**Jaya College of Arts and Science, Thiruninravur-602024.**

**Department of Electronics and Communication Science & physics**

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**Year**

- **2022-2023**

**Programme Offered**

- **M.Sc (AE)**

**Programme Objective:**

- Pursue a diverse range of careers as Electronic Designers, Consultants and Entrepreneurs.
- Continue their education leading to research in interdisciplinary areas to emerge as Competent Technologist, Experts, Educators and Scientist.
- Innovate in ever changing global economic and technological environment maintaining professional discipline and high ethical standard.
- To enable graduates to acquire technical and managerial leadership positions in their chosen fields.
- Develop practical skills by providing hands-on experience to succeed in industry / technical profession through meticulous education.
- Deep understanding of the research techniques and data analysis in the area of specialization.
- An ability to solve unstructured engineering problems, think critically, function well in a team, and communicate effectively
- Apply their knowledge and skills to provide solutions to electrical and electronics engineering problems in industry and governmental organizations or to enhance student learning in educational institutions.
- Update their knowledge continuously through lifelong learning that contributes to personal, organizational, and societal growth.
- To develop critical thinking about the electronics and its processes.
- To inculcate scientific temper through communication for development.

**Programme Outcome:**

- Capable to achieve state-of-art knowledge in Electronics, to discriminate, evaluate, analyze and create existing and new knowledge, and integration of the same for enhancement of knowledge.
- Discover, formulate, review and analyze intricate emerging electronics problems to make intellectual knowledge for conducting research in a wider theoretical and practical.
- Extract information about important problems and apply suitable techniques, resources, and modern electronic software tools towards contributing to the development of scientific/technological knowledge in Electronics.
- Comprehend Professional and ethical responsibility in the field of Electronics Profession.
- Identify the need for, and have the preparation and ability to engage in independent and life-long learning with enthusiasm and commitment in the broadest context of technological change.
- Design, develop and implement electrical and electronics and allied interdisciplinary projects to meet the demands of industry and to provide solutions to the current real time problems.
- Solve real-world problems with in-depth and up-to-date knowledge and relevant skills required by the industry by applying modern tools and techniques in Electronics/Communication/Power System area.
- Recognize the need and ability in engaging in lifelong continual learning, thereby, contributing to their own professional development and growth.
- Communicate effectively about the engineering and related issues to the team members as well as to the broader audience.
- Design reliable systems, devices, components or processes in Electronics/Communication/Power System area that meets the design specifications and requirements under certain constraints.

**SEMESTER I**

| **Course Components** | **Title of the Paper** | **Credits** | **CIA** | **UE** | **Total** |
|---|---|---|---|---|---|
| Core Paper – 1 | Electronics Materials & Semiconductor Devices | 4 | 25 | 75 | 100 |
| Core Paper – II | Mathematical Methods | 4 | 25 | 75 | 100 |
| Core Paper– III | Digital Electronics and Microprocessor | 4 | 25 | 75 | 100 |
| Core Paper IV | Digital Electronics and Microprocessor LAB | 4 | 40 | 60 | 100 |
| Elective Paper – I | Power Electronics | 3 | 25 | 75 | 100 |
| Elective Paper– II | Computer Organization and Architecture | 3 | 25 | 75 | 100 |
| | Soft Skill – 1 | 2 | 40 | 60 | 100 |

## Semester II

| Course Components | Title of the Paper | Credits | CIA | UE | Total |
|---|---|---|---|---|---|
| Core paper – V | Electromagnetic theory and its Applications | 4 | 25 | 75 | 100 |
| Core Paper– VI | Control System | 4 | 25 | 75 | 100 |
| Core Paper – VII | Electronic Instrumentation | 4 | 25 | 75 | 100 |
| Core Paper – VIII | Embedded System Laboratory | 4 | 40 | 60 | 100 |
| Elective Paper –III | Opto Electronics & Fiber Optic Communication | 3 | 25 | 75 | 100 |
| Extra Disciplinary-I | Embedded Systems | 3 | 25 | 75 | 100 |
| | Soft Skill – II | 2 | 40 | 60 | 100 |
| Internship | Internship | 2 | - | - | |

** Internship will be carried out during the summer vacation of the first year and marks should be sent to the University by the College and the same will be included in the Third Semester Marks Statement.

## Semester III

| Course Components | Title of the Paper | Credits | CIA | UE | Total |
|---|---|---|---|---|---|
| Core paper – IX | Data Communication & Computer Networking | 4 | 25 | 75 | 100 |
| Core paper-X | Digital Signal Processing | 4 | 25 | 75 | 100 |
| Core Paper– XI | Basic VLSI Design & VHDL | 4 | 40 | 60 | 100 |
| Core Paper– XII | DSP Laboratory and MAT LAB | 4 | 25 | 75 | 100 |
| Elective Paper–IV | Machine Vision and its Applications | 3 | 25 | 75 | 100 |
| Extra Disciplinary-II | Digital Image Processing | 3 | 25 | 75 | 100 |
| | Soft Skill – III | 2 | 40 | 60 | 100 |

## Semester IV

| Course Components | Title of the Paper | Credits | CIA | UE | Total |
|---|---|---|---|---|---|
| Core Paper– XIII | Neural Networks & Artificial Intelligence | 4 | 25 | 75 | 100 |
| Core Paper – XIV | Microwave Electronics | 4 | 25 | 75 | 100 |
| Core Paper– XV | Project &*viva-voce* | 4 | 40 | 60 | 100 |
| Elective Paper-V | Elements of Nanotechnology in Electronics | 3 | 25 | 75 | 100 |
| | Soft Skill – IV | 2 | 40 | 60 | 100 |

# 15 Core Paper, 7 Electives, 4 Soft Skill Papers and 1 Internship, **Total 91 Credits**

## CORE PAPER I-ELECTRONICS MATERIALS & SEMICONDUCTOR DEVICES

**Course Objective:**

- Describe the phase transitions in materials.
- Discover the need for dielectric and ferro electric materials.
- Understand the uses of semiconductor in day to day life.
- Illustrate the energy band diagrams of diodes, Zener diodes, transistors, FET etc.,

**Course OutCome:**

- Identify the crystal types
- Compare the properties of dielectric and ferroelectric materials
- Define and describe the types of metallic materials
- Recognize the intrinsic and extrinsic semiconductors
- Analyze I-V Characteristics of various semiconductor diodes.

**Syllabus:**

**UNIT 1: FUNDAMENTALS OF MATERIALS SCIENCE:** Relative stability of Phases, Phase rule Phase Diagram. **Phase Transformations:** Elementary idea of Nucleation and Growth, methods of crystal growth. **Defects in crystals:** Elementary idea of point, line and planar defects. **Materials in thin film form:** Concept of thin films, preparation of thin films, Deposition of thin film using sputtering methods (RT and glow discharge).

**UNIT 2: DIELECTRIC AND FERROELECTRIC MATERIALS:** Dielectric materials as capacitive elements, polar dielectrics, properties and applications in electronics. **Ferro electrics:** physical properties and classification, properties modifications, non-linearity, applications in electronic devices.

**UNIT 3: SPECIAL MATERIALS IN ELECTRONICS: COMPOSITE MATERIALS:** Composites of glasses, polymers metals and ceramics, Properties and applications. **Polymers:** Mechanism of polymerization, conducting polymers, application of polymers in electronics. **Metallic Materials:** Functional gradient materials, shape memory alloys, amorphous materials, IC package materials. Liquid crystal polymers: Optical properties of cholesteric (ChLCD) and chiralnematics liquid crystal displays, optical fibre materials.

**UNIT 4: PHYSICS OF SEMICONDUCTORS: SEMICONDUCTOR IN EQUILIBRIUM:** Charge carriers in semiconductors, dopant atoms and energy levels, extrinsic semiconductors, Statistics of donors and acceptors, charge neutrality, position of Fermi energy level. **Carrier transport phenomena:** Charge, effective mass, state & carrier distributions, Carrier drift, carrier diffusion, graded impurity distribution, resistivity, Hall Effect. **Non-equilibrium excess carriers in semiconductors:** Carrier generation and recombination, characteristics of excess carriers, ambipolar transport, quasi-Fermi energy levels, excess carrier lifetime, surface effects.

**UNIT 5: SEMICONDUCTOR DEVICES: DIODE:** Junction terminologies, Poisson's equation, built-in potential, depletion approximation, diode equation, Qualitative and Quantitative analysis, Reverse-bias breakdown, avalanching, Zener process, C-V characteristics, Transient response. **BJT:** Terminology, electrostatics and performance parameters, Eber - Moll model, two port model, hybrid – pi model, device models in Spice, Modern BJT structures – polysilicon emitter BJT, hetro-junction Bipolar transistor (HBT) **MOSFET:** Fundamentals, Capacitance-voltage characteristics, I-V characteristics, Qualitative Theory of Operation, ac response, spice models.

**Books for Study:**


1. S. M. Sze, 1988, **VLSI Fabrication Technology**, *McGraw Hill.*
2. S. K. Gandhi, 1983, **Si/GaAs Devices Fabrication Technology**, *John Wiley Ltd.*
3. S. M. Sze, "Physics of semiconductor devices" 2nd edition (John Wiley& Sons, New York, 1981)
4. P. Y. Yu & M. Cardona, "Fundamentals of Semiconductors, Physics and Materials Properties" 2nd edition (Springer, Berlin, 1999)
5. N. W. Ashcroft and N. D. Mermin, "Solid State Physics" (Saunders College Publishing, Fort Worth, 1976)


**Books for Reference:**


1. Ruska, 1988**, Devices Fabrication Technology**, *McGraw Hill.*
2. D. K. Schroder, 1990, **Semiconductor Material and Device Characterization**,*Wiley, NY.*
3. M. S. Tyagi, **Introduction to Semiconductor Devices**, *Wiley.*
4. Deboo and Burrous, 1987**, Integrated Electronics and Semiconductor Devices**,**Theory and Applications**, *McGraw-Hill International Ed.*


**Web sources:**

1. http://nptel.ac.in/courses/113106062/
2. http://www.springer.com/materials/optical+%26+electronic+materials/journal/10854
3. http://www.dowelectronicmaterials.com/

## CORE PAPER II--MATHEMATICAL METHODS

**Course Objective:**

- To familiarize the ideas of complex variable.
- To understand the fourier series and implement it in solving the waveforms.
- To choose laplace transform in solving in electrical network circuit to LCR etc.
- To implement the ideas of problematic in studying the permutations functions.
- To study interpolation in solving numerical methods problem.

**Course OutCome:**

- Use advanced mathematical method and theories on various mathematical problems
- Develop the skill of problem solving ability
- Use Laplace transform to solve differential equations
- Apply probability to calculate mathematical expectation.

- Recognize the advantages of numerical methods.

**Syllabus:**

**UNIT 1: COMPLEX VARIABLES:** Analytic functions – Cauchy-Riemann conditions – Laplace equation in two dimensions – Expression for exp z – Euler's formula – Generalization of trigonometrical and hyperbolic functions – Cauchy's theorem – Cauchy integral formulae – Zeros and poles – Taylor series and Laurent series – Residue theorem – Applications of complex variables: Resolution into partial fractions – Zeros of normalized Butterworth polynomials and Butterworth poles in the s-plane – Circuit Analysis – Evaluation of real integrals using contour integration – Application in transfer functions.

**UNIT 2: FOURIER TRANSFORMS:** Fourier integral theorem – Generation of a table of Fourier transforms – Fourier cosine and sine transforms – Form Fourier integral to Laplace transform – Simple applications in digital signal processing – Inverse Fourier Transform – Properties of Inverse Fourier Transform.

**UNIT 3: LAPLACE TRANSFORMS:** Generation of a Table of Laplace transforms – Inverse Laplace transform using calculus of residues – Solution to linear differential equations with constant coefficients – Simple applications in feedback control systems, electrical Network, circuits with L.C.R for periodic and non-periodic signals, poles and zeroes of Network functions, time and frequency domain response from pole zero plot – Voltage transfer function.

**UNIT 4: SETS, FUNCTIONS AND PROBABILITY:** Set theory: - Relationships between sets – Operations on sets – Set indenties – Principle of inclusion and exclusion – Minsets. Relations: - Binary relations – Partial orderings – Equivalence relations. Functions: Properties of functions – Composition of functions – Inverse functions – Permutation functions.DiscreteProbability**:** Finite probability – Probability distributions – Conditional probability – Independence – Bayes' theorem – Mathematical expectation.

**UNIT 5: NUMERICAL METHODS:** Interpolation with equally spaced and unevenly spaced points (Newton forward and backward interpolations, Lagrange interpolation) - Curve fitting - Polynomial least-squares fitting - Cubic spline fitting Numerical differentiation - Numerical integration - Trapezoidal rule - Simpson's rule - Error estimates - Gauss-Legendre, Gauss-Laguerre, Gauss-Hermite and Gauss-ChebyshevQuadrature - Numerical solution of ordinary differential equations - Euler and Runge-Kutta methods - Introduction to C programming.

**Books for study:**


1. M. Abramowitz and I.A. Stegun, 1972, Handbook of Mathematical Functions, Dover, NY.
2. M.D. Greenberg Advanced Engineering Mathematics, 2nd Ed., International Ed., Prentice-Hall, NJ.
3. E. Kreyszig, 1999, Advanced Engineering Mathematics, 8th Ed., Willey, NY.
4. B. Grob, 1989, Basic Electronics, 6th Ed., International Ed., McGraw-Hill, NY
5. J. Millman and CC Halkias, 1991, Integrated Electronics: Analog and Digital Systems, Tata McGraw-Hill, New Delhi

6. A.V. Oppenheim, A.S. Willsky, and S.H. Nawab, 1995, Signals and Systems, 2nd Ed., Prentice Hall of India, New Delhi.
7. R. T. Stefani, C. J. SavantJr, B. Shahian, and G.H. Hostier, 1994, Design of Feedback Control Systems, 3rd Ed., Saunders College, NY.
8. M.L. Boas, 2002, Mathematical Methods in Physical Sciences, Willey.
9. Judith L. Gersting, 2003, Mathematical Structures for Computer Science, 5th Ed., W.H. Freeman and Company, NY.
10. W.H. Hayt, Jr. (late), J.E. Kemmerly (late) and S.M. Durbin, 2002, Engineering Circuit Analysis, 6th edition, Tata McGraw-Hill, New Delhi.

**Books for Reference:**

1. E. Butkov, 1968, Mathematical Physics, Addison-Wesley, Reading, MA.
2. H.K. Crowder & S.M. McCuskey, 1964, Topics in Higher Analysis Macmillan, NY.
3. R.P. Feynman, R.B. Leighton, and M. Sands, 1997, Chapters 22-25, The Feynman Lecturers on Physics, Vol. 1, Narodsa, New Delhi.
4. A.H. Robbins and W.C. Miller, 1995, Circuit Analysis: Theory and Practice, Delmar, NY.
5. L.A. Pipes and L.R. Harvill, 1971, Applied Mathematics for Engineers and Physicists, 3rd Ed., McGraw-Hill, NY.
6. W.H. Press, S.A. Teukolsky, W.T. Vetterling, and B.P. Flannery, 1993, Numerical Recipes in C, 2nd Ed., Cambridge University Press, 1992; First Indian Edition, Foundation Books, New Delhi.
7. J.G. Prokis and D.G. Monolakis, 1996, Digital Signal Processing, Prentice-Hall of India, New Delhi.
8. L.R. Rabiner and B. Gold, 1993, Theory and Applications of Digital Signal Processing, Prentice-Hall of India, New Delhi.
9. M.R. Spiegel, 1981, Complex Variables, Schaum's Series, McGraw-Hill, NY.
10. M.R. Spiegel, 1974, Fourier Analysis, Schaum's Series McGraw-Hill, NY.
11. M.R. Spiegel, 1986, Laplace Transforms, Schaum's Series, McGraw-Hill, NY.
12. G.P. Tolstov, 1962, Fourier Series, Prentice-Hall, NJ.
13. M.E. Van Valkenburg, 1997, Network Analysis, 3rd Ed., Prentice-Hall of India, New Delhi.
14. C.R. Wylie and L.C. Barrett, 1995, Advanced Engineering Mathematics, 6th Ed., International Ed., McGraw-Hill, NY.
15. S. Hassani, 2000, Mathematical Methods, Springer, NY.

**Web sources:**

1. http://front.math.ucdavis.edu/physics.math-ph
2. http://www.ma.utexas.edu/mp_arc/
3. http://nptel.ac.in/courses/115103036/
4. http://www.trillia.com/zakon1.html
5. http://www.gallup.unm.edu/~smarandache/eBooks-otherformats.htm#E-Books%20of%20Mathematics
6. http://pam.sla.org/subjects/math/

## CORE PAPER- III- DIGITAL ELECTRONICS & MICROPROCESSOR

**Course Objective:**

- To study the architecture of 8086 microprocessor.
- To understand the systems associated with digital electronics.
- To understand the programming concepts of 8086.
- To perform the interrupt concepts in 8086.
- To understand the ideas of interfacing of 8086.

**Course OutCome:**

- Understand the basics of sequential and combinational logic circuits.
- Know about the architecture of 8086 microprocessor.
- Perform the functions of various instruction set of 8086 microprocessor.
- Recognize the various types of interrupts in 8086.
- Analyze the concept of interfacing DAC, ADC, Stepper Motor etc.,

**Syllabus:**

**UNIT 1: DIGITAL ELECTRONICS:** Combinational circuits – Combinational logic - representation of logic functions-SOP and POS forms, K-map representations minimization using K maps - simplification and implementation of combinational logic - multiplexers and de-multiplexers - code converters, adders, subtractors. Sequential circuits - Flip-Flops R-S, D, T, J-K and Master slave J-K. Flip-Flops Registers, Buffer and shifts Registers, Binary Ripple counter of Mod-N. Synchronous counters, Ring counters, semiconductor memories, Memory Addressing logic, ROM, EPROM & RAM memories.D-A Conversion: Weighted Register and Ladder Method, Sample and Hold Circuit, A-D convertor, Simulation methods, Continuous method, counter method, Successive approximation.

**UNIT 2: INTRODUCTION TO MICROPROCESSOR 8086:**8086 Architecture and programming model, pin description, Registers, flags, interfacing of memory RAM and EPROM. **Hardware features of 8086:** Bus buffering, latching, timing diagrams, wait state, MIN/MAX modes of operation. **Addressing modes:** Immediate addressing, register addressing, memory addressing, base indexed addressing with displacement as the general memory addressing mode, I/O port addressing.

**UNIT-3: PROGRAMMING THE 8086:** Instruction template for 8086 instructions, code generation using template. **Data Transfer Instruction:** Move date to register/memory from register/memory/immediate data, data transfer between a segment register and register/memory, PUSH and POP, exchange, data transfer with I/O ports. **Data Conversion instructions:** XLAT, LEA, LDS, LES, LAHF and SAHF instructions. **Arithmetic Instructions:** Add, subtract, negate, compare, CBW, CWD, multiply and divide instructions. **Logical Instructions:** AND,

OR, EX-OR, Test, NOT, ROTATE and shift instructions. **Process Control Instructions**: Instructions to set/reset flags, halt, wait, lock, prefix and escape to co-processor instructions. **String Instructions:** CMPS, MOVS, LODS, STOS, and SCAS instructions. **Branch Instructions:** JMP, conditional jump, LOOP, LOOPE, LOOPNE, JCXZ, CALL, and RET.

**UNIT-4: INTERRUPTS OF 8086:** Hardware interrupt, software interrupt and exception, priority of interrupts, 8259A priority interrupts controller (block diagram and its operational description).**BIOS and DOS Services:** Binary search, print screen operation, check for password, and rename a file C-language programs using BIOS and DOS services: create sub-directory, get file attributes, control of display on CRT

**UNIT-5: INTERFACING OF 8086:** Interfacing with RAMs, ROMs along with the explanation of timing diagrams. Interfacing with peripheral ICs like 8255, 8254, 8279, 8259, 8259 etc. Interfacing with key boards, LEDs, LCDs, ADCs, and DACs etc.Stepper Motor Interface.

**Books for Study:**


1. Malvino and Leach, **Digital Principles and Applications**, *4th Ed., McGraw-Hill.*
2. Millman and Halkias, 1972, **Integrated Electronics**, *McGraw-Hill.*
3. M. M. Mano, 1995, **Digital Design**, *Prentice-Hall of India, New Delhi.*
4. A.S. Bouwens**, 2000**, **Digital Instrumentation**, *TMH.*
5. W. C. Bosshart, 1994, **Printed Circuit Boards Design and Technology**, *Tata McGraw-Hill.*
6. R. A. Gayakwad, 1994, **OPAMPS and Linear Integrated Circuits**, *3rd Ed., PHI.*
7. B. S. Sode, 1980**, Introduction to System Design using Integrated Circuits**, *Wiley Eastern.*
8. J. R. Johnson, 1994, **Introduction to Digital Signal Processing**, Prentice-Hall of India, New Delhi.


**Books for Reference:**


1. T. L. Floyd, 1993, **Digital Fundamentals,** *5h Ed., Macmillan.*
2. Taub and Shilling, **Digital Electronics.**
3. G. C. Barney, 1988**, Intelligent Instrumentation**, *Prentice Hall of India*.
4. A.K. Sawhney, **A Course in Electrical and Electronics Measurements and Instrumentation**, *DhanpatRai& Sons.*
5. E. O. Doeblin, **Measurement Systems Application and Design,** *TMH, New Delhi.*
6. A.D. Helprick and W. D. Cooper, 1996, **Modern Electronic Instrumentation and Measurement Techniques**, *PHI.*
7. Morris, 1994, **Principles of Measurements and Instrumentation**, *Prentice Hall.*


**Web Sources:**

1. http://www.asic-world.com/digital/tutorial.html
2. http://www.ni.com/example/14493/en/
3. https://en.wikibooks.org/wiki/Fundamental_Digital_Electronics/
4. http://www.pyroelectro.com/edu/digital/introduction/
5. https://www.tutorialspoint.com/digital_electronics/digital_electronics_overview.asp

6. https://www.allaboutcircuits.com/textbook/digital/
7. https://www.electrical4u.com/boolean-algebra-theorems-and-laws-of-boolean-algebra/
8. http://electronics-course.com/
9. https://www.wiziq.com/tutorials/digital-electronics

## CORE PAPER- IV-DIGITAL ELECTRONICS AND MICROPROCESSOR LABORATORY

**Course Objective:**

- To design the Counter circuits.
- To understand the concepts of DAC using IC741.
- To study the programming based on 8086 microprocessor.
- To study to interface with other I/O devices.

**Course OutCome:**

- Learn about counters.
- Demonstrate ability to handle arithmetic and logical operations.
- Understand the concepts related to I/O interfacing.

**Syllabus:**

**A.Advanced Digital Electronics**

1. Digital to analog converter using IC 741 and R/2R ladder.
2. Up/Down counters using IC 7476/7473.
3. Design of synchronous counters – MOD 3, MOD 5 and MOD 10.

**B. Microprocessor 8086 Programs**

1. Basic arithmetic and Logical operations
2. Code conversion, sorting and searching
3. Data transfer operations
4. Password checking
5. Print RAM size and system date

**C. Peripherals and Interfacing Experiments**

1. Traffic light control
2. Stepper motor control
3. Digital clock

4. Key board and Printer status
5. Serial interface and Parallel interface
6. Trouble shooting

**Book for Study:**

1. Ray A K, Bhurchandi K M, "Advanced Microprocessor & Peripherals", Tata McGraw, Hill, Second Edition, 2012.

**Book for Reference**

1. Microprocessor and Interfacing Laboratory Manual.
2.

## ELECTIVE PAPER- I- POWER ELECTRONICS

**Course Objective:**

- To understand the concepts of the thyristors and power MOSFET.
- To learn the functioning of rectifiers and converters.
- To apply the ideas of inverters.
- To understand the various chopper circuits.
- To illustrate the concepts of various control circuits and its application.

**Course OutCome:**

- Explain the working of thyristors, TRIAC, Power diodes and MOSFETs
- Analyze the various functions of rectifiers and converters
- Build the inverters using thyristors, SMPS and Boost Regulators
- Recognize the various types of DC and AC Choppers
- Implement the concepts for PCB designing, UPS, DC and AC Drive

**Syllabus:**

**UNIT 1: THYRISTORS AND RELATED DEVICES:** Thyristors – Triacs – Power diodes – Power transistors – Power MOSFETs – GTOs and insulated gate transistors – Steady state and switching characteristics – Protection circuits – Series and parallel operation – Thyristor commutation techniques.

**UNIT 2: RECTIFIERS AND CONVERTERS:** Phase control – Half-wave Thyristors rectifiers with R, RL and RLC load – Effect of freewheeling diode – Full-wave Thyristors rectifiers – Single phase half-controlled and fully-controlled Thyristor bridge converters - Load voltage, load current and input power factor for continuous current operation – Three-phase half-controlled and fully-controlled Thyristor - Converters – Dual converters.

**UNIT 3: INVERTERS:** Series and parallel inverters using Thyristors – Inverter circuits using devices other than Thyristors – Single phase and three phase bridge inverters – Voltage and wave

form control – Current source inverters – Cyclo-converters. Switch mode regulators: Buck regulators –Boost regulators –Buck/Boost regulators – CUK regulation –SMPS.

**UNIT 4 : CHOPPERS :**DC chopper circuit using devices other than Thyristors – Single quadrant DC – Chopper with R,RL,RLC load - Time ratio control – Load voltage and load current for continuous current operation – Two quadrant and four quadrant DC choppers – AC choppers (AC voltage controller) using Thyristors and Triacs – ON-Off control and phase control – Single phase full-wave controller with R & RL load – load voltage, load current and input power factor – circuits for three phase half-wave and full-wave controllers.

**UNIT 5: CONTROL CIRCUITS AND APPLICATIONS:** Generation of control pulses – Microprocessor based implementation – DC and AC drives – HVDC systems – Static circuit breakers – Regulated power supply – UPS

**Book for study:**


1. S.B. Dewan and A. Stranghen, Power Semiconductor Circuits, Wiley, NY, 1975.
2. M.H. Rashid, Power Electronics – Circuits, Devices, and Application, 2nd Ed., Prentice-Hall of India, New Delhi, 1999.
3. S. Rama Reddy, Fundamentals of Power Electronics, Narosa, New Delhi, 2000.


**Books for Reference:**


1. Ahmed, Power Electronics for Technology, Pearson Education, PHI, NJ, 1999.
2. G.K. Dubey, S.R. Doradla, A. Joshi, and R.M.K. Sinha, Thyristorised Power Controllers, New Age International, New Delhi, 1986.
3. P.C. Sen, Power Electronics, Tata McGraw-Hill, New Delhi, 1987.
4. M. Ramamoorthy, An Introduction to Thyristors and Their Applications, 2nd Ed., Affiliated East West, New Delhi, 1991.
5. M.D. Singh and K.B. Khanchandani, Power Electronics, TMH, New Delhi, 1998.
6. P.S. Bimbhra, Power Electronics, 3rd, Ed., Khanna, New Delhi, 1999.
7. R.K. Sugandhi and K.K. Sugandhi, Thyristors – Theory and Applications, 2nd Ed., Wiley Eastern, New Delhi, 1981.
8. N. Mohan, T.M. Undeland, and W.P. Robbins, Power Electronics – Converters, Applications, and Design, 2nd Ed., Wiley, NY 2001.
9. B.W. Williams, Power Electronics –Devices, Drivers, Application, and Passive Components, 2nd Ed., Macmillan, London, 1992.
10. J.N. Ross, The Essence of Power Electronics, Prentice-Hall, London, 1997.


**Web Sources:**

1. https://www.coursera.org/specializations/power-electronics
2. http://www.ece.umr.edu/courses/power_electronics/
3. http://www.nptel.ac.in/courses/117105140/
4. http://www.nptel.ac.in/courses/108104011/
5. http://www.nptel.ac.in/courses/108101038/
6. http://www.nptel.ac.in/courses/108105066/

## ELECTIVE PAPER- II- COMPUTER ORGANIZATION AND ARCHITECTURE

**Course Objective:**

- To impart knowledge of basic structure of computers.
- To understand the concepts of arithmetic and logic units.
- To explore the processing units and gain the knowledge about bus organization.
- To provide the concepts of working of memory system.
- To familiarize the various I/O devices.

**Course OutCome:**

- Understand the basic structure of computer hardware
- Analyze the various functions of Arithmetic and logic unit.
- Identify the multiple bus organization, pipelining and data hazards.
- Analyze the various types of semiconductor RAM and ROM.
- Know about the standard I/O organization and its interface.

**Syllabus:**

**UNIT 1: BASIC STRUCTURE OF COMPUTERS :** Functional units – Basic operational concepts - Bus structures – Software performance – Memory locations and addresses – Memory operations – Instruction and instruction sequencing – Addressing modes – Assembly language – Basic I/O operations .

**UNIT 2: ARITHMETIC UNIT :**Addition and subtraction of signed numbers – Design of fast adders – Multiplication of positive numbers – Signed operand multiplication and fast multiplication – Integer division – Floating point numbers and operations.

**UNIT 3 : BASIC PROCESSING UNIT :**Fundamental concepts – Execution of a complete instruction – Multiple bus organization – Hardwired control – Micro programmed control – Pipelining – Basic concepts – Data hazards – Instruction hazards – Influence on Instruction sets – Data path and control consideration.

**UNIT 4: MEMORY SYSTEM :**Basic concepts – Semiconductor RAMs – ROMs – Speed – size and cost – Cache memories – Performance consideration – Virtual memory – Memory Management requirements – Secondary storage.

**UNIT 5: I/O ORGANIZATION:** Accessing I/O devices – Interrupts – Direct Memory Access – Buses – Interface circuits – Standard I/O Interfaces (PCI, SCSI, and USB).

**Book for study:**

1. Carl Hamacher, ZvonkoVranesic, SafwatZaky, “Computer Organization”,McGraw-Hill, Fifth Edition, Reprint 2012.

**Books for Reference:**


1. Ghosh T. K., "Computer Organization and Architecture", Tata McGraw-Hill, Third Edition, 2011.
2. William Stallings, "Computer Organization and Architecture – Designing for Performance", Pearson Education, Seventh Edition, 2006.
3. BehroozParahami, "Computer Architecture", Oxford University Press, Eighth Impression, 2011.
4. David A. Patterson and John L. Hennessy, "Computer Architecture-A Quantitative Approach", Elsevier, a division of reed India Private Limited, Fifth edition, 2012.
5. John P. Hayes, "Computer Architecture and Organization", Tata McGraw Hill, Third Edition, 1998.


**Web Sources:**

1. http://nptel.ac.in/courses/106106092/1
2. http://nptel.ac.in/courses/106103068/
3. https://learn.saylor.org/course/view.php?id=6
4. https://www.tutorialspoint.com/computer_logical_organization/
5. https://www.cise.ufl.edu/~mssz/CompOrg/CDAintro.html

## SEMESTER - II
## CORE PAPER-V- ELECTROMAGNETIC THEORY AND APPLICATIONS

**Course Objective:**

- To familiarize the fundamentals of electromagnetic theory and applications to electromagnetic induction.
- To give the student a firm understanding of the basics of Electricity & magnetism.
- To understand the maxwell's equation and solve the probles.
- To recognize the types of wave propogation and learn about electric dipoles.
- To design the waveguides after a study of propogation of waves.

**Course OutCome:**

- Familiarize mathematical concepts and boundary conditions used in classical Electrodynamics.
- Understand magnetic properties of materials.
- Analyze transmission of Electromagnetic wave through waveguide.
- Apply Maxwell's equations to material medium and analyze its Electrical and Magnetic properties.
- Derive formulas to Experimentally measurable quantities (like electric and magnetic susceptibility).
- Calculate Electric field and Electric potential for a given configuration of charges in free space and matter.

**Syllabus:**

**UNIT 1:ELECTROSTATICS AND MAGNETOSTATICS:** Electrostatic field - Divergence and curl of electrostatic fields - Electric potential - Laplace equation - Method of images - Multipole expansion - Lorentz force law - Biot-Savart law - Divergence and curl of $\boldsymbol{B}$- Magnetic vector potential.

**UNIT 2: ELECTROSTATIC AND MAGNETOSTATIC FIELDS IN MATTER:** Polarization - Field of polarized object - Electric displacement - Linear dielectrics - Magnetization - Field of magnetized object - Auxiliary field $\boldsymbol{H}$ - Linear and non-linear media.

**UNIT 3: MAXWELL'S EQUATIONS AND ELECTROMAGNETIC WAVES:** Correspondence of field equations and circuit equations – Applications of circuit and field theory – Series Circuit – Maxwell's equations – Generalization of circuit equations – Maxwell's equations in free space and for harmonically varying fields – Continuity equations – Poynting theorem – Uniform plane wave – Concept of intrinsic impedance of free space – Boundary conditions

**UNIT 4: WAVE PROPAGATION:** Uniform plane wave propagation in good conductor, in poor conductor, in lossy dielectric – Plane wave propagation in metallic film coating - Plastic substrate and application to thin film technology - Oscillating electric dipole – Power radiated by current element - Radiation resistance.

**UNIT 5: GUIDED WAVES AND WAVE GUIDES: Guided waves**: Transverse electric (TE) waves - Transverse magnetic (TM) waves - Transverse electromagnetic (TEM) waves - Velocity of propagation - Attenuation in parallel-plane guides - Wave impedances. Wave Guides: Rectangular guides (RGs) - TM waves and TE waves in RGs - Impossibility of TEM wave in wave guides - TM and TE waves in circular guides - Wave impedances and characteristic impedances - Dielectric slab wave guide.

**Books for Study:**


1. D. J. Griffiths, 2002, Introduction to Electrodynamics, 3rd Ed., Prentice-Hall of India, New Delhi.
2. E. C. Jordan and K. G. Balmain, 1995, Electromagnetic Waves & Radiating Systems, 2nd Ed., Prentice-Hall of India, New Delhi.
3. John D. Kraus, 1992, Electromagnetics, 4th Ed., McGraw Hill International.
4. V.V. Sarawate, 1993, Electromagnetic Fields and Waves, Wiley Easter Limited.


**Books for Reference:**


1. D. Jackson,1993,Classical Electrodynamics, 2nd Ed., Wiley Eastern, New Delhi.
2. B. Laud, 1995, Electromagnetics, 2nd Ed., New Age International, New Delhi.
3. Lorrain and D. R. Corson, 1986, Electromagnetic Fields and Waves, 2nd Ed., CBS, New Delhi.
4. R. Reitz, F. J. Milford and R. W. Christy, 1988, Foundation of Electromagnetic Theory, 3rd Ed., Narosa, New Delhi.

5. Samuel and Y. Liao, 1994, Microwave Devices and Circuits, 3rd Ed., Prentice Hall of India.

**Web Sources:**

1. http://nptel.ac.in/courses/117103065/
2. http://www.nptel.ac.in/courses/115101005/
3. http://www.nptel.ac.in/courses/108104087/
4. http://www.sanfoundry.com/1000-electromagnetic-theory-questions-answers/
5. https://www.britannica.com/science/electromagnetism

## CORE PAPER VI-CONTROL SYSTEM

**Course Objective:**

- To understand the concepts of process control system.
- To familiarize the loop characteristics in control system.
- Learn to implement the computer in process control.
- To know about various discrete state controllers.
- To apply the process control ideas in designing various devices.

**Course OutCome:**

- Understand the various parameters and applications of dynamic system.
- Understand the basic knowledge of open loop and closed loop frequency response of system.
- Analyze the concepts of programmable Controllers, CAM, CAD, CIM and CNC.
- Describe the terminologies of discrete state controllers.
- Understand the principles of control theory and the various components and applications of Control system.

**Syllabus:**

**UNIT 1: INTRODUCTION TO PROCESS:** Identification of functional elements - Control system evaluation-Analog and digital processing - Application specific selection of transducers for measurement of process parameters: temperature, pressure, flow level, density, safety and weight sensors- Synchro/Servo motors- Control valves- Solenoids-Electropneumatic converters- Indicators- annunciators- Alarms-Displays-Recorders- Loggers, etc.

**UNIT 2: CONTROL LOOP CHARACTERESTICS:** Process characteristics : Process equation, process lead, process lag and self-regulation - Control system parameters : Error, variable range, control parameter range, control lag, dead time, cycling- Controller modes: discontinuous controller modes, two position mode, multiposition mode and floating control mode, continuous controller modes, proportional (P), integral (I) and differential (D) control modes, composite controller modes – PI, PD and PID - Control loop characteristics- Control system configurations – Single variable and cascade control- Multivariable control system-

Stability- Process loop tuning- Open loop transient response method- Ziegler-Nicholas method and Frequency response method.

**UNIT 3: COMPUTER IN PROCESS CONTROL:** Programmable controllers- Data logging- Supervisory control- Computer based controller- Hierarchical control- Controller software- Computer aided integrated manufacturing (CIM)- The product cycle and CAD/CAM- Fundamentals of CAD- Computer aided process planning- Computerized scheduling- Material requirement planning and shop floor control- NC, CNC and computer controlled robots- Computer aided quality control- Implementation of CIM's – Introduction to LABVIEW.

**UNIT 4: DISCRETE STATE CONTROLLERS:** Definitions and terminologies- Characteristics of the system-Discrete state variables- Process space and event sequence description- Ladder diagram- Programmable logic controllers (PICs)- Use of microcontrollers- Fuzzy logic control.

**UNIT 5: PROCESS CONTROL SYSTEMS:** Batch process control and automation- Boiler control- Chiller control- Clean room control- Compressor control - Cooling tower to crystallizers control-Distillation control -Dryer control - Evaporation control- Extruder controls-Furnace control- Heat exchangers- PH control- Pump controls- Reactor controls- Rolling mill control- Steam turbine control -Water treatment control.

**Books for Study:**


1. D. Johnson, 1996, Process control instrumentation technology, Prentice Hall of India.
2. M. P. Groover and E. W. Zimmers, 1992, CAD/CAM,Prentice Hall of India.


**Books for Reference:**


1. J. M. Jacob, 1989, Industrial control electronics, Prentice Hall Inc.
2. Liptak, 1995, Process measurement and analysis, Chilton Book Co.
3. Liptak, 1995, Process control, Chilton Book Co.


**Web sources:**

1. http://www.nptel.ac.in/courses/108103008/
2. http://www.nptel.ac.in/courses/108103007/
3. http://www.nptel.ac.in/courses/108106024/
4. https://ocw.mit.edu/resources/res-6-010-electronic-feedback-systems-spring-2013/course-videos/
5. http://controleducation.group.shef.ac.uk/indexwebbook.html

## CORE PAPER –VII-ELECTRONICINSTRUMENTATION

**Course Objective:**

- To familiarize the characteristic of an instrument.
- To study the basic concepts of transducers & sensors.
- To understand basic electronics instruments terminology and measurement instruments.
- To introduce the basic concepts related to the bridge measurement.
- To understand the proper application of electronic instruments.
- To familiarize the ideas in biomedical instruments and MEMS system.

**Course OutCome:**

- Understand the characteristics of different Instruments.
- Identify the principles of various types of transducers and sensors.
- Analyze the different terminology related to measurements and testing the Instruments.
- Employ appropriate instruments to measure given sets of parameters.
- Know about the concepts of MEMS, signal conditioners and Diagnostic equipments.

**Syllabus:**

**UNIT 1: CHARACTERISTICS OF AN INSTRUMENT:** Functional elements of a measurement system – Static characteristics – Accuracy, precision, bias, linearity, threshold, resolution, hysteresis, dead space, scale readability, span, static stiffness, input impedance, repeatability and reproducibility - Errors and calculation of errors in overall system – Dynamic characteristics – Zero, first and second order instruments - Responses for step, impulse, ramp and sinusoidal inputs.

**UNIT 2: TRANSDUCERS AND SENSORS:** Definition of transducer and sensor – Classification of transducers – Pressure (strain gauge, piezoelectric transducer), displacement (potentiometric, LVDT), temperature (thermometer, thermistor, thermocouple) and photosensitive (Vacuum & gas filled phototubes, photomultiplier, photoconductive cell, photovoltaic cell) transducers.

**UNIT 3: BRIDGE MEASUREMENTS:** Introduction - Wheatstone bridge - Kelvin bridge – Guarded Wheatstone bridge - AC bridges and their applications – Maxwell bridge – Hay bridge - Schering bridge - Wien bridge. **TESTING INSTRUMENTS:** Oscilloscopes – Block diagram – CRT Circuits – Vertical and horizontal deflection systems – Delay line, multiple trace – Probes – Special oscilloscopes.

**UNIT-4: MEASURING INSTRUMENTS:** Galvanometer – DC Ammeter & Voltmeter – Series and shunt type ohm meters – Calibration of DC Instruments - Multimeter – Alternating current indicating instruments - Watt-hour meter – Power factor meters – Pen recorders – Servo-recorders – MagNetic recorders- Digital voltmeter – Multimeter – DMM circuits – Accuracy of digital voltmeters - Guarding techniques. **Data acquisition systems:** Block diagram, brief description of preamplifier, signal conditioner, instrumentation amplifier, waveform generator, A/D and D/A converter blocks, computer controlled test and measurement system with examples.

**UNIT-5: BIO-MEDICAL INSTRUMENTATION:** Origin of bio-electric signals, electrodes for ECG, EEG, and EMG, block diagram of ECG and EEG systems, brief analysis of graphs**MEMS:**Definition of MEMS,MEMS history and development- Mechanical sensors and actuators - pressure sensors, accelerometers, rate gyroscopes. Thermal sensors and actuators – Micro-opto-electro mechanical system (MOEMS) – Magnetic sensors and actuators - MEMS applications.

**Books for Study:**

1. C. S. Rangan, G. R. Sarma and V. S. V. Mani, 1999, Instrumentation Devices and Systems, Tata McGraw-Hill, New Delhi.

2. A. D. Helfrick and W. D. Copper, 1992, Modern Electronic Instrumentation and measurement Techniques, Prentice-Hall of India, New Delhi.
3. A. K. Sawhney, A Course in Electrical and Electronic Measurement and Instrumentation, DhanpatRai& Sons.

**Books for Reference:**

1. E. O. Doebelin, 1983, Measurement Systems Application and Design, International Edition, 3rd Ed., McGraw-Hill, NY.
2. D. V. S. Moorthy, 1995, Transducer and Instrumentation, Prentice-Hall of India,NewDelhi.
3. J. W. Dalley, W. F. Riley and K. G. McConnel, 1993, Instrumentation for Measurements,Wiley, NY.
4. B. C. Nakre and K. K. Chaudry, Instrumentation Measurements and Analysis, Tata McGraw-Hill, New Delhi.
5. D. A. Skoog, Principles of Instrumental Analysis, 3rd Ed., Saunders College Publishing.

**WEB SOURCES:**

1. http:/www.techonline.com
2. http://www.circuit-fantasia.com/my-students/ske2004/intro/intro-ske.htm
3. http://www.electronics-tutorials.com/basics/digital-basics.htm
4. http://www.national.com/appinfo/amps/0,2175,967,00.html
5. http://www.pcbdesignandfab.com
6. http://www.signalrecovery.com
7. www.sensorsportal.com
8. www.sensorland.com
9. www.transducersdirect.com
10. http://www.aami-bit.org/
11. http://bio-medical.com/
12. http://www.biomedcentral.com/browse/journals/
13. http://www.ncbi.nlm.nih.gov/pmc/articles/

## CORE PAPER- VIII-EMBEDDED SYSTEM LABORATORY

**Course Objective:**

- To introduces the assembly language programming of Microcontroller.
- To develop the student's Assembly language programming skills and gives practical training of interfacing the peripheral devices with the Microcontroller.
- To know about the Ardino based programming.

**Course OutCome:**

- Understand the basics of assembly language programming.
- Learn about the Ardino based programs.

**Syllabus:**

1. Assembly language programming of the 8031/8051 (16-bit Addition, Subtraction, Multiplication & Division)
2. Interfacing of LED array to generate different sequences, use of timer for delay generation Matrix Keyboard interface with LCD
3. DAC interfacing (sine, staircase, triangular, square wave) use of timer
4. ADC interfacing using 8051.
5. DC motor control using PWM / Intensity control of LED – with CCP
6. Serial EEPROM / EEPROM interface using SPI protocol
7. Real time clock (RTC) using 8051.
8. Stepper motor Interfacing using 8051.
9. Dot matrix rolling display using 8051.
10. Introduction to Arduino board.
11. LED Blink using Arduino.
12. LM35 Temperature control using Arduino.
13. Stepper motor control using Arduino.
14. Dot matrix rolling display using Arduino.
15. Traffic Signal Control using Arduino.

## ELECTIVE PAPER III- OPTO ELECTONICS & FIBRE OPTIC COMMUNICATION (OFC)

**Course Objective:**

- To understand how fibre optic communication system work.
- To understand the concepts of multi mode & single mode fibre.
- To gain knowledge about the optical processes in semiconductor.
- To explore the fundamentals of fibre optics.
- To study the optical communication fibre and processes.
- To familiarize the mobile communication system.

**Course OutCome:**

- Explain the basics of Semiconductor Opto electronics devices.
- Understand the basic elements of optical fiber communication link.
- Know about the optical fiber testing and parameter measurements.
- Design the simple fiber optic communication.
- Understand the applications of mobile communication and satellite communication system.

**Syllabus:**

**UNIT 1: OPTO ELECTRONICS:** Generic Optical Systems and Fundamental Building Blocks; Basics of Semiconductor Optoelectronics: Elemental and Compound Semiconductors; Electronic Properties and Optical Processes in Semiconductors; P-N Junction Theory, LEDs and Photodetectors; Heterostructures, Confinement of Electron Waves, Optical Waveguides and Guided Modes; Semiconductor Optical Amplifiers and Fabry-Perot Lasers; Coupled Mode Theory, DBR and DFB Lasers; Silicon Photonics: Integrated Optical Passive and Active Components; Tunable Filters, Delay-Lines and Switching Circuits in SOI Platform; CMOS Technology: Electrical vs. Optical Interconnects

**UNIT 2:FUNDAMENTALS OF FIBRE OPTICS:** Optical fiber theory and applications - parameters and types of optical fibers - single and multimode fibers, dispersion – intermodal and intramodal - step and graded index fibers - construction of optical fiber cables, loss mechanisms - absorption and scattering, connector types and splices, misalignment and mismatch losses, power budget of optical fiber link.

**UNIT 3: OPTICAL COMMUNIICATION DEVICES AND PROCESSES:** Optical fiber testing and parameter (cut off wavelength, loss per unit length, numerical aperture, bending loss, connector/splice loss) measurement. Power meter, OTDR- principle and uses.Spectrum analyzer, Optical Amplifiers, semiconductor optical amplifiers, EDFA, Raman Amplifier. WDM and DWDM systems

**UNIT 4: FIBER OPTIC COMMUNICATION:** System: design:considerations for point to point link - System architecture - optical transmitters and receivers - elctro optic modulators, Non-linear effects and system performance, Dispersion management, Soliton propagation. Analog and digital modulation, bit error rate, eye diagram.Optical add-drop multiplexers. Optical fiber Networks, SONET, SDH.

**UNIT V: MOBILE COMMUNICATION SYSTEMS:** Cellular concepts - role of base station and mobile switching centers - Hand-off considerations – Communication frequency bands - frequency reuse – roaming - SMS, GSM, GPRS, CDMA and EDGE - Speech coding techniques - Vocoders. Satellite communication principles and GPS.

**Books for Study:**


1. Telecommunication , T.Vishwanathan, PHI
2. Mobile Cellular Telecommunications, W.C.Y. Lee, McGraw Hill.
3. Introduction to Fiber Optics , A.Ghatak and K.Thyagrajan, Cambridge Univ. Press
4. Optical Fiber Communication Principles and Systems, A. Selvarajan, S.Kar and T.Srinivas, TMH
5. Optical Fiber Communications, Keiser, G. McGraw Hill, Int. Student Ed.
6. B. B. Laud, 1991, **Laser and Nonlinear Optics,** *Wiley Eastern, New Delhi.*
7. D. C. O'shea, W. R. Callen, and W. T. Rhodes, 1978, **Introduction to Lasers and their Applications,** *Addison-Wesley, Reading, MA.*

8. K. Thyagarajan and A. K. Ghatak, 1991, **Lasers: Theory and Applications***Macmillan, Madras.*
**9.** D. A. Krohun, 1988**,** Fiber Optics Sensors - Fundamentals and Applications**,** *Instrument Society of America.*

**Books for Reference**

1. Future Developments in Telecommunication, J. Martin, Prentice Hall
2. Fiber Optic Communication systems, G.P.Aggarwal,Wiley Eastern
3. Fiber optics and Optoelectronics, R.P. Khare, Oxford Press
4. Introduction to Optical Electronics, K.A. Jones, Harper & Row
5. Principles and Applications of Optical communications, M.K.Liu, McGraw Hill
6. J. T. Verdeyen, **1993**, Laser Electronics*, Prentice-Hall of India, New Delhi.*
7. A. Yarin, **1991**, Optical Electronics, *Harcourt Brace Jovanovich College Publishers.*
8. J. Gowar, **1995**, Optical Communication Systems, *Prentice-Hall of India, New Delhi.*
9. G. Venkataraman, **1995**, The Quantum Revolution (3 Vols.*), VigNettes in Physics Series***,** *University Press, Hyderabad.*
10. G. Venkataraman, **1992**, Bose and His Statistics, *VigNettes in Physics Series, University Press, Hyderabad.*
11. G. Venkataraman, **1993**, At the Speed of Light**,** *VigNettes in Physics Series, University Press, Hyderabad.*

**Web Sources:**

1. https://onlinecourses.nptel.ac.in/noc17_ph01/preview
2. http://www.nptel.ac.in/courses/115102026/
3. http://www.nptel.ac.in/courses/113104012/
4. http://www.nptel.ac.in/courses/115107095/
5. http://nptel.ac.in/courses/117101054/

## EXTRA DISCIPLINARY-I-EMBEDDED SYSTEMS

**Course Objective:**

- To familiarize the development cycle of Embedded system.
- To learn various bus standards and communication through it.
- To study the architecture of AVR microcontroller.
- To study the architecture of PIC microcontroller.
- To provide knowledge of real time Embedded system.

**Course OutCome:**

- Know about the basic concepts of Embedded system.
- Analyze the Bus standards techniques and communication protocols in embedded system.
- Understand the architecture and interfacing features of AVR microcontroller.
- Explain the architecture and interfacing features of PIC microcontroller.

- Develop the technical hardware and software programming skills in real time embedded system.

**Syllabus:**

**UNIT-1: INTRODUCTION TO EMBEDDED SYSTEM:** Embedded System: components, examples, development cycle of embedded system, embedded System Development Environment - algorithm, flow chart, IDE, ICE, programmer Processor Architectures: Harvard architecture, Von-Neumann architecture, RISC and CISC.

**UNIT-2: BUS STANDARDS AND COMMUNICATION:** Communication Protocols: I2C bus- specification, general characteristics, bus signals and address mechanism. Serial Peripheral Interface (SPI): specifications, master slave configuration, Bus Standards- RS 232, RS 485, USB, Bluetooth, Zigbee Controller Area Network (CAN): specifications, basic concepts, frame types, bus signals, error handling and addressing.

**UNIT-3: AVR MICROCONTROLLER:** Architecture (Atmega16), instruction set, addressing modes, memory organization, timers, I/O, ADC, interrupts, serial communication Design of General Purpose Target Board: reset, oscillator circuit, derivatives of AVR Basic Assembly Programs: arithmetic, logical, code converter, block data transfer, I/O programming C Programs: ADC, timer, I/O ports, interrupts, Inter-Integrated Circuit (I2C), serial communication, PWM. Real world interfacing with the microcontrollers and programming in C: DAC, LED, SSD, dot matrix display, and LCD displays (text and graphic), keyboard and motors (DC, stepper, and servo), I2C and SPI based RTC, EEPROM, DAC and ADC, coding assembly in C and code optimization.

**UNIT-4: PIC MICROCONTROLLER:** Architecture (PIC18F4550, 18F458), instruction set, addressing modes, memory organization, timers, I/O, ADC, interrupts, serial communication Design of General Purpose Target Board: reset, oscillator circuit, derivatives of PIC Basic Assembly Programs: arithmetic, logical, code converter, block data transfer, I/O programming C Programs: ADC, timer, I/O ports, interrupts, I2C, serial communication, PWM Real world interfacing with the microcontrollers and programming in C: DAC, LED, SSD, dot matrix display, and LCD displays (text and graphic), keyboard and motors
22 (DC, stepper, and servo), I2C and SPI based RTC, EEPROM, DAC and ADC, coding assembly in C and code optimization

**UNIT 5: REAL – TIME EMBEDDED SYSTEMS:** Architecture of the kernel – Task and task scheduler – Interrupt service routines- Semaphores – Mutex – Mailboxes – Message queues – Event registers – Pipes – Signals – Timers – Memory management – Priority inversion problems – Embedded operating systems – Embedded linux – Real-time operating systems – RT linux – Handheld operating systems – Windows CE

**Books for Study:**

1. Frank Vahid, Tony D. Givargis, 2002, Embedded System Design – A Unified Hardware/Software Introduction, John Wiley.
2. KVKK Prasad, 2005, Embedded / Real Time Systems, Dreamtech Press.
3. Programming for Embedded Systems- Dreamtech Software Team, Wiley Dreamtech
4. Muhammad Ali Mazidi& Janice GillispieMazidi, 2002, The 8051 Microcontroller and Embedded Systems, Fourth Indian Reprint, Pearson Education.
5. John B. Peatman, 2004, Design with PIC Microcontrollers, Seventh Indian Reprint Pearson Education.

**Books for Reference:**

1. David E. Simon, 2005, An Embedded Software Primer, Pearson Ed.,.
2. Raj Kamal, 2002, Introduction to Embedded Systems, TMS.
3. 1187D: Atmel semiconductor reference manual.
4. DS30292B: Microchip reference manual.

**Web Sources:**

1. http://www.eg3.com/8051/index.htm
2. http://www.programmersheaven.com/tags/
3. http://www.engineersgarage.com/8051-microcontroller
5. http://ww1.microchip.com/downloads/en/devicedoc/35007b.pdf
6. http://www.microchip.com/pagehandler/en-us/products/picmicrocontrollers
7. http://hem.passagen.se/communication/870.html
8. http://www.nptel.ac.in/courses/108102045/
9. http://www.nptel.ac.in/courses/108105057/
10. http://www.nptel.ac.in/courses/106105159/

## III SEMESTER

## CORE PAPER-IX- DATA COMMUNICATION AND COMPUTER NETWORKING

**Course Objective:**

- To learn data communicatiobn and various multiplexing techniques.
- To familiarize data transmission, data compression, analog and digital transmission.
- To understand the computer communications and Network techniques.
- To understand the basics of computer architecture, protocols and interfaces.
- To familiarize the advances in telecommunication systems.

**Course OutCome:**

- Explain the basic concepts of data communication and data link protocols.
- Recognize the concepts of data transmission technologies.

- Understand and apply the knowledge to identify the different types of network topologies LAN, TREE LANs etc.,
- Analyze the TCP/IP, RS232, RS432 architecture and their communication protocols.
- Compare various internet devices and their functions in modern telecommunications.

**Syllabus:**

**UNIT 1:DATA COMMUNICATION:** Introduction to data communication: A digital communication system - Data terminal equipment (DTE) - Line control unit (LCU) - Data communication Equipment (DCE) - Transmission media and communication link - Communication system formats - Data link protocols : General protocols, Character oriented protocols, Synchronous Data Link Control (SDLC), High level data control (HDLC) and XMODEM communications protocols - Low speed data communications - Frequency shift keying- FSK link and FSK modems- High speed modems and systems - Balanced modulator - Phase shift Keying- Differential PSK Bit splitters - PSK modulator- Quadrature Phase shift keying (QPSK)- QPSK modems - QPSK demodulator- Higher data rate modems- Multi channel data communications : Frequency division multiplexing (FDM) - FDM groups and subgroups - Multichannel data distribution- Data under voice (DUV)- Digital T carriers and Time division multiplexing (TDM)-Multichannel TDM- Sampling theorem- Sampling using TDM- Natural sampling- Sample and hold- Quantization - Pulse code modulation- Delta modulation - Adaptive delta modulation- CODECS Vocoders.

**UNIT 2: DATA TRANSMISSION:** Transmission – Synchronous transmission – Overview of modems and control – Error detection methods - Data compression – Transmission control circuits – Communication control devices - Data transmission concepts – Analog and Digital data transmission – Transmission media – Guided transmission media – Wireless transmission – Protocols - Error control - Ideal RQ – Continuous RQ – Link management – Data link control protocols – Bit oriented protocols.

**UNIT 3: COMPUTER COMMUNICATIONS AND NETWORKS:** Open system Network models : Data topologies - Data switching- Types of Networking- The open system interconnection (OSI) model-System Network architecture (SNA)- SNA layers- Logical units- SNA message formats- Local area Networks – Selection issues – Types – Protocols – Performance – High speed and bridged area Networks - Interconnection methods - High speed LAN - Bridges - Transparent bridges – Source routing bridges – Performance issues – LAN technology – Architecture – BUS/TREE LANs, Ring LANs, Star LANs and Wireless LANs. **CHARACTERISTIC OF PUBLIC NETWORKS** - Packet switched data Networks – Circuit switched data Networks – Integrated services digital Networks – Private Networks – Inter Network architecture – Network layer structure - Internet protocol standards – Frame relay protocols architecture – Frame relay call control - User data transfer - Network function - Congestion control.

**UNIT 4: ARCHITECTURE, PROTOCOLS AND INTERFACES:** Protocols and architecture - TCP/IP protocols – Principles of inter-Networking and intra-Networking - Current loop interface – RS232- RS432 interface – BASIC test - Breakout box and line monitors – Pattern

generators and bit error rate analyzers – Protocol analyzers – Time domain refractometry – Fiber optic systems.

**UNIT 5 ADVANCES IN TELECOMMUNICATIONS:** Enhanced features of telephone : Conference calls -Call transfers- Call queuing- Priority calls and automatic directory search- PBXs- Picture phone- Still picture video telephone - Telephotograph transmission- Facsimile services- Radio paging- Radio telephone- Mobile/cellular telephone-Vehicle location monitoring- Vehicle traffic control-Remote control of machines-Emergency communication - Interactive TV (shopping, advertisement and games)- Data broadcasting - Mail gram- Voice gram -Electronic mail delivery-Electronic fund/cash transfer (banking) - Person identification systems (security systems) - Computer assisted instructions

**Books for Study:**


1. F. Halsall, 1994, Data Communications, Computer Networks and Open Systems, Addison Wesley.
2. A. C. Agarwall, Computer Communication and ISDN Systems, Khanna Publishers.
3. W. L. Schweber, Data Communications, McGraw–Hill.
4. D. Besteskas and R. Gallagar, Data Networks, Prentice Hall.
5. J. Quinn, Digital Data Communications, Prentice Hall.
6. James Martin, 1987, Future developments in Telecommunications, Prentice Hall Inc.


**Books for Reference:**


1. A. S. Tanenbaum, 1999, Computer Networks, 3rd Ed., PHI.
2. D. F. Commer, 2000, Computer Networks and Internets, 2nd Ed., Addison –Wesley.
3. U. Black, 1999, Computer Networks, 2nd Ed., PHI.
4. ThiagrajanVishwanathan, 1992, Telecommunication switching systems and Networks, Prentice Hall of India.
5. Gordon White, Newnes, 1995, Mobile Radio technology, Butterworth Heinemann Ltd.
6. John L. McNamara, 1991, Local Area Networks, Prentice Hall of India.


**Web Sources:**

1. http://www.nptel.ac.in/courses/106105082/
2. http://www.nptel.ac.in/courses/106108098/
3. http://www.nptel.ac.in/courses/106102064/
4. http://www.nptel.ac.in/courses/106106127/
5. http://www.nptel.ac.in/courses/106105081/
6. http://www.nptel.ac.in/courses/106105080/
7. http://www.nptel.ac.in/courses/106106091/
8. https://doc.lagout.org/network/Computer%20Networking%20%26%20Hardware%20Concepts.pdf
9. https://www.lantronix.com/resources/networking-tutorials/ethernet-tutorial-networking-basics/

## CORE PAPER – X- DIGITAL SIGNAL PROCESSING

**Course Objective:**

- To introduce signals, systems, time and frequency domain concepts, and DSP techniques.
- To acquire the knowledge of design, implementation, analysis and comparison of digital filters for processing of discrete time signals.
- To program DSP Processor for various applications.
- To know about the typical Digital signal processing boards.

**Course OutCome:**

- Understand the basic fundamental concepts of Digital Signal Processing.
- Classify the discrete time signals and systems.
- Apply Z-transform and Fourier transform for different types of signals and systems.
- Determine the convolution of discrete time signals and digital filter designs.
- Discuss the different transform techniques used in DSP
- Develop the technical skills of DSP hardware and software .

**Syllabus:**

**UNIT 1 : FUNDAMENTALS OF DSP:** Signals and graph terminology – Mean and standard deviation – Histogram – Normal distribution – Digital noise generation – Precision and accuracy – Quantization – Sampling theorem – Digital to analog conversion – Analog filters for data conversion – Selecting the antialias filter – Multirate& single bit data conversion

**UNIT 2: SIGNALS AND SYSTEMS:** Basics of signals - Discrete sequences - Signal amplitude – Magnitude - Power - Sampling rate - aliasing - Discrete linear systems - Time-invariant systems – Frequency domain representation of discrete time signals – Transfer function - Types of transfer functions – All pass, minimum-phase and maximum-phase - Complementary transfer functions – Discrete-time processing of random signals.

**UNIT 3: TRANSFORM TECHNIQUES IN DSP:** Laplace transform – Discrete Fourier transform – Computation of the DFT - Fast Fourier transform – Decimation in time – Decimation in frequency – Bit reversal – Radix-2 Butterfly structures - Z-transform – Chirp Z-transform – Hilbert transform.

**UNIT 4: DIGITAL FILTER DESIGN:** Fundamentals and basic structures of FIR & IIR filters – Convolution - Low-pass, band-pass, high-pass FIR filters – Design of IIR filters – Impulse invariance method – Bilinear transform method – Design of digital IIR notch filter – Low-pass IIR digital filter design – Comparison of IIR & FIR digital filters.

**UNIT 5: DSP TECHNIQUES IN TYPICAL DSP HARDWARE:** DSP circuits – Different DSP hardware – Typical DSP board (Analog devices/Texas Instruments/Motorola/AT&T) – Functional block diagram– Program Language - Fixed point – Floating point – Number precision – – DSP software – Introduction to CCS - Applications of DSP.

**Books for Study**:


1. Alan V. Oppenheim, Ronald W. Schafer, 1999, Digital Signal Processing, Prentice-Hall of India Pvt. Ltd., New Delhi.
2. Steven W Smith, 1999 , The Scientist and Engineer's Guide to Digital Signal
3. Processing, California Technical Publishing.


**Books for Reference:**


1. Richard G. Lyons, 1999, Understanding Digital Signal Processing, Addison Wesley.
2. Sanjit K. Mitra, 1998, Digital Signal Processing: A Computer Based Approach, TMH.
3. John G. Proakis, Dimitris G. Manolakis, 2000, Digital Signal Processing, Principles, Algorithms and Applications, Third Edition, PHI.
4. Boaz Porat, 1997, A Course in Digital Signal Processing, John Wiley & Sons.
5. Andrew Bateman, Iain Paterson-Stephens, 2002, The DSP Handbook - Algorithms, Applications and Design Techniques, Prentice Hall & Pearson Education Ltd,
6. Walt Kestler, 2000, Mixed Signal and DSP Design Techniques, Analog Devices Inc.


**WEBSITES:**

1. www.techonline.com
2. www.ti.com
3. www.dspvillage.com
4. www.dspguru.com
5. www.dspguide.com
6. http://www.nptel.ac.in/courses/117101001/
7. http://www.nptel.ac.in/courses/108105055/
8. http://www.nptel.ac.in/courses/117102060/
9. http://www.nptel.ac.in/courses/117104070/

## CORE PAPER XI- BASIC VLSI DESIGN & VHDL

**Course Objective:**

- To Study the design and realization of combinational & sequential digital circuits.
- Architectural and performance tradeoffs involved in designing and realizing the circuits in CMOS.
- To know about the VHDL statements.
- To understand the concepts of design process computational techniques.
- Study and design digital circuits using Verilog HDL.
- To learn the design of VLSI circuits

**Course OutCome:**

- Know about the MOS and BiCMOS circuit design rules and layout diagrams.
- Analyze the basic circuit concepts and scaling of MOS circuits.
- Understand the logic of subsystem design and computational elements.
- Learn the VHDL language and implement various types of programming models.

- Discuss the various types of statements in VHDL programming.

**Syllabus:**

**UNIT 1: MOS AND BI-CMOS CIRCUIT DESIGN PROCESSES:**MOS Layers –Stick Diagrams –Design Rules and Layout –General Observations on the Design Rules –2um Double Metal, Double Poly. CMOS/Bicomos Rules –1.2um Single Metal, Single Poly. CMOS Rules – Layout Diagrams –A Brief Introduction –Symbolic Diagrams – Translation to Mask Form.

**UNIT 2: BASIC CIRCUIT CONCEPTS:** Sheet resistance (Rs) –Sheet resistance concept applied to MOS transistors and inverters –Area capacitances of layers –Standard unit of capacitance Cg –Standard unit of capacitances calculation –The delay unit –Inverter delays – Driving large capacitive loads –Propagation delay –Wiring capacitances. **SCALING OF MOS CIRCUITS:** Scaling models and scaling factors –Scaling factors for device parameters –Some discussion on and limitations of scaling.
**UNIT 3: SUBSYSTEM DESIGN AND LAYOUT:** Some architectural issues –Switch logic – Gate (restoring) logic –Examples of structured design (combinational logic) –Some clocked sequential circuits –Other system considerations. **DESIGN PROCESS– COMPUTATIONAL ELEMENTS:** Some observations on the design process –Regularity –Design of an ALU subsystem –A further consideration of adders –Multipliers

**UNIT 4: INTRODUCTION TO VHDL:** Introduction to Computer-aided design tools for digital systems. Hardware description languages; introduction to VHDL, data objects, classes and data types, Operators, Overloading, logical operators. Types of delays Entity and Architecture declaration. Introduction to behavioral, dataflow and structural models.

**UNIT 5: VHDL STATEMENTS:** Assignment statements, sequential statements and process, conditional statements, case statement Array and loops, resolution functions, Packages and Libraries, concurrent statements. Subprograms: Application of Functions and Procedures, Structural Modelling, component declaration, structural layout and generics.

**Books for Study**:


1. Douglas A. Punknell& Kamran Eshraghian,**Basic VLSI Design,** Eastern Economy Edition, IIIrd Edition.
2. S. M. Sze, 1988, **VLSI Fabrication Technology**, *McGraw Hill.*
3. Nell H. E. Weste and Kamran Eshraghian, "**Principles of CMOS VLSI Design**", 2ndEdition, Addision Wesley, 1998.
4. Jacob Backer, Harry W. Li and David E. Boyce, "**CMOS Circuit Design, Layout and Simulation**", Prentice Hall of India, 1998.


**Books for Reference:**


1. Wolf Wayne, Modern VLSI Design System on Chip Design (3rd Edition).
2. John P. Uyemura, Introduction to VLSI Circuits and Systems.


Web Sources:

1. http://www.nptel.ac.in/courses/117101105/

2. http://www.nptel.ac.in/courses/117101004/
3. http://www.nptel.ac.in/courses/106106088/
4. http://www.nptel.ac.in/courses/106106089/
5. http://www.vlsi-expert.com/p/vlsi-basic.html
6. https://www.tutorialspoint.com/vlsi_design/
7. http://esd.cs.ucr.edu/labs/tutorial/
8. http://www.asic-world.com/vhdl/tutorial.html
9. http://www.uco.es/~ff1mumuj/h_intro.html

## CORE PAPER – XII- DSP LABORATORY & MATLAB

**Course Objective:**

- To design and apply digital signal processing techniques to design discrete time systems and digital filter .
- To compile and solve the digital signal processing problems using MAT lab.
- To interpret to analyze the importance of various transformation techniques in signal processing.

**Course OutCome:**

- Design FIR and IIR filters.
- Enumerate the basic concepts of signals and systems and their interconnections in a simple and easy-to-understand manner using MATLAB.
- Process images using techniques of smoothing, sharpening, histogram processing, and filtering.

**Syllabus:**

**Any twelve experiments of the following to be done**

**DSP LABORATORY:**

1. Introduction to DSP & DSK (TMS320C6711)
2. Examples with DSK & CCS (Echo generation, sine wave generation with two sliders for amplitude and frequency control, square wave generation, ramp wave generation)
3. FIR filter design (Low, High, Bandpass&Bandstop)
4. IIR filtering (Low, High, Bandpass&Bandstop) Convolution & correlation
5. FFT & DFT
6. Generation of fixed PWM with variable frequency and variable duty cycle
7. AC induction motor control using sine modulation technique

**MATLAB:**

1. Practicing MATLAB environment with simple exercises to familiarize Command Window, History, Workspace, Current Directory, Figure window,Edit window, Shortcuts, Help files.
2. Data types, Constants and Variables, Character constants, operators,Assignment statements.

3. Control Structures: For loops, While, If control structures, Switch, Break,Continue statements.
4. Input-Output functions, Reading and Storing Data.
5. Vectors and Matrices, commands to operate on vectors and matrices, matrixManipulations.
6. Arithmetic operations on Matrices, Relational operations on Matrices, Logicaloperations on Matrices.
7. Polynomial Evaluation, Roots of Polynomial, Arithmetic operations onPolynomials.
8. Graphics: 2D plots, Printing labels, Grid & Axes box, Text in plot, Bar and Piechart.
9. Image display and Addition of noise (Salt and Pepper noise).
10. Image display and Removal of noise (Salt and Pepper noise).

## ELECTIVE – IV- MACHINE VISION AND ITS APPLICATIONS

**Course Objective:**

- To understand the basic concepts of sensors for vision system.
- To know about the knowledge in machine vision.
- To explain the functions of robotics and robotic sensors.
- To implement the Robots in various application.

**Course OutCome:**

- Analyze the working of sensors for 2D and 3D vision system.
- Learn the hardware, algorithms and components used in machine vision.
- Describe the characteristics of robots and classify based on its coordinate systems.
- Understand the concepts of robot programming language and various types of sensors in artificial intelligence.
- Know about the application of robots in various fields.

**Syllabus:**

**UNIT1: SENSORS FOR VISIONSYSTEM:** Sensing Range, proximity, Position, velocity, acceleration, Touch, Force, Torque. Optical &laser sensors. 2D & 3D vision: Competing technologies, principle, CCD, Videocon and other cameras, data capture. Triangulation geometry, resolution, passive and active 3-D stereo imaging, data processing

**UNIT 2: MACHINE VISION :** Machine vision components, hardware's and algorithms, image function and characteristics, image formation & image sensing frequency space analysis, Fourier transform, convolution algorithms, image Gaussian, image enhancement, image analysis and segmentation data reduction, feature extraction, edge detection, image recognition m/c learning, image processing, machine vision edges detection, inspection part identification, industrial robot control, mobile robot application.

**UNIT 3:ROBOTICS:**Definition of robot, classification of robots according to coordinate system and control method, Main components of robots – manipulator, sensors, controller etc, Robot characteristics – payload, reach, repeatability, accuracy, resolution.

**UNIT 4: ROBOTIC SENSORS:** Sensors and Artificial Intelligence 6L Characteristics of Sensors, Position sensors, velocity sensors, acceleration sensors, force and pressure sensors, force and torque sensors, micro switches, touch and slip sensors, non-contact proximity sensors, Robot Vision System, Robot programming Languages – VAL, AML/2, ARM BASIC

**UNIT 5: APPLICATION OF ROBOTS:** Handling, loading, & unloading, Welding, Spray painting, Assembly, Machining, Inspection, Rescue robots, Underwater robots, Parallel robot, and Medical robot.

**Books for Study**


1. Ramesh Jain, RangacharKasturi, Brian G. Schunck, **Machine Vision**,Published by McGraw-Hill, Inc., ISBN 0-07-032018-7, 1995
2. E.R. Davis, **Machine Vision**,Theory, Algorithm Practicalities.
3. Computer Vision A Modern Approach by Forsyth and Ponce


**Books for Reference:**


1. David A. Forsyth and Jean Ponce, Computer Vision: A Modern Approach.
2. Velho, Image Processing For Computer Graphics and Vision.
3. Escolano, Information Theory In Computer Vision And Pattern Recognition.
4. Kisacanin, Real-Time Vision For Human-computer Interaction.


**Web Sources:**

1. https://www.udemy.com/learn-computer-vision-machine-vision-and-image-processing-in-labview/
2. https://www.kickstarter.com/projects/visionai/vmx-project-computer-vision-for-everyone
3. https://elitedatascience.com/learn-machine-learning
4. https://www.xerox.com/en-us/innovation/insights/computer-vision
5. https://blog.robotiq.com/robot-vision-vs-computer-vision-whats-the-difference

## EXTRA DISCIPLINARY- II- DIGITAL IMAGE PROCESSING

**Course Objective:**

- To introduce the fundamental concepts and techniques in digital image processing and their applications.
- To emphasize on the Image Transforms, Image Enhancement, Restoration and Compression, Image segmentations and Image Analysis.
- To improve the students ability to use mathematical tools required for the design and development of image processing algorithms to solve image processing problems.

**Course OutCome:**

- Know about the fundamentals of digital image processing.
- Classify the types of image enhancement techniques.
- Describe the concepts of color image processing techniques.
- Analyze the types of restoration filters for noise removal.
- Understand the concepts of morphological image processing and image segmentation techniques.
- Recognize the image patterns and represents the features of images.

**Syllabus:**

**UNIT 1: DIGITAL IMAGE FUNDAMENTAL:** Elements of Visual Perception, Digital Image Processing, Fundamental Steps in Digital Image Processing, Image Sensing and Acquisition, Image Sampling and Quantization, Some Basic relationships Between Pixels, Linear and Nonlinear Operations.
**UNIT 2: IMAGE ENHANCEMENTS:** Image Enhancement in the Spatial Domain**,** Basic Gray Level Transformations, Histogram Processing, Enhancement Using Arithmetic/Logic Operations, Basics of Spatial Filtering, Smoothing and Shaping using Spatial Filtering. Image Enhancement in the Frequency Domain, Introduction to the Fourier Transform and the Frequency Domain**,** Smoothing and shaping using Frequency Domain Filtering, Homomorphic Filtering.
**UNIT 3: COLOR IMAGE PROCESSING:** Color Fundamentals, Color Models, Pseudo color Image Processing, Basics of Full-Color Image Processing, Color Transformations, Smoothing and Sharpening, Color Segmentation, Noise in Color Images.
**UNIT 4 : IMAGE RESTORATION:** Model of the Image Degradation/Restoration Process, Restoration in the Presence of Noise Only–Spatial Filtering, Noise Reduction by Frequency Domain Filtering, Linear, Position-Invariant Degradations, Estimating the Degradation Function, Inverse Filtering, Minimum Mean Square Error (Wiener) Filtering, Constrained Least Squares Filtering, Geometric Mean Filter, Geometric Transformations.
**UNIT 5: MORPHOLOGICAL IMAGE PROCESSING:** Preliminaries, Dilation and Erosion, Opening and Closing, The Hit-or-Miss Transformation, Basic Morphological Algorithm, Extensions to Gray-Scale Images. **Image Segmentation:** Detection of Discontinuities, Edge Linking and Boundary Detection, Thresholding, Region-Based Segmentation, Segmentation by Morphological Watersheds.

**Books for Study**:

1. R.C.Gonzalez, R.E.Woods, 2002, Digital Image processing, 2nd Edition, Pearson Education.

**Reference Books:**

1. Anil K. Jain, 1994, Fundamentals of Digital image Processing, 2nd Edition, Prentice Hall of India, New Delhi.

2. Pratt. W.K., Digital Image Processing, 3rd Edition, John Wiley & Sons.
3. Rosenfled A. &Kak, A.C, 1982, Digital Picture Processing, vol.I & II, Academic Press.

**Web Sources:**

1. www.dspguru.com
2. www.dspguide.com
3. http://www.nptel.ac.in/courses/106105032/
4. http://www.nptel.ac.in/courses/117105079/
5. http://www.nptel.ac.in/courses/117104069/
6. http://www.nptel.ac.in/courses/117105135/

## IV SEMESTER
## CORE PAPER-XIII-NEURALNETWORKS & ARTIFICIAL INTELLIGENCE

**Course Objective:**

- To familiarize the concepts of artificial intelligence.
- To know about the simple neuralnets techniques for pattern classification.
- To understand the basics of artificial intelligence and production system.

**Course OutCome:**

- Know about the ANN biological neural networks and its applications.
- Analyze the neural nets design rules and applications based on their pattern.
- Describe the patterns associated with neural network memory and its application.
- Learn the applications of neural nets based on their competitive network.
- Understand the concepts of AI formulation, production and their characteristics.
- Identify the problems in AI and to solve them by using various methods in algorithms.

**Syllabus:**

**UNIT 1: INTRODUCTION:** Definition of ANN-Biological Neural Networks-Applications of ANN-Typical Architectures-Setting the weights-Common Activation functions-Development of Neural Networks-McCulloch-Pitts Neuron.

**UNIT 2: SIMPLE NEURALNETS FOR PATTERN CLASSIFICATION:** General discussion – Hebb Net – Perceptron- Adaline– Back propagation Neural Net- Architecture- Delta Learning Rule Algorithm-Applications

**UNIT3: PATTERN ASSOCIATION:** Training Algorithm for Pattern Association-Hetero-associative Memory Neural etwork Applications-Auto-associative Net-Iterative Auto-associative Net-Bidirectional Associative Memory-Applications

**UNIT 4: NEURALNETS BASED ON COMPETITION: Fixed** Weights Competitive Nets-Kohonen's Self-Organizing Map –Applications Learning Vector Quantization-Applications-Counter Propagation Network Applications.

**UNIT 5: INTRODUCTION TO Al AND PRODUCTION SYSTEMS:** Introduction to AI-Problem formulation, Problem Definition -Production systems, Control strategies, Search strategies. Problem characteristics, Production system characteristics -Specialized production system- Problem solving methods - Problem graphs, Matching, Indexing and Heuristic functions -Hill Climbing-Depth first and Breath first, Constraints satisfaction - Related algorithms, Measure of performance and analysis of search Algorithms.

**Books for Study**


1. LaureneV. Fausett, "Fundamentals of Neural Networks-Architectures, Algorithms and Applications", Pearson Education, 2011.
2. Kevin Night, Elaine Rich, Nair B., "Artificial Intelligence (SIE)",McGraw Hill- 2008.
3. Dan W. Patterson, "Introduction to AI and ES", Pearson Education, 2007. (Unit-III)


**Books for Reference:**


1. James. A. Freeman and David.M.Skapura, "NeuralNetworks Algorithms, Applications and Programming Techniques ", Pearson Education, Sixth Reprint, 2011.
2. Simon Haykin, "NeuralNetworks and Learning Methods", PHI Learning Pvt. Ltd., 2011.
3. James A. Anderson, "An Introduction to NeuralNetworks", PHI Learning Pvt.Ltd., 2011.
4. Martin T. Hagan, Howard B. Demuth, Mark Beale, "NeuralNetwork Design", Cengage Learning, Fourth Indian Reprint, 2010.
5. Bart Kosko, "NeuralNetworks and Fuzzy Systems-A Dynamical Approach toMachine Intelligence", PHI Learning Pvt. Ltd., 2010.
6. Peter Jackson, "Introduction to Expert Systems", 3rd Edition, Pearson Education, 2007.
7. Stuart Russel, Peter Norvig "AI – A Modern Approach", 2nd Edition, Pearson Education 2007.


**Web Sources:**

1. http://www.cs.stir.ac.uk/~lss/NNIntro/InvSlides.html
2. http://www.willamette.edu/~gorr/classes/cs449/intro.html
3. http://ocw.mit.edu/courses/electrical-engineering-and-computer-science/6-867-machine-learning
4. http://www.nptel.ac.in/courses/117105084/
5. http://www.nptel.ac.in/courses/106105079/
6. http://www.nptel.ac.in/courses/106105077/
7. http://www.nptel.ac.in/courses/106106126/
8. http://www.nptel.ac.in/courses/106105078/
9. http://www.nptel.ac.in/courses/106106140/

## CORE PAPER XIV-MICROWAVE ELECTRONICS

**Course Objective:**

- To analysis the microwave circuits and systems
- Understand the concepts of Microwaves, Microwave transmission modes, Transmission lines, Microwave Amplifiers and Oscillators.
- To understand the functions of microwave tubes.
- To explore the fundamentals of strip lines and MIC's.
- To apply the microwave concepts in various applications.

**Course OutCome:**

- 1.Understand the theory of microwave and Maxwell's equations.
- Discuss the working of microwave waveguides and components
- Design and analyze the microwave tubes, amplifiers, oscillators and devices.
- Describe the characteristic of strip Lines and MICs, and its detection and measurement.
- Understand the basics of Radar Technology.

**Syllabus:**

**UNIT 1 BASICS:** Motion of an electron in an electric field and magnetic fields. Review of Gauss's law, Laplace's equation, Faraday's law and Ampere's law. Maxwell's equations, boundary conditions, Poynting's energy theorem.

**UNIT 2 INTRODUCTION TO MICROWAVES:** Microwave frequency bands, microwave transmission lines - transmission line equations and solutions, reflection and transmission coefficients, standing waves and standing wave ratio, line impedance and admittance, Smith chart, impedance matching – single stub and double stub matching. **Microwave waveguides and components:** Rectangular waveguides, TE and TM modes, power transmission and power losses, excitation of modes in rectangular waveguides. Circular waveguides, possible modes, power transmission and power losses, co-axial waveguides. Microwave cavities – rectangular and circular cavity resonators, resonant cavities, Q factor of a cavity resonator. Waveguide tees, magic tee, hybrid ring, waveguide corners, bends and twists, two-hole directional coupler, hybrid coupler, microwave circulators and isolators.

**UNIT 3: MICROWAVE TUBES:** High frequency limitation of conventional vacuum tubes, Klystron, multicavity klystron amplifier, helix and coupled cavity TWT, cylindrical magnetron – construction, principle of operation, performance characteristics and applications. **Microwave solid state devices and circuits:** Principle, structure, construction and working of Gunn diodes, modes of operation, LSA diode, READ diode, IMPATT, TRAPATT and BARRIT diode, HEMT, tunnel diodes, parametric devices.

**UNIT 4: STRIP LINES AND MICs:** Characteristic impedance of microstrip lines, losses and Q-factor of micro strip lines, parallel strip lines, distributed parameters, characteristic impedance and attenuation losses, coplanar and shielded strip lines. **Detection and measurement:** Crystal detectors, slotted line measurements, measurement of VSWR, frequency power and impedance.

**UNIT 5: APPLICATIONS OF MICROWAVES**: Radar systems, radar equation, duplexer, pulsed radar, CW Doppler, radar, FMCW radar. Industrial applications of microwaves. **Microwave radiation hazards**: HERP, HERO, radiation hazard limits, radiation protection.

**Book for Study:**


1. Yoshihiro Konishi: Microwave Integrated Circuits, CRC Press 1991
2. Ivan Kneppo: Microwave Integrated Circuits, Springer, 2013
3. Konishi, Microwave Integrated Circuits.

**Books for Reference:**

1. C. K. Ong, C. P. Neo, L. F. Chen, and V. K. Varadan, Microwave Electronics: Measurement and Materials Characterization
2. T.G. Roer, Microwave Electronic Devices.

**Web Sources:**

1. http://www.nptel.ac.in/courses/117105130/
2. http://www.nptel.ac.in/courses/117105138/
3. http://www.nptel.ac.in/courses/117105122/
4. http://scitechconnect.elsevier.com/microwave-active-circuit-analysis-and-design/
5. http://www.mwrf.com/

## ELECTIVE PAPER-V-ELEMENTS OF NANOTECHNOLOGY IN ELECTRONICS

**Course Objective:**

- To introduce the students to Nano Electronics, Nano Devices, and Nano Materials.
- To identify characterization Techniques behind Nano Electronics.
- To describe the principle and the Applications of Nano Electronic Devices.
- To know about the ideas of Nano structuring.

**Course OutCome:**

- Understand the fundamentals properties and different types of nano materials.
- Learn Quantum dots, wells and wires.
- Study the morphological and size of the nano particles using various analytical techniques.
- Tune the size and shape of the nanomaterials for diverse applications.
- Synthesis nanomaterials using various physic..al, chemical and biological properties.

**Syllabus:**

**UNIT 1: INTRODUCTION OF NANOTECHNOLOGY:** Definition of nanoscale – Significance of nanoscale: Surface-volume, Grain boundary, Examples of Critical sizes in phenomena - Property Enhancements: Quantum mechanical aspects – nanosize and energy bands –confinement effects, discretisation and tunnelling – lithography at nanoscale.

**UNIT 2: NANOSCALE FORMATIONS AND ELECTRONICS:** Nanoparticles – production methods: Gas condensation, laser ablation, decomposition (thermal and ultrasonic), chemical methods, mechanical milling – Application of nanoparticles. Nanolayers – production methods:

deposition (PVD, CVD, Epitaxy - ion implantation – Applications of nanolayers. Nanotubes – carbon nanotubes – types – production – properties – applications in electronics.

**UNIT3: NANOSTRUCTURING:** Nano polishing - Etching of nanostructures – Lithography: optical, electron beam, ion beam, x-rays lithography procedures (principles and methodologies) – Nano imprinting – Nanostructure characterisation tools: AFM, Near-field Optics and Electron microscopy (principles and procedure in each of these).

**UNIT 4: CONVENTIONAL DEVICES BY NANOTECHNIQUES:** MOS transistors: structure and technology – electrical characteristics of sub-100 nm MOS devices- limitations – low-temperature aspects – future trends. Bipolar transistors: Structure and technology at nanoscale – trends

**UNIT 5: NOVEL DEVICES BASED ON NANOSTRUCTURES:** Resonant Tunnelling Diode: principles and technology – applications -- Quantum Cascade Laser: Principles and structure – applications – Single Electron Transistor: Principle – technology – applications – Carbon Nanotube devices: structure and technology – CNT transistors.

**Books for Study:**


1. W.R. Fahrner (Ed) *Nanotechnology and Nanoelectronics* Springer International Edition,Indian reprint 2006.
2. M. A. Shah, Principles of Nanoscience and Nanotechnology, Narosa.


**Books for Reference:**


1. Korkin, Anatoli, Krstić, Predrag S., Wells, Jack C., Nanotechnology for Electronics, Photonics, and Renewable Energy.


**Web Sources:**

1. http://www.understandingnano.com/nanotechnology-electronics.html
2. http://www.research.gatech.edu/areas/electronics-and-nanotechnology
3. http://www.research.gatech.edu/areas/electronics-and-nanotechnology
4. http://www.nanoandme.org/nano-products/computing-and-electronics/
5. https://www.tcd.ie/Physics/research/themes/nanotech/