micro systems Design and Manufacture" Tata McGraw Hill, New Delhi, 2002.

Sub Code	L	T	P	Duration	IA	ESE	Credits
EC06TPE07	3	1	0	4 hours	30	70	4

HIGH SPEED DEVICES & CIRCUITS

Course Objectives:

- To understand the Challenges and concepts of High Speed Electronics.
- To understand the Electronic Materials structure and working principles useful for high speed device.
- To understand the concept of MESFET and Hetero Junctions in High Speed Devices and Electronics.

Unit I: Introduction: Requirement of High speed devices, circuits in Electronics; Classification and Properties of Compound Semiconductors, Ternary Compound Semiconductors and their Applications.

Unit II: Crystal Structures of GaAs, Dopants and Impurities in GaAs and InP, Brief overview of GaAs technology for High speed transistors, Epitaxial techniques, Molecular Beam Epitaxy, Liquid Phase Epitaxy.

Unit III: Metal Semiconductor contacts for MESFET-details, Ohmic contacts on Semiconductors.

Unit IV: MESFET operation and I-V Characteristics, Shockley's Model, Velocity Saturation Effect, Drain Current Saturation, Self-aligned MESFET-SAINT.

Unit V: Hetero Junctions, High Electron Mobility Transistor(HEMT), Heterojunction Bipolar Transistor (HBT)

Text/Reference Books:

1. S K Ghandhi, VLSI Fabrication Principles, 2nd Edition, Wiley India Pvt Ltd
2. C Y Chang & F Kai, GaAs High Speed Devices: Physics, Technology and Circuit Applications, Wiley, NY, 1994
3. H Beneking, High Speed Semiconductor Devices: Circuit aspects and fundamental behavior, Chapman and Hall, London, 1994
4. S M Sze, High Speed Semiconductor Devices, Wiley, 1990
5. Michael Shur, GaAs Devices and Circuits, Springer

Course Outcomes:

At the end of the course, students will demonstrate the ability to:

- Understand modern day electronic materials structures, properties required and concepts.
- Understand the VLSI Techniques and their Modifications required for High speed electronics.
- Understand the concept of Hetero-junction transistors

Sub Code	L	T	P	Duration	IA	ESE	Credits
EC06TPE08	3	1	0	4 hours	30	70	4

NANO ELECTRONICS

Course Objectives:

- To learn and understand basic and advance concepts of nanoelectronics.
- To introduce the Nanoelectronics & nano devices,
- To identify quantum mechanics behind nanoelectronics.
- To describe the principle and the operation of nanoelectronic
- To introduce basic theory of Metal Semiconductor Contacts, construction and operation of BJT and MOSFET and basic theory, operation and structure and scaling of MOS transistors.

Unit I: INTRODUCTION TO NANO- ELECTRONICS: The "Top-Down" Approach, Lithography, The "Bottom- Up" Approach, Why Nano electronics? Nanotechnology Potential, MESO structures.

Unit II: QUANTUM MECHANICS OF ELECTRONS: General Postulates of Quantum Mechanics Operators: Eigen values and Eigen functions, Hermitian Operators, Operators for Quantum Mechanics, Measurement Probability, Time Independent Schrodinger equation: Boundary Conditions on the Wave function.

PARTICLE STATISTICS AND DENSITY OF STATES: Density of States, Density of States in Lower Dimensions, Density of States in a Semiconductor, Particle in a box Concepts, Degeneracy.

Unit III: ELECTRONS SUBJECT TO A PERIODIC POTENTIAL-BAND THEORY OF SOLIDS: Crystalline Materials, Electrons in a Periodic Potential, Kronig Penney Model of Band Structure: Effective Mass, Brillouin Zones. Band Theory of Solids, Doping in Semiconductors, Interacting Systems Model, The Effect of an Electric Field on Energy Bands, Band structures of Some Semiconductors, Electronic Band Transitions Interaction of Electromagnetic Energy and Materials, Carbon Nano tubes.

Unit IV: COULOMB BLOCKADE AND THE SINGLE-ELECTRON TRANSISTOR: Coulomb Blockade: Coulomb Blockade in a Nanocapacitor, Tunnel Junctions, Tunnel Junction Excited by a Current Source, Coulomb Blockade in a Quantum Dot Circuit, Resonant Tunneling Diode, The Single-Electron Transistor : Single-Electron Transistor Logic, Other SET and FET Structures : Carbon Nanotube Transistors (FETs and SETs), Semiconductor Nanowire FETs and SETs, Molecular SETs and Molecular Electronics, 2D semiconductors and electronic devices, Graphene, atomistic simulation.

Unit V: Shrink-down approaches of Transistors: Introduction, CMOS Scaling, The nanoscale MOSFET, FinFETs, Vertical MOSFETs, limits to scaling, system integration limits (interconnect issues etc.).

Sub Code	L	T	P	Duration	IA	ESE	Credits
EC06TOE04	3	0	0	3 hours	30	70	3

ARTIFICIAL INTELLIGENCE

Course Objectives:

- Students will develop a basic understanding of the building blocks of AI as presented in terms of intelligent agents.
- Students to understand the main approaches to artificial intelligence such as heuristic search, game search, logical inference, decision theory, planning, machine learning, neural networks and natural language processing.

Unit I: Introduction of Artificial Intelligence(AI), Difference between Intelligence and Artificial Intelligence, Definitions of AI, Strong AI and Weak AI, Application areas of AI, Comparison of Conventional and AI Computing, History of AI, Turing Test, Branches of AI, Intelligent Agents, State Space Representation, Production System, Heuristic Search, Search Methods (Uninformed Search and Informed Search), Breadth First Search, Depth First Search, Difference between Breadth First Search and Depth First Search, Hill Climbing, Best First Search.

Unit II: Role of Knowledge Representation in AI, Types of Knowledge, Properties of Knowledge Representation System, Categories of Knowledge Representation Scheme, First Order Predicate Calculus, Well Formed Formula in Predicate Logic, Conversion to Clausal Form, Resolution in Predicate Logic, Semantic Nets, Properties of Semantic Nets, Frames, Scripts, Advantages and Disadvantages of Scripts.

Unit III: Introduction of Expert System, Comparison between Human Expert and Expert System, Comparison between Expert System and Software System, Difference between Knowledgebase and Database, Basic Components of an Expert System, Characteristics of Expert System, Life Cycle Development of Expert System, Advantages of Expert System, Limitation of Expert System, Expert System Tools, Existing Expert Systems (DENDRAL and MYCIN).

Unit IV: Introduction to LISP : Syntax and Numeric Functions, Working with GNU CLISP, Basic Data Objects in GNU CLISP, Basic List Manipulation Functions in GNU CLISP (setq, car, cdr, cons, list, append, last, member, reverse), User Defined Functions in GNU CLISP, Predicates (atom, equal, evenp, numberp, oddp, zerop, >=, <=, listp, null) and Conditionals (cond and if) in GNU CLISP, Logical Functions (not, or, and) in GNU CLISP, Input / Output and Local Variables (read, print, princ, terpri, format, let, prog) in GNU CLISP, Recursion and Iteration(do) in GNU CLISP, Arrays in GNU CLISP.

Unit V: Introduction to PROLOG, Term, Ground Term, Function, Predicate, Features of PROLOG, Program Clause, Unit Clause, Logic Program, Goal Clause, Empty Clause, Simple Query, Conjunctive Query, Structure of PROLOG Program, Working with SWI-Prolog General Syntax of PROLOG, Execution of a Query in Logic Program (Ground Query and Non-Ground Query),