1.2.1

List of New Courses Introduced with Course Contents

Colour Codes		
Employability Contents	**Green**	
Entrepreneurship Contents	**Light Blue**	
Skill Development Contents	**Pink**	
Name of the Subjects/Related to all three Components (Employability/ Entrepreneurship/ Skill Development)	**Yellow**	

List of New Courses

Department : *Pure and Applied Physics*

Program Name : *M.Sc. (Electronics)*

Academic Year : 2021-22

List of Revised Courses

Sr. No.	Course Code	Name of the Course
01.	PEPATT1	Mathematical Techniques for Electronics
02.	PEPALT2	Semiconductor Materials & Devices Lab
03.	PPPALT3	Analog and Digital Electronics Lab
04.	OPNPET1	Applications of Nanotechnology in Electronics
05.	OPNPEL1	Applications of Nanotechnology in Electronics Lab
06.	PEPBTT2	IC Fabrication and VLSI Technology
07.	PEPBTT3	Microprocessors and Microcontrollers
08.	PEPBLT3	Microprocessors and Microcontrollers Lab
09.	PEPBLD1	Analog and Digital Communication System Lab

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

Academic Year : 2021-22

School : *School of Physical Sciences*

Department : *Pure and Applied Physics*

Date and Time : *March 10, 2022 – 02:00 PM*

Venue : *Smart Class Room*

The scheduled meeting of member of Board of Studies (BoS) of Department of Pure and Applied Physics, School of Studies of Physical Sciences, Guru Ghasidas Vishwavidyalaya, Bilaspur, was held to design and discuss the M. Sc. (Electronics), scheme and syllabi.

The following members were present in the meeting:

1. Dr. M. N. Tripathi
2. Prof. P. K. Bajpai
3. Prof. D. C. Gupta, External Member (Professor & Head, School of Studies in Physics, Jiwaji University, Gwalior)
4. Dr. A. K. Singh
5. Mr. P. Rambabu
6. Dr. R. P. Patel
7. Dr. M. P. Sharma

The committee discussed and approved the scheme and syllabi. The following courses were revised in the M. Sc. (Electronics):

- Semiconductors Materials & Devices
- Analog and Digital Electronics
- Electromagnetic theory and Wave Propagation
- Advanced Communication System-1

The following new courses were introduced in the M. Sc. (Electronics):

- Mathematical Techniques for Electronics
- Semiconductors Materials & Devices Lab
- Analog and Digital Electronics Lab
- Applications of Nanotechnology in Electronics
- Applications of Nanotechnology in Electronics Lab
- IC Fabrication and VLSI Technology
- Microprocessors and Microcontrollers
- Microprocessors and Microcontrollers Lab
- Analog and Digital Communication System Lab

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Signature & Seal of HoD

Scheme and Syllabus

Course Structure
M.Sc. Electronics Syllabus 2021-22

Sem	Course Opted	Course Code	Name of the course	Credit	L:T:P	Internal	External	Total
I	Core-1	PEPATT1	Mathematical Techniques for Electronics	5	4+1+0	30	70	100
	Core -2	PEPATT2	Semiconductors Materials & Devices	3	3+0+0	30	70	100
		PEPALT2	Semiconductors Materials & Devices Lab	2	0+0+2	30	70	100
	Core -3	PEPATT3	Analog and Digital Electronics	3	3+0+0	30	70	100
		PPPALT3	Analog and Digital Electronics Lab	2	0+0+2	30	70	100
	Open Elective		Opted from the pool and offered by other departments	5	5+0+0	30	70	100
	Other if any*							
			TOTAL	**20**				**600**
		Open Elective offered by the Department						
	Open Elective	OPNPET1	Applications of Nanotechnology in Electronics	3	3+0+0	30	70	100
		OPNPEL1	Applications of Nanotechnology in Electronics Lab	2	0+0+2	30	70	100
II	Core-4	PEPBTT1	Electromagnetic theory and Wave Propagation	5	4+1+0	30	70	100
	Core -5	PEPBTT2	IC Fabrication and VLSI Technology	5	4+1+0	30	70	100
	Core -6	PEPBTT3	Microprocessors and Microcontrollers	3	3+0+0	30	70	100
		PEPBLT3	Microprocessors and Microcontrollers Lab	2	0+0+2	30	70	100
	Discipline Specific Elective 1	PEPBTD1	Advanced Communication System-1	3	3+0+0	30	70	100
		PEPBLD1	Analog and Digital Communication System Lab	2	0+0+2	30	70	100
	Other if any*							
			TOTAL	**20**				**900**
III	Core-7	PEPCTT1	Power Semiconductor Devices and Control System	5	4+1+0	30	70	100
	Core-8	PEPCTT2	Sensors and Transducers	5	4+1+0	30	70	100
	Core-9	PEPCTT3	Optoelectronics Devices	3	3+0+0	30	70	100
		PEPCLT3	Optoelectronics Devices Lab	2	0+0+2	30	70	100
	Research Methodology	PEPCTR1#	Research Methodology in Electronics	2	2+0+0	30	70	100
	Discipline Specific elective 2	PEPCTD1	Advanced Communication System-2	3	3+0+0	30	70	100
		PEPCLD1	Advanced Communication System-2 Lab	2	0+0+2	30	70	100
	*Certificate/ FC/UEC			2		30	70	100
	Other if any							
			TOTAL	**22+2***				**700**
IV	Major Project Work With Dissertation	PEPDD01#	Major Project Work With Dissertation	12		30	70	100
	Industrial Training (Internship)	PEPDE01#	Industrial Training in the fields Related to the Programme with Project Report	08		30	70	100
			TOTAL	**20**				**200**

Semester - I

Core -1: Mathematical Techniques for Electronics

Course Code: PEPATT1

Credits = 5 (4+1+0)

Course Objectives:

- Create deep interest in learning mathematics techniques.
- To offer a gentle introduction to the concepts of Laplace transforms, Inverse Laplace transforms, solution of ordinary differential equations using Laplace transform, Fourier series and their properties with applications in real life.

Course outcomes:

The student after undergoing this course will be able to:

- Analyze, identify and solve the problem using Laplace Series.
- Analyze, identify and solve the problems using Fourier Series
- Apply -Transforms, Inverse Z-Transforms and solve Difference Equations.
- To apply the application of Mathematics in Electronics.

Unit I: Laplace Transform: Definition and Properties, Laplace Transform derivatives and integrals, Evaluation of differential equations using Inverse Laplace Transform, Applications of Laplace Transform , Fourier Series & Transform: Definition and Properties, Fourier series in the Interval, Uses of Fourier Series,Fourier sine and cosine transform of Derivatives, Finite Fourier Transform,

and Applications of Fourier Transform.

Unit II: Partial differential equations: Homogeneous and non-homogeneous boundary conditions, Solutions by separation of variables and series expansion methods. Laplace, wave and diffusion equations in various coordinate systems. Integral equations: methods and solutions,

Unit III: Mathematical Transforms: Discrete time signal analysis and linear systems , Sampling theorem and applications , Sampling of continuous time signals. z-transform, inverse z-transform, Digital Filters: signal flow graph representation, basic structures for IIR and FIR filters, noise in digital filters, filter design techniques, Transforms: Discrete Fourier Transform (DFT) , properties and Fast Fourier Transforms (FFT)

Unit IV: Mathematical tool for Electrical circuits; Superposition, Thevenin, Norton and Maximum Power Transfer Theorems, Network elements, Network graphs, Nodal and Mesh analysisTime and frequency domain response, Passive filters, Two-port Network Parameters : Z, Y, ABCD and h parameters, Transfer functions, Signal representation, State variable method of circuit analysis, AC circuit analysis, Transient analysis, Zero and Poles, Bode Plots.

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Reference Books:

1. Advanced Engineering Mathematics : E Kreyszig (John Wiley & Sons)
2. Higher Engineering Mathematics : Dr. B.S. Grewal, Khanna Publishers, New Delhi.
3. Advanced Engineering Mathematics: H. K. Das, S.Chand&company Ltd.
4. Theory and Application of Digital Signal Processing: L. R. Rabiner and B. Gold, Prentice Hall.
5. Introduction to Digital Signal Processing: J.R. Johnson, Prentice Hall.
6. Industrial Control Electronics – Applications and Design, Michael Jacob Prentice Hall

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Core -2: Semiconductor Materials and Devices Lab

Course Code: PEPALT2

Credits = 2 (0+0+2)

Name of the experiments

1. Measurement of resistivity of sample at various temperatures by four probe method.
2. To calculate the energy band gap of given semiconductor sample.
3. To study the Hall Effect: determine the Hall coefficient, type of semiconductor and carrier concentration in the given semiconductor sample
4. I-V characteristics measurement of a p-n diode/Schottky diode calculate its device Parameters.
5. To study the performance of solar cell.
6. To study characteristics of JFET and its application as switch.
7. To study characteristics of MOSFET and its application.

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Core - 3: Analog and Digital Electronics Lab

Course Code: PEPALT3

Credits = 2 (0+0+2)

Name of the experiments

1. Design some combinational circuits using NAND & NOR Gate.
2. Design circuit Using IC 7400 and 7402 to verify.
3. Study characteristics of FET and MOSFET.
4. Study characteristics of Colpit's oscillator.
5. Experiment based on Operational Amplifier (like adder, subtractor and Others)
6. To Study the characteristics of op- amp as Inverting and non inverting.
7. To Study the characteristics of op- amp as Schmitt trigger & Comprator.
8. Study and designs flip flop.
9. Study and designs of A/D & D/A Convertor.

References:

1. Millman's Integrated Electronics - Analog and Digital Circuit and Systems.
2. Digit al Principles & Application: Malvino& Leach.
3. Digit al electronics: R.P. Jain.

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Open Elective: Applications of Nanotechnology in Electronics

Course Code: OPNPET1

Credits = 3 (3+0+0)

Course Objectives

- Foundation knowledge of the nanoscience field
- To bring out the distinct properties such as electronic, optical properties of nanostructures
- To make the students acquire an understanding the nanomaterials and their applications

Learning Outcomes

Upon successful completion of this course, students will be able to address following points:

- Learn about the distinct properties of nanomaterials
- Understand the principles of nanomaterial characterization techniques
- Describe the principle and operation of nanomaterial-based devices

Unit – I: Definition of Nano-science and nano technology, History of nanoscience, Energy band-gap in semiconductors, Fermi level, Donors, acceptors and deep traps, Excitons, Mobility, Conduction electrons, density of states, Zero dimensional (0D), one dimensional (1D) , two dimensional (2D) , three dimensional (3D), Nano-structured materials, Influence of nano over micro/macro.

Unit – II: Properties of Nanomaterials: Size dependence of properties, Optical: Absorption, transmission, Photoluminiscence, Fluoroscence, Phosphorescence, Surface Plasmon Resonance, effect of size of nano particles. Electrical: Conduction mechanisms in 3D (Bulk), 2D (Thin film) and Low dimensional systems.

Unit – III: Type of Nanomaterials: different type of nano materials,Carbon nanotube, Fullerene, Type of CNT: SWNT (Single wall nano tube), Multi wall nano tubes, Graphite and Graphene, metal nano particle silver and gold, ZnO and TiO_2 metal oxides, Semiconductors, Nano-composites,Creating nanoparticles by using software.

Unit – IV: Synthesis of nanomaterials: Combustion method, Sol-gel method, Co-precipitation method. Characterization tools for nanomaterials: X-Ray Diffraction, UV-VIS Spectrophotometer, Spectrofluorophotometer, Scanning Electron Microscopy, Transmission Electron Microscopy.

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Reference Books:

1. Introduction to Nanotechnology, Charles P. Poole, Jr., Frank J. Owens, Wiley India (P)Limited New Delhi.
2. Nanoscience and Nanotechnology, K.K. Chattopadhyay, A.N. Banerjee, PHI Learning Private Limited, New Delhi.
3. Understanding of Nano Science and Technology, PoorviDutta, Sushmita Gupta, Global Vision Publishing House, New Delhi.
4. Nanotechnology, WM Breck, CBS Publishers & Distributors Pvt Ltd, New Delhi.
5. Optical Imaging and Microscopy (Techniques and Advanced Systems), Peter Török, Fu-Jen Kao, Springer Publication.

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Open Elective: Applications of Nanotechnology in Electronics Lab

Course Code: OPNPEL1

Credits = 2 (0+0+2)

Name of the experiments

1. To calculate the energy bandgap of nanoparticle from UV-VIS spectra.
2. To measure the average crystallite size using XRD data of a given nanomaterial.
3. Estimation of lattice strain in nanoparticle by XRD pattern.
4. To calculate the grain size of a material fromSEM micrograph.
5. To analyse the absorption and emission spectrum of a given material.
6. Synthesis of nanomaterial by combustion method.

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Semester – II

Core -5: IC Fabrication and VLSI Technology

Course Code: PEPBTT2

Credit: 5 (4+1+0)

Course Objectives:

The course aims to develop an understanding of:

- Know the physics of semiconductor junctions, metal-semiconductor junctions and metal-insulator-semiconductor junctions.
- Know the physics and application of semiconductor hetero junctions and quantum-confined structures.
- Understand the fundamental principles and applications of modern electronic and optoelectronic semiconductor devices

Learning Outcomes:

Upon successful completion of this course, students will be able to address following points:

- To get understanding of device fabrication methods
- Understands the VLSI technology
- Understanding the IC Technology

Unit – I: Clean room technology - Clean room concept – Growth of single crystal Si , surface contamination, cleaning & etching. (Laboratory Practices : Cleaning of p-type & n-type Si-wafer by solvent method & RCA cleaning) Oxidation – Growth mechanism and kinetic oxidation, oxidation techniques and systems, oxide properties, oxide induced defects, charactrisation of oxide films, Use of thermal oxide and CVD oxide; growth and properties of dry and wet oxide, dopant distribution, oxide quality; (Laboratory Practices : Fabrication of MOS capacitor)

Unit – II: Solid State Diffusion – Fick's equation, atomic diffusion mechanisms, measurement techniques, diffusion in polysilicon and silicon di-oxide diffusion systems. Ion implantation – Range theory, Equipments, annealing, shallow junction, high energy implementation. Lithography – Optical lithography, Some Advanced lithographic techniques. Physical Vapour Deposition – APCVD, Plasma CVD, MOCVD. Metallisation - Different types of metallisation, uses & desired properties. VLSI Process integration.

Unit – III: Materials For Integrated Circuits and Fabrication Technology: Classification of IC's, Electronic grade silicon, Silicon shaping lapping polishing and wafer preparation, Vapour phase epitaxy, Molecular beam epitaxy, Optical lithography, Photomask, Photoresist and process, Limitation of optical Lithography, Idea of electron and X-ray Lithography, Wet chemical etching, reactive plasma etching.

Unit – IV: Microelectronic Fabrication: Fabrication of mono lithic diodes, Fabrication of integrated transistors, idea of burried layer fabrication, Monolithic circuit layout and design rule, Isolation methods, Monolithic FET, MOSFET, Processing idea of HEMT (High Electron Mobility transistor), CCD, MOS integrated circuit, Large and medium scale integrated, Hybrid Integrated circuit.

Reference Books:

1. Integrated Electronics : Milliman and Taub
2. Microelectronics : Milliman and Gros
3. Thin film Phenomenon : K.L. Chopra
4. Hand Books Of Thin Film : Marshe l and Gland
5. Physics of Semiconductor devices : Michel Shur
6. IC Fabrication : J. A. Ellcott
7. Semiconductor Devices Physics and Technology, Author: Sze, S.M.; Notes: Wiley, 1985
8. An Introduction to Semiconductor Microtechnology, Author: Morgan, D.V., and Board, K
9. The National Technology Roadmap for Semiconductors , Notes: Semiconductors Industry Association, SIA, 1994
10. Electrical and Electronic Engineering Series VLSI Technology, Author: Sze, S.M. Notes: McgrawHill International Editions

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Core -6: Microprocessors and Microcontrollers

Course Code: PEPBTT3

Credit: 3 (3+0+0)

Course Objectives:

The course aims to develop an understanding of:

- The difference between microprocessor and microcontrollers
- Their architecture including designed, memory organizing, addressing modes, timing
- Data moving and transferring
-

Learning Outcomes:

After completion of this syllabus, students are able to understand:

- The difference between microprocessor and microcontrollers and their architecture.
- To write the programs and load the data on registers and perform the arithmetic and logical operations.

Unit – I: 8086 Architecture and Programming: 8086 Architecture – Min.Mode, Max.Mode – Software Model – Segmentation – Segmentation of address – Pipe line Processing. Addressing Modes – Instruction Set- Constructing Machine Code – Instruction Templates for MOV Instruction– Data Transfer Instructions– Arithmetic, Logic, Shift, rotate instructions Flag Control instructions- Compare, Jump Instructions– Loop and String instructions -Assembly programs- Block move, Sorting, Averaging, Factorial – Code Conversion : Binary to BCD, BCD to Binary.

Unit – II: 8051 Microcontroller Hardware Introduction – Features of 8051 – 8051 Microcontroller Hardware : Pin-out of 8051, Central Processing Unit (CPU), Internal RAM, Internal ROM, Register set of 8051 – Memory organization of 8051 – Input / Output pins, Ports and Circuits – External data memory and Program memory : External program memory, External data memory.

Unit – III: 8051 Instruction Set And Assembly Language Programming Addressing modes – Data moving (Data transfer) instructions : Instructions to Access external data memory, external ROM / program memory, PUSH and POP instructions, Data exchange instructions – Logical instructions : byte and bit level logical operations, Rotate and swap operations – Arithmetic instructions : Flags, Incrementing and decrementing, Addition, Subtraction, Multiplication and division, Decimal arithmetic – Jump and CALL instructions : Jump and Call program range, Jump, CALL and subroutines – Programming.

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Unit – IV: Interfacing to External World Interfacing keyboard: Simple keyboard interface, Matrix keyboard interface – Interfacing displays: Interfacing seven segment LED displays, Interfacing LCD display – Interfacing DAC to 8051– Interfacing ADC to 8051 – Interfacing sensors – Interfacing stepper motor.

REFERENCE BOOKS:

1. A. P. Godse and D. A. Godse, "Microprocessors & its Applications", Technical Publications, Pune,
2. Kenneth Ayala, "The 8051 Microcontroller", Third Edition, Delmar Cengage Learning, 2005.
3. Muhammad Ali Mazidi, Janice Gillispie Mazidi, Rolin D.McKinlay, "The 8051 Microcontroller and Embedded Systems", Second Edition, Pearson Education 2008.
4. W.A. Triebel and Avatar Singh, The 8086 /8088 Microprocessors- Programming, Software, Hardware and application, Prentice Hall of India, New Delhi.
5. Douglas V. Hall : - Microprocessors and Interfacing programming and Hardware (Tata Mc Graw Hill) (Unit 1)
6. B. Brey, 1995, Intel Microprocessors 8086/8088, 80186,80286,80486,80486, Architecture, Programming and Interfacing
7. Yu – Cheng and Glenn A. Gibson, The 8086 / 8088 family Architecture, Programming and Design, Prentice-Hall of India.
8. Muhammed Ali Mazidi and Janice Gillespie Mazidi, 2004, The 8051 Microcontroller and Embedded Systems, Fourth Indian Reprint, Pearson Education.
9. V. Vijayendran, 2002, Fundamentals of Microprocessor –8086- Architecture, Programming (MASM) and interfacing, Viswanathan, Chennai.

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Core -6: Microprocessors and Microcontrollers Lab

Course Code: PEPBLT3

Credit: 2 (0+0+2)

Name of the experiments

1. Write an assembly language program to multiply two 16-bit hexadecimal numbers.
2. Write an assembly language program to convert a 16-bit hexadecimal numbers to decimal number
3. To write a language program to generate Fibonacci series.
4. To study working of IC 8086 (interfacing experiment)
5. Write an assembly language program to sort hexadecimal numbers in descending order.
6. Generation of Fibonacci series. Micro controller 8051
7. Addition, subtraction, multiplication and division of two 8-bit numbers.
8. Sum of a series of 8-bit numbers, average of N numbers.
9. Factorial of number, Fibonacci series of N terms.
10. Sorting in ascending and descending order – Picking up smallest and largest number

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DSE 1: Advanced Communication System I Lab

Course Code: PEPBLD1

Credit: 2 (0+0+2)

Name of the experiments

1. Study the sample signal and sample hold signal and its reconstructions.
2. ASK /FSK/ PSK generation and detection
3. Study of Frequency Modulation using Reactance Modulator.
4. Study of Frequency Modulation using Varactor modulator.
5. Study the operation of Quadrature Detector.
6. Study the operation of Detuned Resonance Detector.
7. Study the operation of Foster - Seeley Detector
8. Study the operation of Ratio Detector
9. Study the FM transmitter and receiver.
10. Study the AM transmitter and receiver.

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